

AC/DC Drive for industrial applications

TPD500

Instruction manual

Language: English



Information about this manual

Firmware version

This manual refers to the following firmware version: **TPD500 1.0.4**.

General information

NOTE!

The terms "Inverter," "Converter," and "Drive" are sometimes used interchangeably in the industry. In this document, the term "Drive" will be used.

Thank you for choosing this WEG product.

Before using the product, carefully read **Chapter 1 - SAFETY INSTRUCTIONS**.

Throughout the product's operational life, make sure this manual is always accessible to technical personnel.

This manual covers the TPD500 series products designed for motor control: the TPD500 and TPD500-CU.

For the TPD500-FC product, designed for field control, refer to the corresponding manual **1S4T500FCEN**.

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1. SAFETY INSTRUCTIONS

This chapter contains the safety regulations to be followed during the installation, use, and maintenance of **TPD500** series drive. Failure to comply with these regulations may endanger human safety, posing a risk of death, or may damage the drive, the motor, or the driven equipment.

The safety instructions must be read carefully before working on the equipment.

Drives are electrical devices used in high-current applications. During operation, certain parts of the drives are live. Therefore, electrical installation and access to the interior of the equipment are permitted only for qualified personnel. Improper motor installation may damage the drive and cause personal injury or material damage.

Refer to the instructions provided in this manual and comply with local and national safety regulations.

The equipment must be installed in compliance with the following standards, as applicable:

- Canadian Electrical Code, Part I (CSA C22.1);
- National Electrical Code (ANSI/NFPA 70);
- European standards of the IEC 60364 series.

1.1 Symbols used in the manual



Indicates a procedure or operating condition which, if not observed, may result in death or personal injury.



Indicates a procedure or operating condition which, if not observed, may cause damage to or destruction of the equipment.



Indicates a procedure or operating condition which, if followed, may optimize the application.



Draws attention to specific procedures and operating conditions.

1.2 General safety instructions

Qualified personnel

The installation, operation, and maintenance of the **TPD500** drive must be carried out exclusively by qualified, trained, and authorized personnel who are capable of identifying and handling risks associated with electrical components.

Personal protective equipment (PPE)

During all operations, it is mandatory to wear appropriate Personal protective equipment (PPE), such as insulating gloves, safety glasses, and antistatic clothing, to prevent injuries from electric shock or contact with overheated surfaces.

Risk of personal injury

Transporting and lifting the equipment using improper methods may result in serious or fatal injury. The equipment must be lifted using appropriate tools and by trained personnel.

Functional safety

The TPD500 drive is not a device designed to ensure functional safety, but rather a component that can be integrated into a machine. The responsibility for risk assessment and the implementation of appropriate risk reduction measures lies with the machine manufacturer.

Documentation and compliance

The equipment is classified as **Open Type** (*Type 1, and Type 0 for Frame E only*) and requires the implementation of appropriate technical measures to ensure compliance with current Electromagnetic Compatibility (EMC) regulations. It is strongly recommended to carefully follow all instructions provided in the technical documentation to ensure adherence to these directives. Additionally, proper installation precautions must be taken to comply with Pollution Degree 2 (PD II) and the specified ambient temperature limits.

1.3 Safety measures during installation

Installation preparation

Before starting any work, ensure that the drive is completely disconnected from the power supply and that no residual voltage is present on any components. Additionally:

- inform all personnel involved about the ongoing operations;
- isolate the drive from the power supply and secure it against accidental power-up.

Safety condition check

Before starting the installation, check for the absence of voltage at the power terminals. Verify that all auxiliary circuits are de-energized and that the motors cannot rotate unintentionally.

Grounding

Ensure that the drive is properly grounded to prevent the risk of electric shock and electromagnetic interference. Grounding must be carried out in accordance with applicable regulations, using appropriately sized, non-interruptible conductors.

Power supplies

Do not connect supply voltages that exceed the allowable voltage range. Applying excessive voltages to the drive will damage internal components.

Fire and explosion hazard

Installing a drive in areas where flammable substances, fuel vapors, or dust are present can lead to fire or explosion risks. Drives should be installed away from such hazardous environments, even when used with motors designed for these conditions.

Installation environments

Do not install the drive in environments where the temperature exceeds the limits specified. Ambient temperature has a significant impact on the device's lifespan and reliability.

Mounting

The equipment must be mounted on a wall made of heat-resistant materials. During operation, the temperature of the cooling heatsinks can reach 90°C.

1.4 Protection during operation

Protection against electrostatic discharge (ESD)

When handling electronic components, take precautions against electrostatic discharge (ESD) to prevent damage to the equipment:

- use conductive surfaces;
- wear antistatic wrist straps and footwear;
- handle components only with appropriate tools.

Electromagnetic interference (EMC)

Drives generate electromagnetic fields that may interfere with medical devices such as pacemakers. It is essential to assess the specific risk and implement protective measures for individuals with active implantable devices.

Response to alarm conditions

When the drive indicates an alarm condition, refer to **Chapter 9 - FAULT INDICATIONS** and resume operation only after resolving the cause. Do not reset the alarm automatically via an external sequence.

1.5 Accident prevention

Ventilation spaces

Ensure that ventilation spaces are clear and unobstructed to prevent overheating of components, which could lead to fires. Install the equipment in enclosures designed to prevent the spread of flames.

Unexpected machine movements

When the drive is off but still connected to the power supply, accidental movement of the motor shaft cannot be ruled out. Ensure that all safety functions of the system are operational and correctly configured to prevent unexpected machine movements that could lead to accidents.

Handling the equipment

- Never open the equipment when it is connected to the power supply.
- Handle the equipment without touching or damaging any parts. Do not alter the insulation distances, nor remove insulating materials or covers.
- Do not apply voltage to the drive output (terminals C/D, C1/D1), and do not parallel the outputs of multiple drives.
- Do not connect capacitive loads to the drive output (terminals C/D), such as power factor correction capacitors.
- Even though the drive, when properly wired, can detect motor overheating, it is not designed to provide motor thermal protection.
- Avoid unauthorized modifications to the drive firmware to prevent risky operating states. Keep the firmware updated and implement security measures to protect the system from viruses and malware.

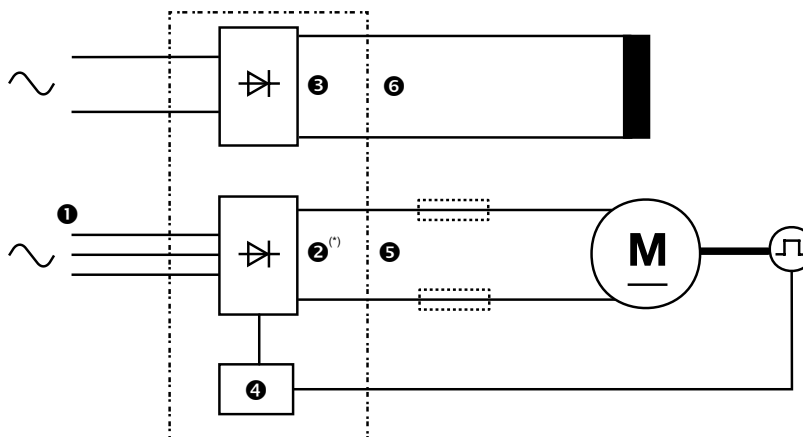
Reinstalling covers

Ensure that all covers are properly reinstalled before applying power to the equipment. Failure to follow this warning could result in death or serious injury.

2. COMPONENT IDENTIFICATION AND SPECIFICATIONS

2.1 General description

An AC/DC drive converts the AC voltage from a three-phase supply into a variable DC voltage, allowing the speed and/or torque of a separately excited DC motor to be controlled.



(*) Not present on **TPD500-CU**, which is the stand-alone solution for controlling external power bridges.

Contact WEG for further information and details.

Figure 2-1: Schematic diagram of a AC/DC drive

- ❶ Three-phase supply voltage
- ❷ Armature circuit: three-phase controlled bridge (dual bridge for TPD500-...-4B-...)
- ❸ Field circuit: single-phase semi-controlled bridge
- ❹ Drive programmable control board
- ❺ Armature output DC voltage
- ❻ Field output DC voltage

The **TPD500** series drives are available in two variants:

TPD500-...-2B-...	for bi-quadrant operation (also indicated 2Q)
TPD500-...-4B-...	for tetra-quadrant operation (also indicated 4Q)

Each variant is available in two subseries, which differ in the maximum supply voltage:

TPD500-500-... / TPD500-CU-500-...	supply voltage up to 3 x 500 Vac
TPD500-690-... / TPD500-CU-690-...	supply voltage up to 3 x 690 Vac, limited to 600 Vac for the North American market (cULus)

2.1.1 Functions and general features

The **TPD500** series devices have been developed as AC/DC drives featuring excellent control performance and a wide range of available functions.

General features

- Integrated field converter.
- Galvanic isolation between the power section and the control section.
- Galvanic isolation between the control section and the digital command and signal terminals.

Easy operation of the equipment

- Through the removable programming keypad with backlit display (KB-TPD500), provided as standard equipment.
- Via standard PC software **WEG_DriveLabs**, with Ethernet connection (Modbus TCP) or RS485 serial line (Modbus RTU).
- Through a fieldbus connection (optional): **PROFIBUS**, **PROFINET**, **EtherNet/IP**.

TPD500-CU -### -THY# -FC##

Field circuit:

- 40 = 40 A
- 70 = 70 A

SCR Driving:

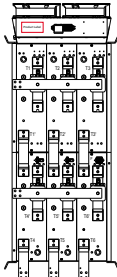
- 1 = single-secondary pulse transformer, suitable for driving a single SCR per branch
- 2 = dual-secondary pulse transformer, suitable for driving two SCR in parallel per branch

Input voltage [Vac]:

- 500 = up to 500 Vac
- 690 = up to 690 Vac

Drive model

Side label	Positioning on the drive	
		FRAME A Left side of the drive
Serial number Drive model Main Power Input (armature) Main Power Output (armature) Field Input / Output Regulation Power Input Pollution Degree / Overvoltage Category Code Approvals  WEG AUTOMATION EUROPE S.R.L. Via G.Carducci, 24 21040 - Garenzano (Va) - Italy Type: TPD500 - ### - #### - ## - # S/N: xxxxxxxxx Main Power Input: xxxVac xxAac 50/60Hz 3Phase Main Power Output: xxxVdc xxAdc Field Input: xxxVac xxAac 50/60Hz 1Phase Field Output: xxxVdc xxAdc Regulation Power Input: 115/230Vac 1/0,5Aac 50/60Hz 1Phase PD2 OVC III Code: xxxxxxx C E Made in Italy		FRAME B Right side of the drive
		FRAME C Right side of the drive
Serial number Drive model Sensing Voltage Input (from external bridge) Field Input / Output Regulation Power Input Pollution Degree / Overvoltage Category Code Approvals  WEG AUTOMATION EUROPE S.R.L. Via G.Carducci, 24 21040 - Garenzano (Va) - Italy Type: TPD500 - CU - ### - THY# - FC## S/N: xxxxxxxxx Sensing Voltage Input: xxxVac Field Input: xxxVac xxAac 50/60Hz 1Phase Field Output: xxxVdc xxAdc Regulation Power Input: 115/230Vac 1/0,5Aac 50/60Hz 1Phase PD2 OVC III Code: xxxxxxx C E Made in Italy		TPD500-CU Left side of the drive

Side label		Positioning on the drive	
Serial number Drive model Main Power Input (armature) Main Power Output (armature) Field Input / Output Regulation Power Input Pollution Degree / Overvoltage Category Code Approvals WEG WEG AUTOMATION EUROPE S.R.L. Via G.Carducci, 24 21040 - Gerenzano (Va) - Italy Type: TPD500 - ### - #### - ## - # S/N: xxxxxxxxxx Main Power Input: xxxVac xxAc 50/60Hz 3Phase Main Power Output: xxxVdc xxAdc Field Input: xxxVac xxAc 50/60Hz 1Phase Field Output: xxxVdc xxAdc Regulation Power Input: 115/230Vac 1/0,5Ac 50/60Hz 1Phase PD2 OVC III Code: xxxxxx C E Made in Italy			FRAME E -CU Right side of the drive EXTERNAL BRIDGE Right side of the drive
Serial number Drive model Main Power Input (armature) Main Power Output (armature) Field Input / Output Regulation Power Input Pollution Degree / Overvoltage Category Code Approvals WEG WEG AUTOMATION EUROPE S.R.L. Via G.Carducci, 24 21040 - Gerenzano (Va) - Italy Bridge of: TPD500 - ### - #### - ## - # S/N: xxxxxxxxxx Main Power Input: xxxVac xxAc 50/60Hz 3Phase Main Power Output: xxxVdc xxAdc Field Input: xxxVac xxAc 50/60Hz 1Phase Field Output: xxxVdc xxAdc Regulation Power Input: 115/230Vac 1/0,5Ac 50/60Hz 1Phase PD2 OVC III Code: xxxxxx C E Made in Italy			

NOTE:

The TPD500-FRAME E is a product comprising a TPD500-CU, which controls the system, and an external bridge, which handles the power section (armature).

Figure 2-2: Product label and its positioning on the drive

The available sizes are listed in the following tables:

Table 2-1: Drive sizes - TPD500 Compact version

SIZE	QUA-DRANTS		CONSTRUCTION TYPE	ARMATURE CIRCUIT								FIELD CIRCUIT		REG. CARD
	2B	4B		AC supply voltage		Rated DC output voltage [Vdc]				Rated DC output current [A]	DC output current overload	AC supply voltage	Rated DC output current @40°C [A]	AC supply voltage
				TPD500-500	TPD500-690	TPD500-500		TPD500-690						
						2B	4B	2B	4B					
00020	•	•	A1	•		580	525			20	Programmable up to 150%	230 ... 500 Vac ±10% 1-phase, 50/60 Hz ±5%	6.25	115 Vac ±10% or 230 Vac ±10%, 1-phase, 50/60 Hz ±5%
00040	•	•	A1	•						40			8.33	
00070	•	•	A2	•						70			8.33	
00110	•	•	A3	•						110			12.5	
00140	•	•	A3	•						140			12.5	
00185	•	•	A3	•						184			12.5	
00280	•	•	B1	•						280			20	
00350	•	•	B1	•						350			20	
00420	•	•	B1	•						420			20	
00500	•	•	B1	•						500			20	
00650	•	•	B2	•						650			20	
00770	•	•	C	•						770			25	
01000	•		C	•						1000			25	
01050		•	C	•						1050			25	
00560	•	•	C		•	800	725			560			25	
00700	•	•	C		•					700			25	
00900	•	•	C		•					900			25	

Table 2-2: Drive sizes - TPD500 External bridge

SIZE	QUA-DRANTS		CONSTRUCTION TYPE	ARMATURE CIRCUIT								FIELD CIRCUIT		REG. CARD
	2B	4B		AC supply voltage		Rated DC output voltage [Vdc]				Rated DC output current [A]	DC output current overload	AC supply voltage	Rated DC output current @40°C [A]	AC supply voltage
				TPD500-500	TPD500-690	TPD500-500		TPD500-690						
				230 ... 500 Vac ±10% 3ph, 50/60 Hz ±5%	350 ... 690 Vac ±10% 3ph, 50/60 Hz ±5%	2B	4B	2B	4B					
01200	•	•	E	•		580	525			1200	Programmable up to 150%	230 ... 500 Vac ±10% 1-phase, 50/60 Hz ±5%	40	115 Vac ±10% or 230 Vac ±10%, 1-phase, 50/60 Hz ±5%
01500	•	•	E	•						1500			40	
01700	•	•	E	•						1700			40	
01800	•	•	E	•						1800			40	
02000	•	•	E	•						2000			40	
02400	•	•	E	•						2400			70	
02700	•	•	E	•						2700			70	
02900	•	•	E	•						2900			70	
03300	•	•	E	•						3300			70	
01010	•	•	E		•			800	725	1010			40	
01400	•	•	E		•					1400			40	
01700	•	•	E		•					1700			40	
02000	•	•	E		•					2000			40	
02400	•	•	E		•					2400			70	
02700	•	•	E		•					2700			70	
03300	•	•	E		•					3300			70	

Table 2-3: Drive sizes - TPD500-CU Control Unit

SIZE	QUA-DRANTS	CONSTRUCTION TYPE	ARMATURE SENSING CIRCUIT		Rated DC output current (selectable) [A]	SCR DRIVING [°]		FIELD CIRCUIT		REG. CARD
	2B 4B		AC voltage sensing			THY1	THY2	AC supply voltage	Rated DC output current @40°C [A]	AC supply voltage
			TPD500-500	TPD500-690						
			230 ... 500 Vac ±10% 3ph, 50/60 Hz ±5%	350 ... 690 Vac ±10% 3ph, 50/60 Hz ±5%						
500-THY1-FC40	•	A1	•		4 ... 20.000	•		230 Vac ... 500 Vac ±10% 1-phase, 50/60 Hz ±5%	40	115 Vac ±10% or 230 Vac ±10%, 1-phase, 50/60 Hz ±5%
500-THY2-FC40	•	A1	•				•		40	
500-THY1-FC70	•	A1	•			•			70	
500-THY2-FC70	•	A1	•				•		70	
690-THY1-FC40	•	A1		•		•			40	
690-THY2-FC40	•	A1		•			•		40	
690-THY1-FC70	•	A1		•		•			70	
690-THY2-FC70	•	A1		•			•		70	

[*] THY1: single-secondary pulse transformer, suitable for driving a single SCR per branch.

THY2: dual-secondary pulse transformer, suitable for driving two SCR in parallel per branch.

Example of drive selection for a 15 kW motor

Supply voltage: 3 x 400 Vac

1. Biquadrant operation

Motor nameplate data	Rated power	P	15 kW
	Armature voltage	U _{DN}	470 V
	Armature current	I _{DN}	37.6 A
	Field voltage	U _{FN}	310 V
	Field current	I _{FN}	0.8 A
Selection criteria	Input voltage	U _{LN}	3 x 400 V < 500 V
	Closest available armature current value to the motor's required value	I _{DN}	37.6 A < 40 A
	Closest available field current value to the motor's required value	I _{FN}	0.8 A < 6.25 A
Selected drive	TPD500-500-00040-2B-A		
For use with overload cycles, refer to Chapter 6.18.8 - Overload .			

2. Tetraquadrant operation

Motor nameplate data	Rated power	P	15 kW
	Armature voltage	U _{DN}	420 V
	Armature current	I _{DN}	42 A
	Field voltage	U _{FN}	310 V
	Field current	I _{FN}	0.8 A
Selection criteria	Input voltage	U _{LN}	3 x 400 V < 500 V
	Closest available armature current value to the motor's required value	I _{DN}	42 A < 70 A
	Closest available field current value to the motor's required value	I _{FN}	0.8 A < 8.33 A
Selected drive	TPD500-500-00070-4B-A		
For use with overload cycles, refer to Chapter 7.18.9 - Overload .			

2.2 Technical data

2.2.1 Environmental conditions

Degree of protection: IP20 - Frame A, B, C and TPD500-CU

IP00 - Frame E

Type: Open Type with Type 1 enclosure (UL) - Frame A, B, C

Open Type with Type 0 - Frame E

Pollution degree: 2

Altitude: North America (cULus)

Up to 2000 m with the following precautions:

- Up to 1000 m above sea level - no derating.
- Above this altitude - reduce the current by 1.2% for every 100 m of increase.

Rest of the world

Up to 4000 m with the following precautions:

- Up to 1000 m above sea level - no derating.
- Above this altitude - reduce the current by 1.2% for every 100 m of increase.
- From 2000 m to 4000 m - use with voltage derating (1.1% reduction of the nominal value for every 100 meters of increase).

OPERATING

Temperature:

TPD500 FRAME A,B,C,E

Ta = 0 ... 55°C

When the maximum ambient air temperature is between 40°C and 55°C, apply a derating of the output current of 1.25%/°C (down to 81% at 55°C).

TPD500-CU

Ta = 0 ... 55°C

Above 50°C, reduce the current by 1.25% per degree Celsius (derating to 93% at 55°C)
5% to 85%, 1 g/m³ to 25 g/m³, without condensation or ice formation.

Air humidity:

NOTE!

The derating factors to be applied are detailed in the following chapter.

TRANSPORT AND STORAGE

Storage temperature:	$T_a = -20 \dots +55^\circ\text{C}$
Transport temperature:	$T_a = -20 \dots +60^\circ\text{C}$
Air humidity:	5% up to 95%, 1 g/m ³ up to 29 g/m ³
Vibration:	Sinusoidal profile 1 g _{rms} 10-57 Hz

2.2.1.1 Derating

Three derating factors, K_T , K_i and K_u , must be considered, as they affect the drive's performance when used under conditions different from the design specifications, particularly in the following cases:

- Operating temperature above 40°C;
- Installation altitude above 1000 m above sea level.

Derating due to operating temperature

For operation above 40°C, a derating of **1.25%** of the rated armature current per degree of temperature increase must be applied, up to the maximum operating ambient temperature of 55°C.

The following graph shows the derating coefficient K_T as a function of the operating temperature.

The graph also displays the compensation coefficient K_{TC} which can be used for compensation in certain cases (see the next section "Derating due to altitude").

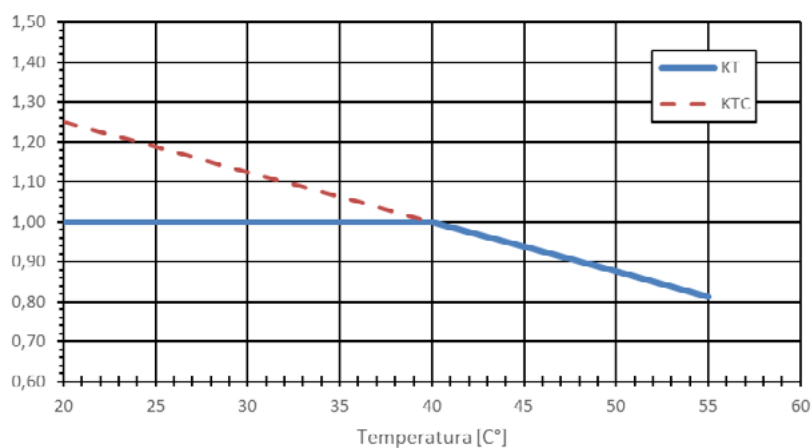


Figure 2-3: Temperature derating factor

Derating due to altitude

For operation in installations above 1000 m above sea level, the armature output current must be reduced by **1.2%** for every 100 meters of increase, up to a maximum altitude of 4000 m. This derating is included in the coefficient K_i . Additionally, the supply voltage U_{LN} must be reduced for installations above 2000 m above sea level, by **1.1%** for every 100 meters. This derating is defined by the coefficient K_u .

The following graph shows the values of K_i and K_u as a function of altitude.

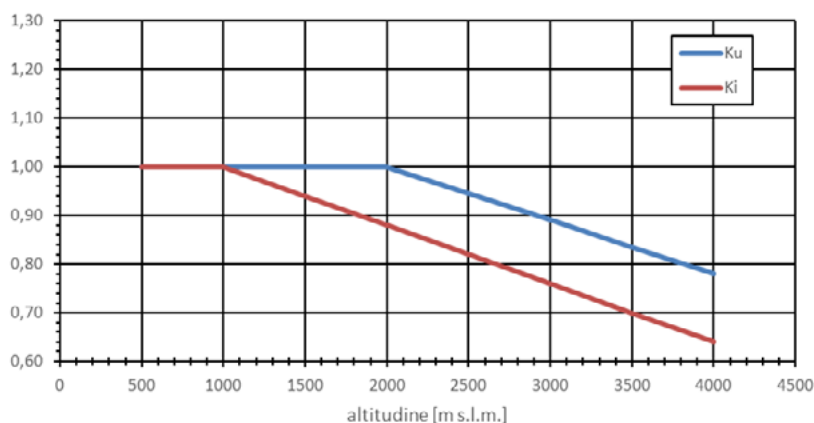


Figure 2-4: Altitude derating factor



For North American compliance marking (cULus), the maximum installation altitude must not exceed 2000 m.

The three coefficients K_I , K_U and K_T contribute together to the definition of the overall derating. For temperatures below 40°C, the overall derating on the current can be compensated using the coefficient K_{TC} . However, the final result cannot exceed the design rated current.

NOTE!

The values of the rated voltage and current must never exceed those specified in the technical specifications.

$$I_{ND} = I_N \cdot K_T \cdot K_I \cdot K_{TC}$$

$$U_{LND} = U_{LN} \cdot K_U$$

Example 1

$$V_n = 500 \text{ V}$$

$$I_n = 1000 \text{ A}$$

Operating conditions:

- Temperature = 50°C
- Altitude = 2500 m ASL

$$K_T = 0.88; K_I = 0.82; K_U = 0.95; K_{TC} = \text{Not applicable}$$

$$I_{ND} = 1000 \times 0.88 \times 0.82 = 721.6 \text{ A}$$

$$U_{LND} = 500 \times 0.95 = 475 \text{ V}$$

Example 2

Operating conditions:

- Temperature = 25°C
- Altitude: 2500 m ASL

$$K_T = 1.0; K_I = 0.82; K_U = 0.95; K_{TC} = 1.19$$

$$I_{ND} = 1000 \times 1.0 \times 1.19 \times 0.82 = 975.8 \text{ A}$$

$$U_{LND} = 500 \times 0.95 = 475 \text{ V}$$

Example 3

Operating conditions:

- Temperature = 25°C
- Altitude: 2000 m ASL

$$K_T = 1.0; K_I = 0.88; K_U = 0.96; K_{TC} = 1.19$$

$$I_{ND} = 1000 \times 1.0 \times 1.19 \times 0.88 = 1004.72 \rightarrow 1000 \text{ A}$$

$$U_{LND} = 500 \times 0.96 = 480 \text{ V}$$

NOTE!

Proceed in the same way when using a TPD500-CU, applying the dedicated coefficients.

2.2.2 Standards

General standards:	EN 61800-1, EN 60146-1-1
Electrical safety:	EN 61800-5-1, UL 61800.5.1
Electromagnetic compatibility:	EN 61800-3 Category C3
Operating conditions:	Environment II
Degree of protection:	EN 60529 IP20 - Frame A, B, C and TPD500-CU IP00 - Frame E

Approvals:

CONSTRUCTION TYPE	APPROVED MARKS	PENDING
A	  * 	
B	  	
C	  	
CU	 	 
E	 	 

* except for TPD500-500-00020-xB-A.

NOTE!

The certification for the TPD500 series drive is currently in progress at the time of writing this manual. Please refer to the updated product documentation for this information or contact customer service.
For products already received, verify the presence of the **compliance mark** on the product label.

2.2.3 Connection to the armature power input

The equipment must be used with a power supply up to the value indicated on the label.

During the drive commissioning, the undervoltage threshold for the power section can be set using the parameter IPA 5018-Undervolt thr (default 230 V).

NOTE!

For the operation of the TPD500 series drives, network inductors and possible interference filters are required. Refer to the guidelines in **Chapter 4.12 – Inductors and filters**. Drives with a rating above 770 A and network filters have high leakage currents to ground.
Installation regulations require a fixed, non-interruptible ground connection.

2.3 Electrical data

North America (cULus)

Rest of the world

Overvoltage Category

Short Circuit Current Rating (SCCR)

3 x 230...500 Vac, 50/60 Hz (230 Vac minimum operating voltage)

3 x 350...600 Vac, 50/60 Hz (350 Vac minimum operating voltage)

3 x 230...500 Vac, 50/60 Hz (230 Vac minimum operating voltage)

3 x 350...690 Vac, 50/60 Hz (350 Vac minimum operating voltage)

III

TPD500 Frame A and B = high current 50 kA

TPD500 Frame C = high current 100 kA

TPD500 Frame E = standard current

TPD500-CU = standard current

The **general tolerances** for the nominal supply voltages and nominal network frequencies indicated are:

- Voltage = $\pm 10\%$
- Frequency = $\pm 5\%$

2.3.1 Input circuit

Table 2-4: Input currents for Frame A, B, C, E

DRIVE		U/V/W MAIN INPUT (armature)			U1/V1 INPUT (field circuit)			U2/V2 INPUT (control board)										
Model	Construction type	Voltage	Frequency	Continuous current	Voltage	Frequency	Current	Voltage	Frequency	Current								
		[Vac]	[Hz]	[Aac]	[Vac]	[Hz]	[A]	[Vac]	[Hz]	[A]								
TPD500-500-00020-2B-A	A	230 ... 500	50/60	17	230 ... 500	50/60	6,25	115 230	50/60	1 A @115 V 0.5 A @230 V								
TPD500-500-00040-2B-A				34			8,33											
TPD500-500-00070-2B-A				60			8,33											
TPD500-500-00110-2B-A				95			12,5											
TPD500-500-00140-2B-A				120			12,5											
TPD500-500-00185-2B-A				158			12,5											
TPD500-500-00020-4B-A				17			6,25											
TPD500-500-00040-4B-A				34			8,33											
TPD500-500-00070-4B-A				60			8,33											
TPD500-500-00110-4B-A				95			12,5											
TPD500-500-00140-4B-A				120			12,5											
TPD500-500-00185-4B-A				158			12,5											
TPD500-500-00280-2B-B				B			230 ... 500				50/60	241	230 ... 500	50/60	20	115 230	50/60	1 A @115 V 0.5 A @230 V
TPD500-500-00350-2B-B												301						
TPD500-500-00420-2B-B	361																	
TPD500-500-00500-2B-B	430																	
TPD500-500-00650-2B-B	559																	
TPD500-500-00280-4B-B	241																	
TPD500-500-00350-4B-B	301																	
TPD500-500-00420-4B-B	361																	
TPD500-500-00500-4B-B	430																	
TPD500-500-00650-4B-B	559																	
TPD500-500-00770-2B-C	C	230 ... 500	50/60	663	500	50/60	25	115 230	50/60	1 A @115 V 0.5 A @230 V								
TPD500-500-01000-2B-C				860														
TPD500-690-00560-2B-C		350 ... 690 [1]		482														
TPD500-690-00700-2B-C				603														
TPD500-690-00900-2B-C				775														
TPD500-500-00770-4B-C		230 ... 500		663														
TPD500-500-01050-4B-C				904														
TPD500-690-00560-4B-C		350 ... 690 [1]		482														
TPD500-690-00700-4B-C				603														
TPD500-690-00900-4B-C				775														

[1] Up to 600 Vac for the North American market (cULus)

DRIVE		U/V/W MAIN INPUT (armature)			U1/V1 INPUT (field circuit)			U2/V2 INPUT (control board)		
Model	Construction type	Voltage	Frequency	Continuous current	Voltage	Frequency	Current	Voltage	Frequency	Current
		[Vac]	[Hz]	[Aac]	[Vac]	[Hz]	[A]	[Vac]	[Hz]	[A]
TPD500-500-01200-2B-E	E	230 ... 500	50/60	1032	230 ... 500	50/60	40	115/230	50/60	1 A @115 V 0.5 A @230 V
TPD500-500-01500-2B-E				1290			40			
TPD500-500-01800-2B-E				1542			40			
TPD500-500-02000-2B-E				1720			40			
TPD500-500-02400-2B-E				2064			70			
TPD500-500-02700-2B-E				2313			70			
TPD500-500-02900-2B-E				2485			70			
TPD500-500-03300-2B-E				2827			70			
TPD500-500-01500-4B-E				1290			40			
TPD500-500-01700-4B-E				1464			40			
TPD500-500-02000-4B-E				1720			40			
TPD500-500-02400-4B-E				2064			70			
TPD500-500-02700-4B-E				2313			70			
TPD500-500-03300-4B-E				2827			70			
TPD500-690-01010-2B-E		350 ... 690		860			40			
TPD500-690-01400-2B-E				1205			40			
TPD500-690-01700-2B-E				1464			40			
TPD500-690-02000-2B-E				1720			40			
TPD500-690-02400-2B-E				2064			70			
TPD500-690-02700-2B-E				2313			70			
TPD500-690-03300-2B-E				2827			70			
TPD500-690-01010-4B-E				860			40			
TPD500-690-01400-4B-E				1205			40			
TPD500-690-01700-4B-E				1464			40			
TPD500-690-02000-4B-E				1720			40			
TPD500-690-02400-4B-E				2064			70			
TPD500-690-02700-4B-E				2313			70			
TPD500-690-03300-4B-E				2827			70			

Table 2-5: Input currents for TPD500-CU - Control Unit

DRIVE		INPUT VOLTAGE SENSING		U1/V1 INPUT (field circuit)			U2/V2 INPUT (control board)		
Model	Construction type	Voltage	Frequency	Voltage	Frequency	Current	Voltage	Frequency	Current
		[Vac]	[Hz]	[Vac]	[Hz]	[A]	[Vac]	[Hz]	[A]
TPD500-CU-500-THY1-FC40	A4	230 ... 500	50/60	230 ... 500	50/60	40	115/230	50/60	1 A @115 V 0.5 A @230 V
TPD500-CU-500-THY1-FC70						70			
TPD500-CU-500-THY2-FC40						40			
TPD500-CU-500-THY2-FC70						70			
TPD500-CU-690-THY1-FC40		350 ... 690				40			
TPD500-CU-690-THY1-FC70						70			
TPD500-CU-690-THY2-FC40						40			
TPD500-CU-690-THY2-FC70						70			

NOTE!

If the U2/V2 terminals of Frame B and C are powered at 115 V, connect the SA/SB terminals located at the top of the drive using an AWG 18 cable with an insulation voltage rating of at least 300 Vac. For Frame B take as reference the below figure, for Frame C ask assistance to technohelp@weg.net

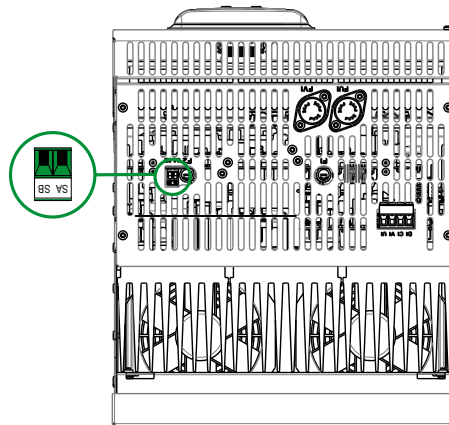


Figure 2-5: Position of SA/SB terminals for Frame B

2.3.2 Output circuit

The considered output voltages account for a network undervoltage within the specified tolerance limits and a voltage drop of 4% due to the network inductors used. This value corresponds to the recommended nominal armature voltage for the connected motor.



WARNING!

It is not allowed to connect an external voltage to the drive's output terminals! It is also not allowed to disconnect the motor from the device's output while the drive is operating.

Under normal conditions, a smoothing inductor is not required. However, it may be necessary depending on the type of motor used (refer to the motor documentation). In this case, insert the prescribed inductor by connecting it in series with the armature. The specified currents refer to continuous operation with an ambient temperature of 40°C.

Table 2-6: Output currents for Frame A, B, C, E

DRIVE		MAIN OUTPUT - ARMATURE		FIELD OUTPUT		
Model	Construction type	Voltage	Continuous current	Voltage	Frequency	Current
		[Vdc]	[Adc]	[Vdc]	[Hz]	[Adc]
TPD500-500-00020-2B-A	A	580	20	390	50/60	6.25
TPD500-500-00040-2B-A			40			8.33
TPD500-500-00070-2B-A			70			
TPD500-500-00110-2B-A			110			
TPD500-500-00140-2B-A			140			12.5
TPD500-500-00185-2B-A			184			
TPD500-500-00020-4B-A		525	20			6.25
TPD500-500-00040-4B-A			40			8.33
TPD500-500-00070-4B-A			70			
TPD500-500-00110-4B-A			110			
TPD500-500-00140-4B-A			140			12.5
TPD500-500-00185-4B-A			184			

DRIVE		MAIN OUTPUT - ARMATURE		FIELD OUTPUT		
Model	Construction type	Voltage	Continuous current	Voltage	Frequency	Current
		[Vdc]	[Adc]	[Vdc]	[Hz]	[Adc]
TPD500-500-00280-2B-B	B	580	280	390	50/60	20
TPD500-500-00350-2B-B			350			
TPD500-500-00420-2B-B			420			
TPD500-500-00500-2B-B			500			
TPD500-500-00650-2B-B			650			
TPD500-500-00280-4B-B		525	280			
TPD500-500-00350-4B-B			350			
TPD500-500-00420-4B-B			420			
TPD500-500-00500-4B-B			500			
TPD500-500-00650-4B-B			650			
TPD500-500-00770-2B-C	C	580	770	390	50/60	25
TPD500-500-01000-2B-C			1000			
TPD500-690-00560-2B-C		800	560			
TPD500-690-00700-2B-C			700			
TPD500-690-00900-2B-C			900			
TPD500-500-00770-4B-C		525	770			
TPD500-500-01050-4B-C			1050			
TPD500-690-00560-4B-C		725	560			
TPD500-690-00700-4B-C			700			
TPD500-690-00900-4B-C			900			
TPD500-500-01200-2B-E	E	580	1200	390	50/60	40
TPD500-500-01500-2B-E			1500			40
TPD500-500-01800-2B-E			1800			40
TPD500-500-02000-2B-E			2000			40
TPD500-500-02400-2B-E			2400			70
TPD500-500-02700-2B-E			2700			70
TPD500-500-02900-2B-E			2900			70
TPD500-500-03300-2B-E			3300			70
TPD500-500-01500-4B-E		525	1500			40
TPD500-500-01700-4B-E			1700			40
TPD500-500-02000-4B-E			2000			40
TPD500-500-02400-4B-E			2400			70
TPD500-500-02700-4B-E			2700			70
TPD500-500-03300-4B-E			3300			70
TPD500-690-01010-2B-E		800	1010			40
TPD500-690-01400-2B-E			1400			40
TPD500-690-01700-2B-E			1700			40
TPD500-690-02000-2B-E			2000			40
TPD500-690-02400-2B-E			2400			70
TPD500-690-02700-2B-E			2700			70
TPD500-690-03300-2B-E			3300			70
TPD500-690-01010-4B-E		725	1010			40
TPD500-690-01400-4B-E			1400			40
TPD500-690-01700-4B-E			1700			40
TPD500-690-02000-4B-E			2000			40
TPD500-690-02400-4B-E			2400			70
TPD500-690-02700-4B-E			2700			70
TPD500-690-03300-4B-E			3300			70

Table 2-7: Output currents for TPD500-CU - Control Unit

DRIVE		MAIN OUTPUT - ARMATURE		FIELD OUTPUT		
Model	Construction type	Voltage	Continuous current	Voltage	Frequency	Current
		[Vdc]	[Adc]	[Vdc]	[Hz]	[Adc]
TPD500-CU-500-THY1-FC40	A4	depends on external power bridge 4 20000 A is the currents range managed by CU		390	50/60	40
TPD500-CU-500-THY1-FC70						70
TPD500-CU-500-THY2-FC40						40
TPD500-CU-500-THY2-FC70						70
TPD500-CU-690-THY1-FC40						40
TPD500-CU-690-THY1-FC70						70
TPD500-CU-690-THY2-FC40						40
TPD500-CU-690-THY2-FC70						70

2.3.3 Field circuit calibration

The field current reading is performed by inserting resistors that determine the maximum readable scale. These resistors can be selected via **dip-switch S14** (refer to the following tables). The drive, by default, is set to the maximum current managed by the internal circuitry.

Configure the dip-switches so that the set current scale is greater than or equal to the motor's field current.

If you want to maximize reading accuracy, you can insert your own resistor, properly calculated according to the formula described in the following tables, through terminals LA and LB. In this case, set all the dip-switches to zero (OFF) to disconnect the internal resistors.

Remember to set the parameter IPA 304 - **Drive field current** to the chosen value.

Example:

- Motor field current = 2.5 A
- Select the dip-switches corresponding to 3 A
- Set IPA 304 - **Drive field current** = 3 A

NOTE!

Calibration is not necessary when the field control of the motor is managed by an external system, rather than the internal field converter of the TPD500.

1) For sizes TPD500-500-00020-...-A to TPD500-500-00185-...-A

NOTE!

For improved readability of the following tables, the OFF state of the dip-switches is indicated by "-" (dash).

Table 2-8: PFC1-6 board mounted on TPD500-500-00020-xB-A

PFC1-6 board mounted on TPD500-500-00020-xB-A										Factory setting
Dip-switch	S14-1	S14-2	S14-3	S14-4	S14-5	S14-6	S14-7	S14-8	Equivalent resistance [Ω]	
Resistive value [Ω]	168.5	333.3	182	36.4	845	1668	3333	-		
Rated field current [A]	Equivalent resistance = 416.7 / field current									
6.25	ON	ON	ON	-	-	ON	-	-	66.5	•
6	ON	ON	ON	-	-	-	-	-	69.3	
5	ON	-	ON	-	-	ON	-	-	83.1	
4	ON	ON	-	-	-	ON	-	-	104.9	
3	-	-	ON	-	ON	ON	-	-	137.4	
2	-	ON	-	-	ON	ON	-	-	208.9	
1.5	-	ON	-	-	-	ON	-	-	277.6	

Table 2-9: PFC1-8 board mounted on TPD500-500-00040-xB-A and TPD500-500-00070-xB-A

PFC1-8 board mounted on TPD500-500-00040-xB-A and TPD500-500-00070-xB-A										Factory setting
Dip-switch	S14-1	S14-2	S14-3	S14-4	S14-5	S14-6	S14-7	S14-8	Equivalent resistance [Ω]	
Resistive value [Ω]	168.5	333.3	182	36,4	845	1668	3333	-		
Rated field current [A]	Equivalent resistance = 555.5 / field current									
8.33	ON	ON	ON	-	-	ON	-	-	66.5	•
8	ON	ON	ON	-	-	-	-	-	69.3	
7	ON	-	ON	-	ON	-	-	-	79.3	
6	ON	ON	-	-	ON	ON	-	-	93.3	
5	ON	ON	-	-	-	-	-	-	111.9	
4	-	-	ON	-	ON	ON	-	-	137.4	
3	-	-	ON	-	-	-	-	-	182	
2	-	ON	-	-	-	ON	-	-	277.6	
1	-	-	-	-	ON	ON	-	-	560.9	

Table 2-10: PFC1-12 board mounted on TPD500-500-00110-xB-A and TPD500-500-00185-xB-A

PFC1-12 board mounted on TPD500-500-00110-xB-A and TPD500-500-00185-xB-A										Factory setting
Dip-switch	S14-1	S14-2	S14-3	S14-4	S14-5	S14-6	S14-7	S14-8	Equivalent resistance [Ω]	
Resistive value [Ω]	168.5	333.3	182	36.4	845	1668	3333	-		
Rated field current [A]	Equivalent resistance = 833.3 / field current									
12.5	ON	ON	ON	-	-	ON	-	-	66.5	•
12	ON	ON	ON	-	-	-	-	-	69.3	
10	ON	-	ON	-	-	ON	-	-	83.1	
8	ON	ON	-	-	-	ON	-	-	104.9	
7	-	ON	ON	-	-	-	-	-	117.7	
6	-	-	ON	-	ON	ON	-	-	137.4	
5	ON	-	-	-	-	-	-	-	168.5	
4	-	ON	-	-	ON	ON	-	-	208.9	
3	-	ON	-	-	-	ON	-	-	277.6	
2.5	-	ON	-	-	-	-	-	-	333.3	
1.5	-	-	-	-	ON	ON	-	-	560.9	
1	-	-	-	-	ON	-	-	-	845	

2) Per sizes above TPD500-500-00280-...-B up to TPD500-500-01050-...-C

Table 2-11: PFC3S2A-31 and PFC3 boards mounted on TPD500-500-00280-xB-B up to TPD500-500-01050-xB-C

PFC3S2A-31 and PFC3 boards mounted on TPD500-500-00280-xB-B up to TPD500-500-01050-xB-C										Factory setting
Dip-switch	S14-1	S14-2	S14-3	S14-4	S14-5	S14-6	S14-7	S14-8	Equivalent resistance [Ω]	
Resistive value [Ω]	168.5	333	182	36.4	845	1668	3333.3	-		
Rated field current [A]	Equivalent resistance = 1667 / field current									
25.1	ON	ON	ON	-	-	ON	-	-	66.5	•
24.1	ON	ON	ON	-	-	-	-	-	69.3	
20	ON	-	ON	-	-	ON	-	-	83.1	
17.1	-	ON	ON	-	ON	ON	-	-	97.3	
14.2	-	ON	ON	-	-	-	-	-	117.7	
12.9	ON	-	-	-	ON	ON	-	-	129.6	
9,9	ON	-	-	-	-	-	-	-	168.5	
5	-	ON	-	-	-	-	-	-	333.3	
3	-	-	-	-	ON	ON	-	-	560.9	
2	-	-	-	-	ON	-	-	-	845	
1	-	-	-	-	-	ON	-	-	1668	

3) Per sizes above TPD500-500-01010-...-E up to TPD500-500-02000-...-E

Table 2-12: Field current resistors (> 1010 ... 2000 A, type E)

1010 A ... 2000 A										Factory setting
Dip-switch	S14-1	S14-2	S14-3	S14-4	S14-5	S14-6	S14-7	S14-8	Equivalent resistance [Ω]	
Resistive value [Ω]	168.5	333	182	36.4	845	1668	3333.3	-		
Rated field current [A]	Equivalent resistance = 3332 / field current									
40	ON	-	ON	-	-	ON	-	-	83	
20	ON	-	-	-	-	-	-	-	168	
10	-	ON	-	-	-	-	-	-	332	

4) Per sizes above TPD500-500-02000-...-E up to TPD500-500-03300-...-E

Table 2-13: Field current resistors (> 2000 ... 3000 A, type E)

> 2000 A										Factory setting
Dip-switch	S14-1	S14-2	S14-3	S14-4	S14-5	S14-6	S14-7	S14-8	Equivalent resistance [Ω]	
Resistive value [Ω]	168.5	333	182	36.4	845	1668	3333.3	-		
Rated field current [A]	Equivalent resistance = 1667 / field current									
70	ON	ON	ON	ON	-	-	-	-		
46	-	-	-	ON	-	-	-	-	36.4	
24	ON	ON	ON	-	-	-	-	-	69.2	
14	-	ON	ON	-	-	-	-	-	117.6	

5) Per sizes TPD500-CU-...-FC40

Table 2-14: Field current resistors sizes TPD500-CU-...-FC40

TPD500-CU-....FC40										Factory setting
Dip-switch	S14-1	S14-2	S14-3	S14-4	S14-5	S14-6	S14-7	S14-8	Equivalent resistance [Ω]	
Resistive value [Ω]	168.5	333	182	36.4	845	1668	3333.3	-		
Rated field current [A]	Equivalent resistance = 1667 / field current									
40	ON	-	ON	-	-	ON	-	-	83.3	•
30	ON	ON	-	-	-	-	-	-	111.1	
20	ON	-	-	-	-	-	-	-	166.6	
10	-	ON	-	-	-	-	-	-	333.2	
6	-	-	-	-	ON	ON	-	-	555.3	
4	-	-	-	-	ON	-	-	-	833.0	
2	-	-	-	-	-	ON	-	-	1666.0	

6) Per sizes TPD500-CU-...-FC70

Table 2-15: Field current resistors sizes TPD500-CU-...-FC70

TPD500-CU-....FC70										Factory setting
Dip-switch	S14-1	S14-2	S14-3	S14-4	S14-5	S14-6	S14-7	S14-8	Equivalent resistance [Ω]	
Resistive value [Ω]	168.5	333	182	36.4	845	1668	3333.3	-		
Rated field current [A]	Equivalent resistance = 1667 / field current									
70	ON	ON	ON	ON	-	-	-	-	23,8	
50	-	ON	-	ON	-	-	-	-	33,3	
20	ON	-	ON	-	-	ON	-	-	83,4	
10	ON	-	-	-	-	-	-	-	166,7	
5	-	ON	-	-	-	-	-	-	333,4	
1	-	-	-	-	-	ON	-	-	1667,0	

2.3.4 Control and regulation section

Below are the technical specifications of the digital and analog inputs and outputs of the **R-TPD500** control board, along with the system's power supply and control parameters. Tolerances and operating values are provided to ensure stable and reliable operation, including detailed information on voltages, currents, and encoder signals.

Interlocks (enabling signals):		0 / 15 ... 30 V	3.2 ... 6.5 mA (approx. 5 mA at 24 V)		
Analog inputs:	configurable	0 ... ±10 V	0.25 mA max		
		0 ... 20 mA	10 V max		
		4 ... 20 mA	10 V max		
		0... ±10 V	5 mA max		
Analog outputs:		0 / 15 ... 30 V	3.2 ... 6.5 mA (approx. 5 mA at 24 V)		
Digital inputs:	power supply	+15 ... 30 V			
		+15 ... 30 V	50 mA max		
Digital outputs:	signals				
Incremental digital encoder inputs:	voltage		5 V TTL / 15...24 V HTL (High level)		
			4.5 mA / 6.8 ... 10.9 mA per channel when logic level is high		
			min 150 - max 16382		
			150 kHz		
			shielded, 150 m (0.75 mm ²) / 125 m (0.5 mm ²) / 55 m (0.22 mm ²)		
Tachogenerator input:	cable		22.7 / 45.4 / 90.7 / 181.6 / 302.9 ^[1] V max		
			it depends on the configuration set using dip-switch S4		
			8 mA at full scale		
			shielded; max length depends on installation - typically 150 m		
Internal power supply voltage:	max load	+5 V encoder	300 mA max	connectors XE1/XE2, PIN 7/9	
			150 mA each		
		+24 V encoder	300 mA max	connectors XE1/XE2, PIN 2/7	
			150 mA each		
		+10 V	10 mA	terminal 7	
		-10 V	10 mA	terminal 8	
		+24 V	150 mA	terminal 19	
		tolerance	+5 V encoder	± 10%	internal power supply
				± 10%	
				± 3 % ^[2]	
				± 3 % ^[2]	
+24 V	+ 20 ... 30 V	unregulated			

^[1] Max 300 V only for North America (cULus).

^[2] The +10 V and -10 V voltage values are identical in absolute terms. The indicated tolerance refers to the voltage amplitude.

2.4 Dimensions and weights

In addition to the complete dimensional drawings, the overall dimensions are provided in the tables below in the format $W \times H \times d$, as illustrated in **Figure 2-6: Frame A-B-C and TPD500-CU**.

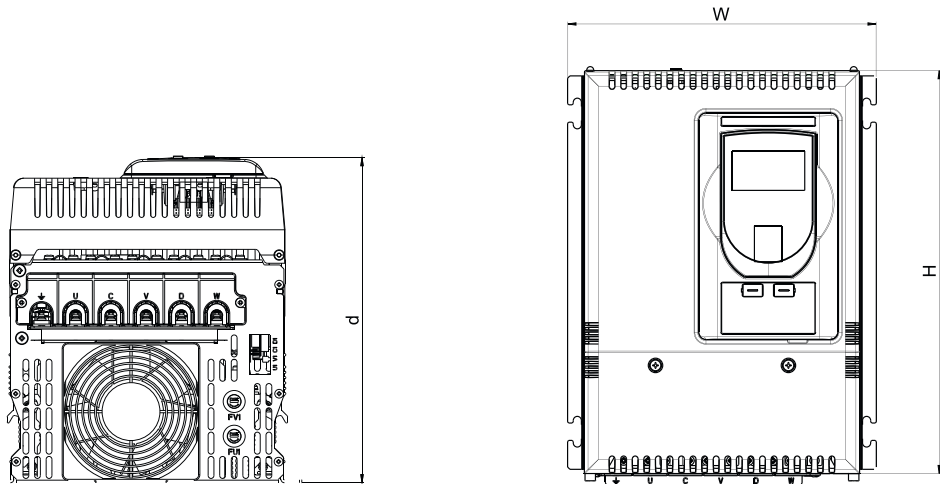


Figure 2-6: Frame A-B-C and TPD500-CU

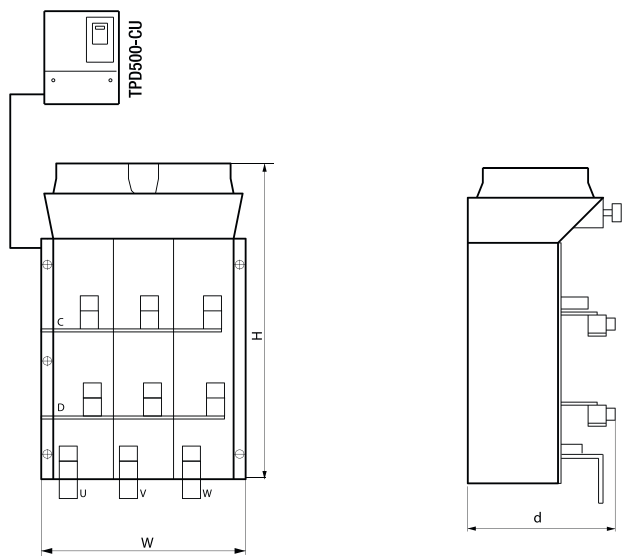


Figure 2-7: Frame E - External bridge

2.4.1 Frame A1

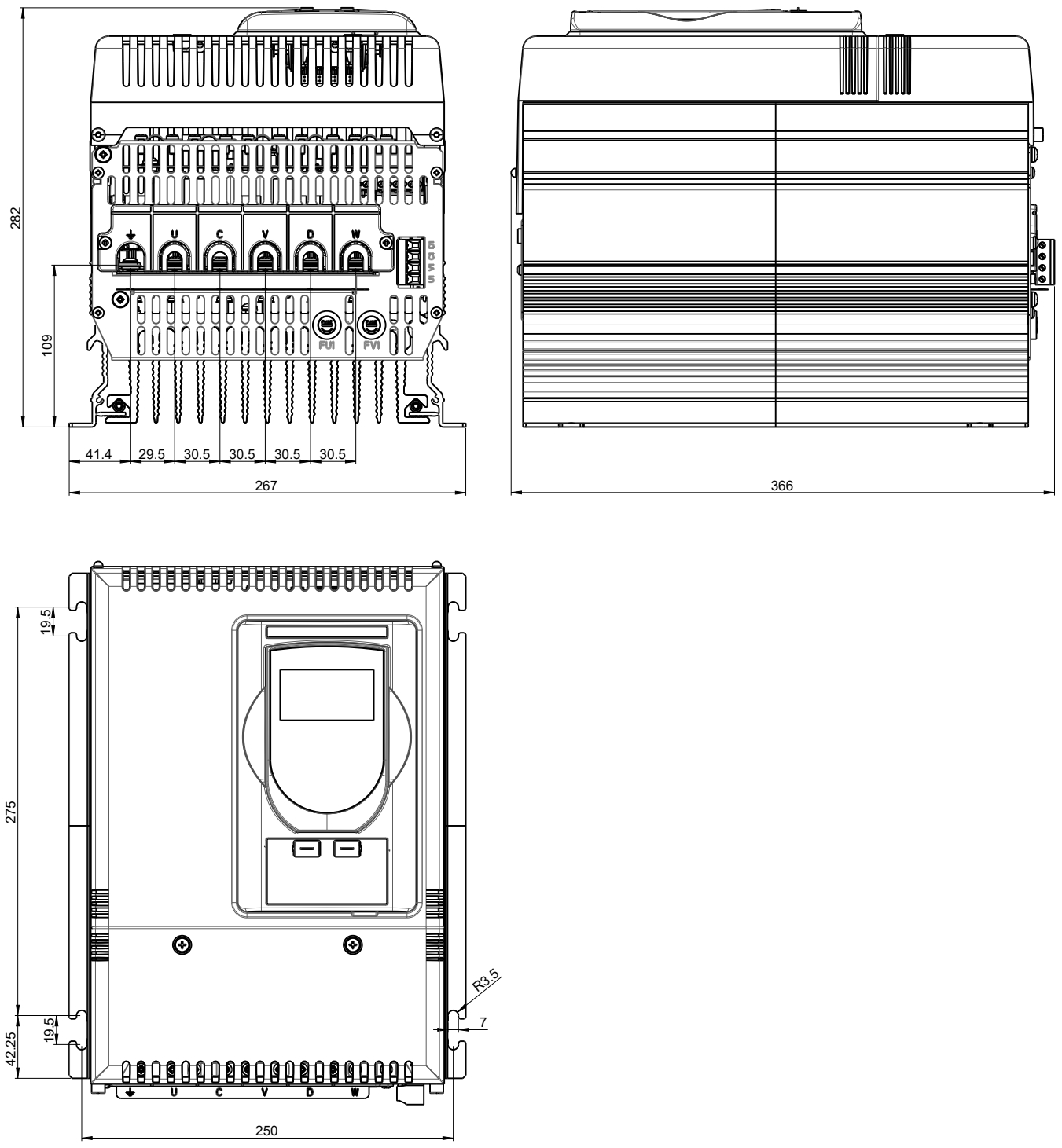


Figure 2-8: Dimensions - Frame A1

Table 2-16: Overall dimensions and weight - Frame A1

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lb]
TPD500-...-00020-...-A	282 x 366 x 267	11.1 x 14.41 x 10.51	11	24.3
TPD500-...-00040-...-A				

2.4.2 Frame A2

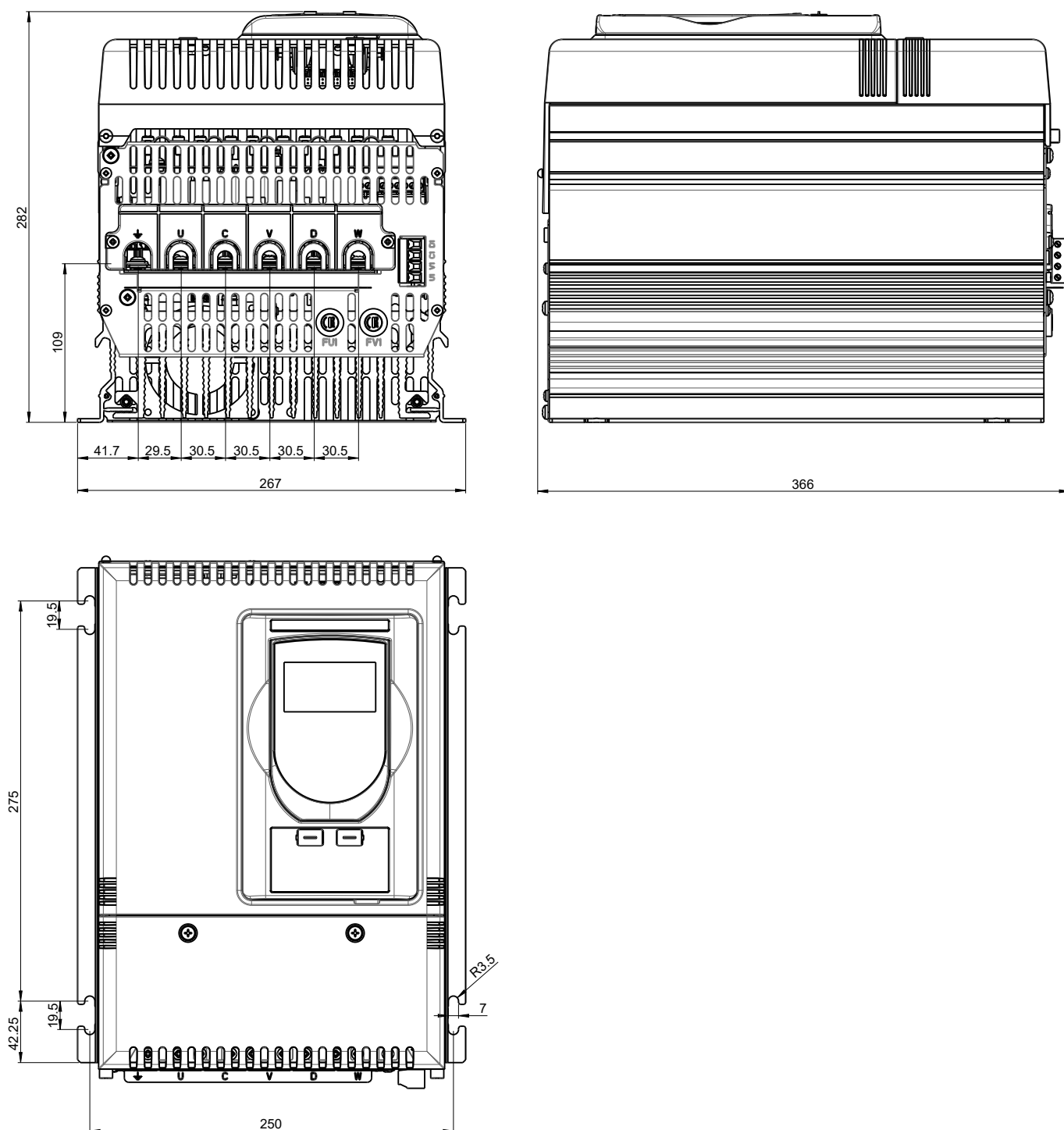


Figure 2-9: Dimensions - Frame A2

Table 2-17: Overall dimensions and weight - Frame A2

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lb]
TPD500-....00070-....A	282 x 366 x 267	11.1 x 14.41 x 10.51	11.5	25.4

2.4.3 Frame A3

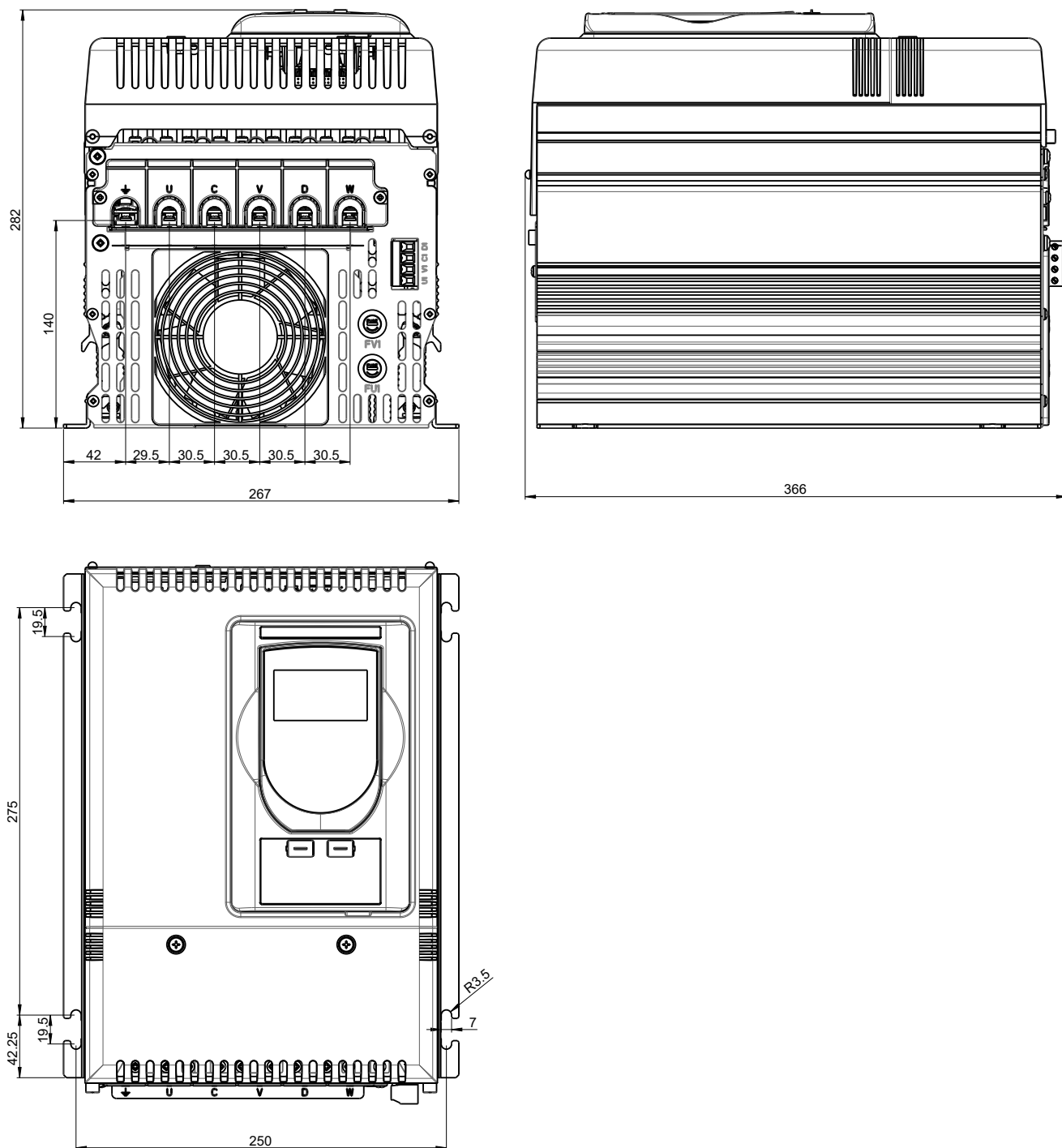


Figure 2-10: Dimensions - Frame A3

Table 2-18: Overall dimensions and weight - Frame A3

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lb]
TPD500-...-00110-...-A	282 x 366 x 267	11.1 x 14.41 x 10.51	12	26.5
TPD500-...-00140-...-A				
TPD500-...-00185-...-A				

2.4.4 Frame B1

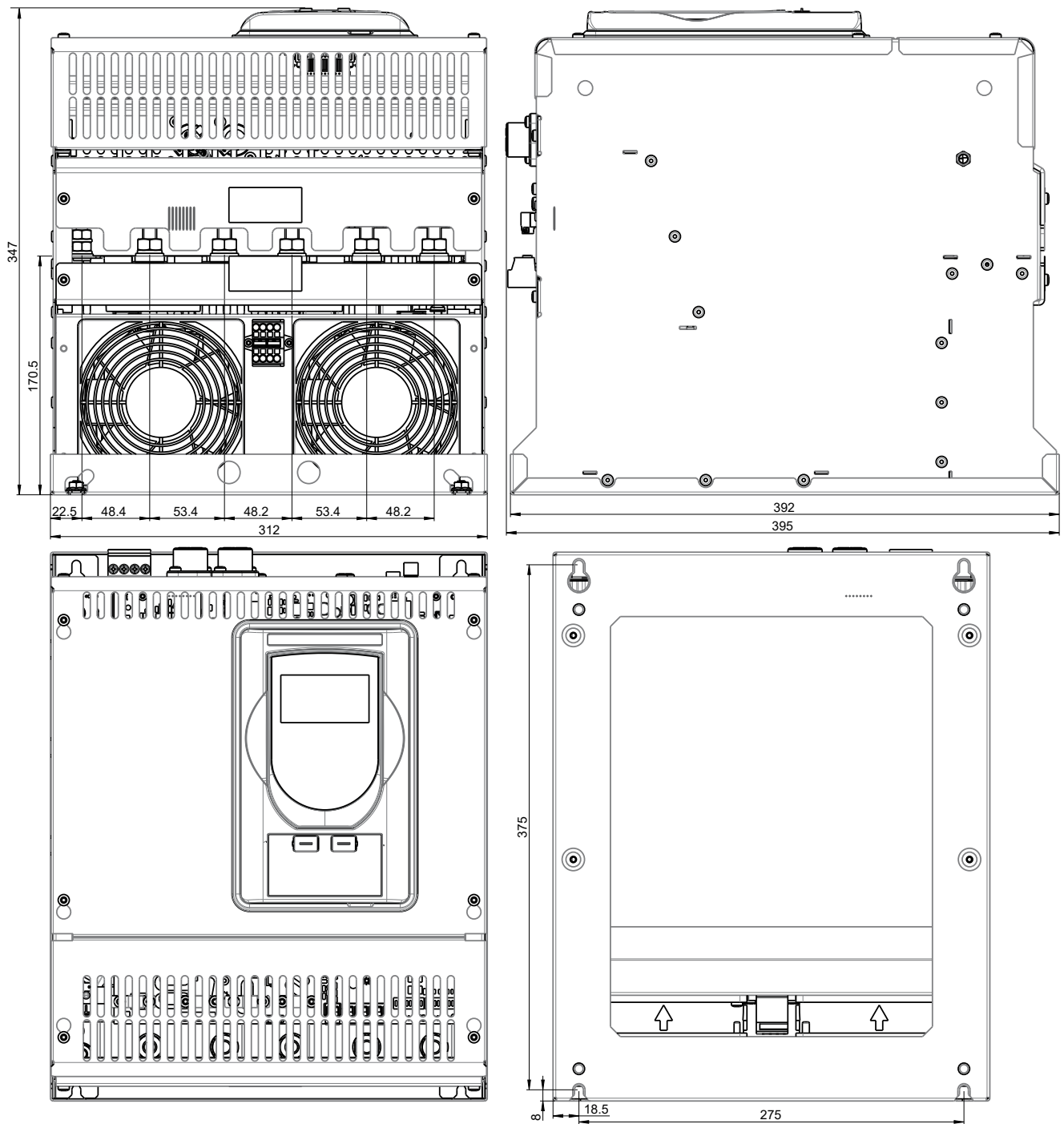


Figure 2-11: Dimensions - Frame B1

Table 2-19: Overall dimensions and weight - Frame B1

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lb]
TPD500-...-00280-...-B	312 x 395 x 347	12.28 x 15.55 x 13.66	26	57.3
TPD500-...-00350-...-B				
TPD500-...-00420-...-B				
TPD500-...-00500-...-B				

2.4.5 Frame B2

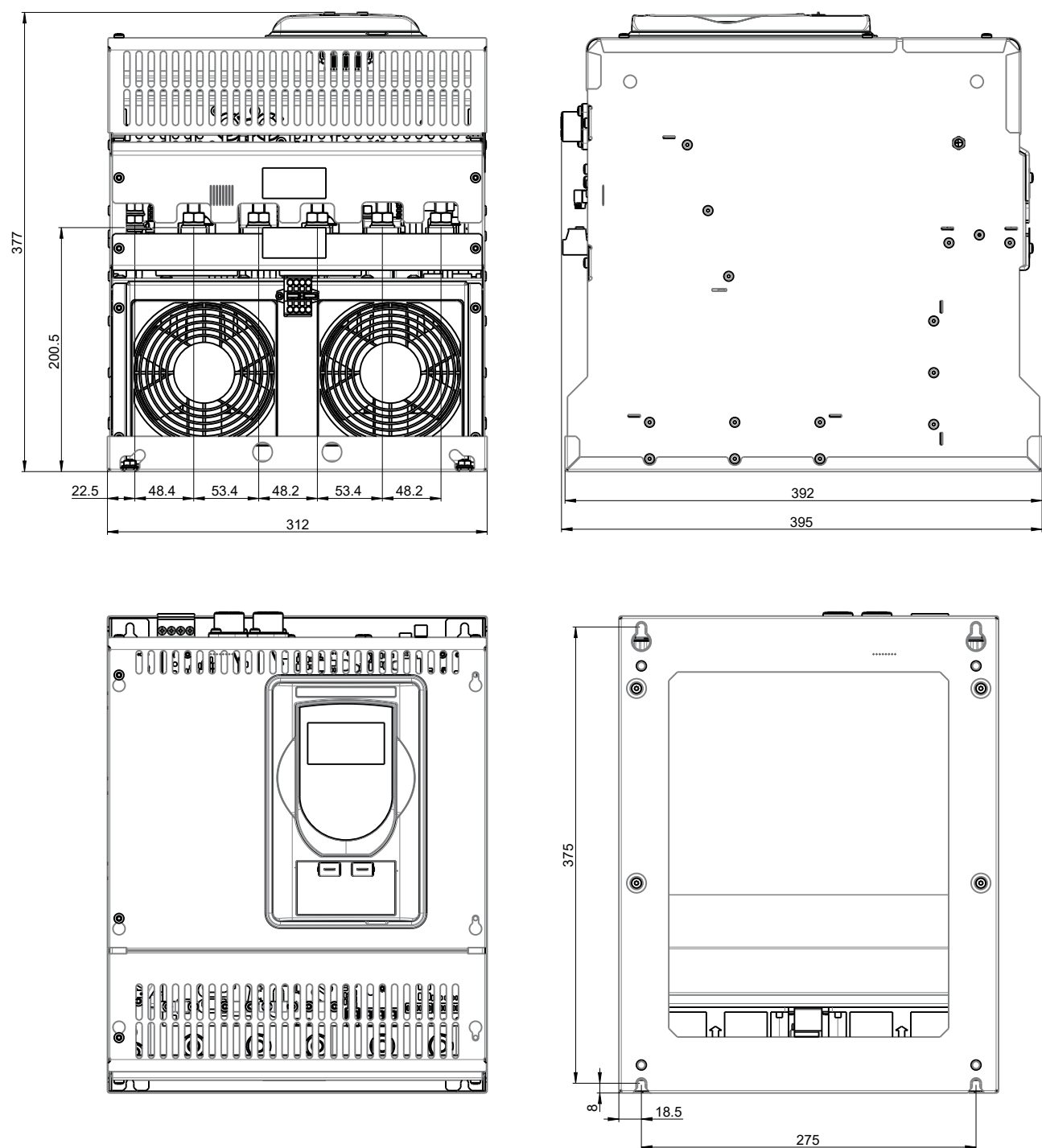


Figure 2-12: Dimensions - Frame B2

Table 2-20: Overall dimensions and weight Frame B2

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lb]
TPD500-...-00650-...-B	312 x 395 x 377	12.28 x 15.55 x 14.84	32	70.6

2.4.6 Frame C

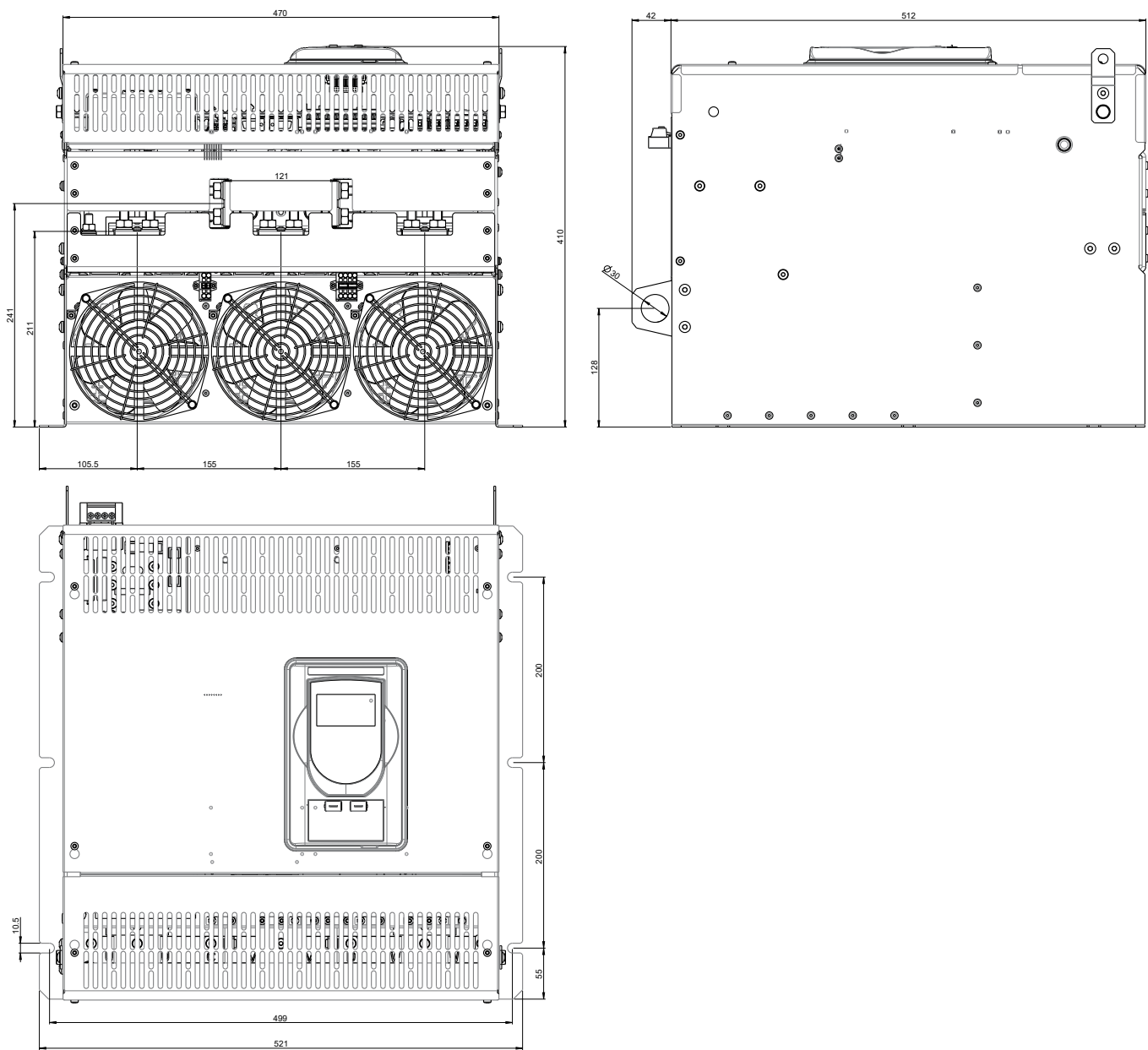


Figure 2-13: Dimensions Frame C

Table 2-21: Overall dimensions and weight Frame C

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lbs]
TPD500-...-00560-...-C	521 x 512 x 410	20.51 x 20.16 x 16.14	61	134.5
TPD500-...-00700-...-C				
TPD500-...-00770-...-C			65	143.3
TPD500-...-00900-...-C				
TPD500-...-01000-...-C			72	158.7
TPD500-...-01050-...-C				

2.4.7 TPD500-CU - Control Unit

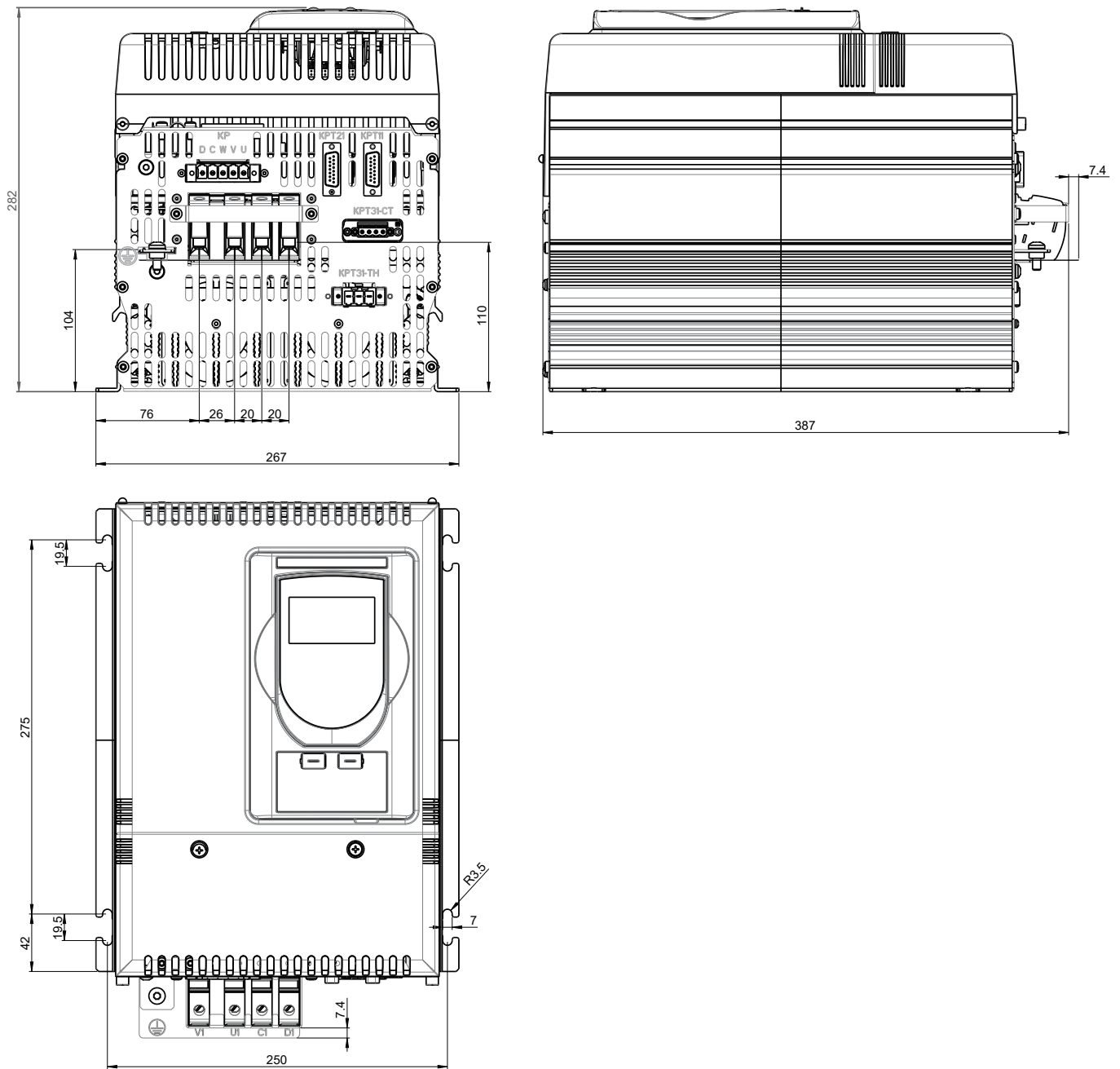


Figure 2-14: Dimensions - TPD500-CU

Table 2-22: Overall dimensions and weight - TPD500-CU

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lbs]
TPD500-CU-...-THY1-FC40	267 x 387 x 282	10.51 × 15.24 × 11.10	11	24.2
TPD500-CU-...-THY2-FC40				
TPD500-CU-...-THY1-FC70				
TPD500-CU-...-THY2-FC70				

2.4.8.1 External bridge 690 Vac - 1010 A - 2B

2.4.8.1 External bridge 690 Vac - 1010 A - 2B

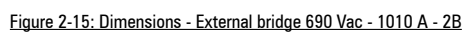


Table 2-23: Overall dimensions and weight - External bridge 690 Vac - 1010 A - 2B

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lbs]
TPD500-690-01010-2B-E	578 x 846 x 265	22.76 x 33.31 x 10.43	75	165.3

2.4.8.2 External bridge 500 Vac - 1200 A - 2B

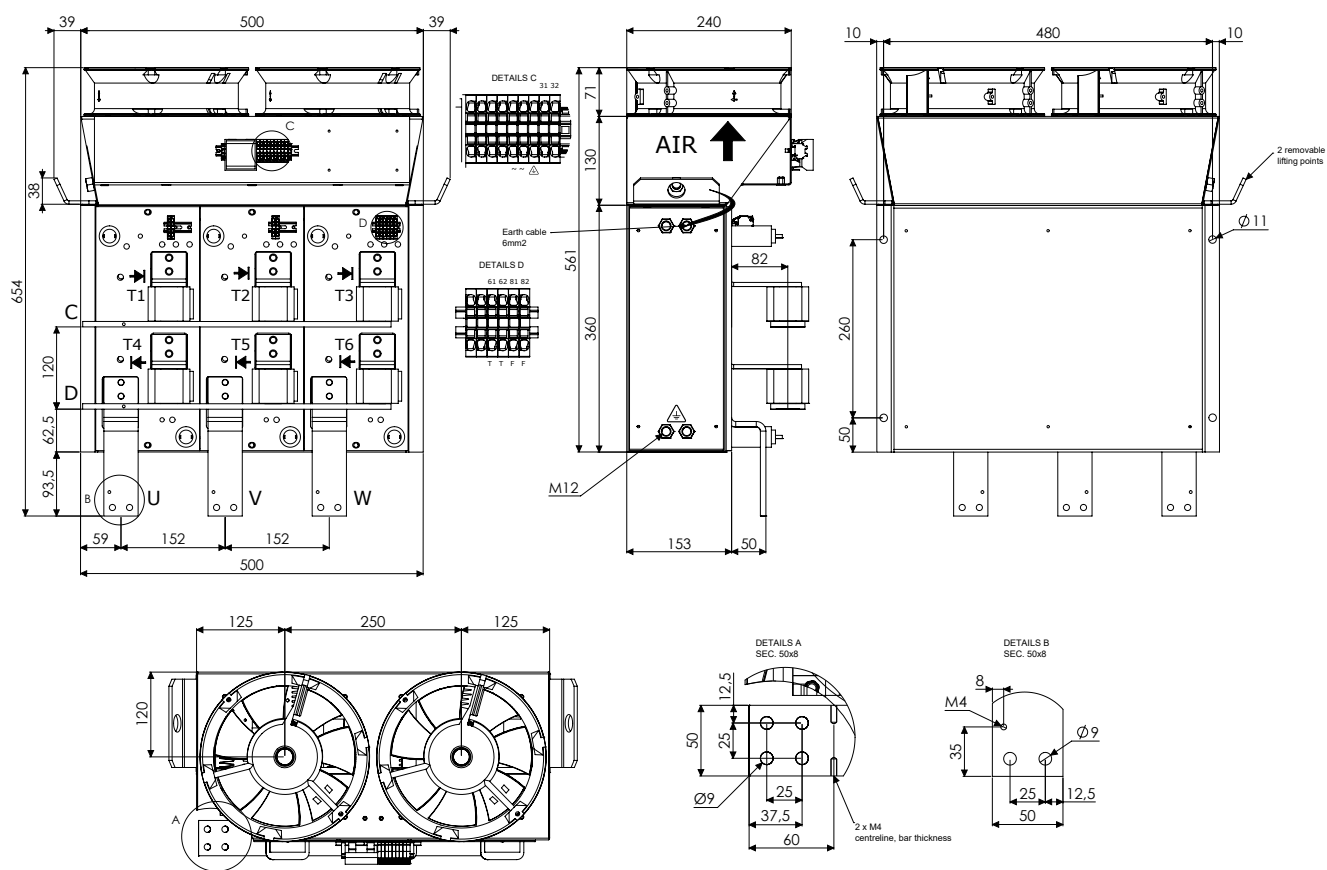


Figure 2-16: Dimensions - External bridge 500 Vac - 1200 A - 2B

Table 2-24: Overall dimensions and weight - External bridge 500 Vac - 1200 A - 2B

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lbs]
TPD500-500-01200-2B-E	578 x 654 x 265	22.76 x 25.75 x 10.43	75	165.3

2.4.8.3 External bridge 500/690 Vac - 1400...2000 A - 2B

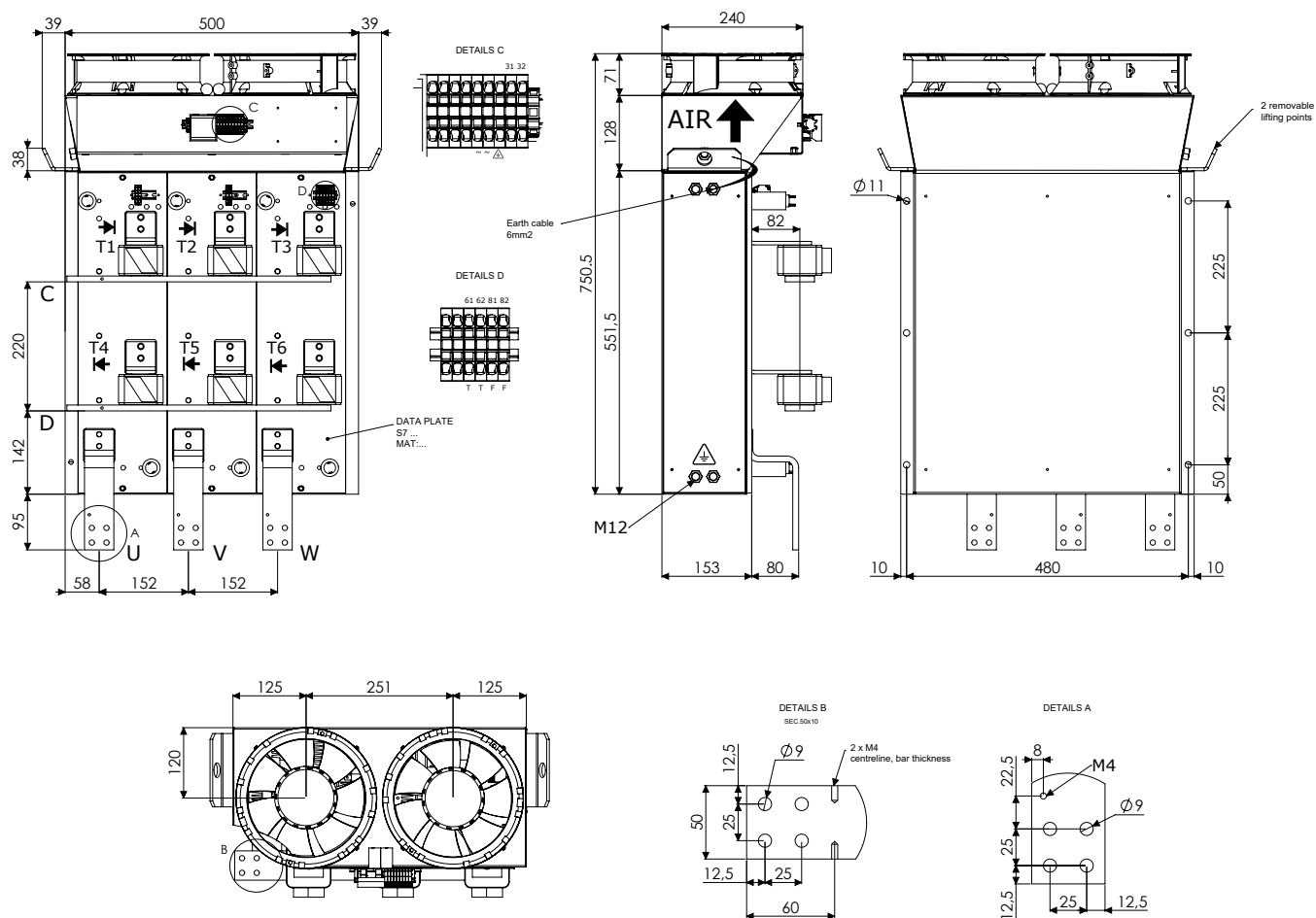


Figure 2-17: Dimensions - External bridge 500/690 Vac - 1400...2000 A - 2B

Table 2-25: Overall dimensions and weight - External bridge 500/690 Vac - 1400...2000 A - 2B

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lbs]
TPD500-690-01400-2B-E	578 x 845 x 275	22.76 x 33.27 x 10.83	75	165.3
TPD500-500-01500-2B-E				
TPD500-500-01800-2B-E				
TPD500-500-02000-2B-E				

[illegible]

Table 2-26: Overall dimensions and weight - External bridge 500/690 Vac - 1700...2400 A - 2B

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lbs]
TPD500-690-01700-2B-E	682 x 852 x 365	26.85 x 33.54 x 14.37	115	253.5
TPD500-690-02000-2B-E				
TPD500-500-02400-2B-E				

2.4.8.5 External bridge 690 Vac - 2400...2700 A - 2B

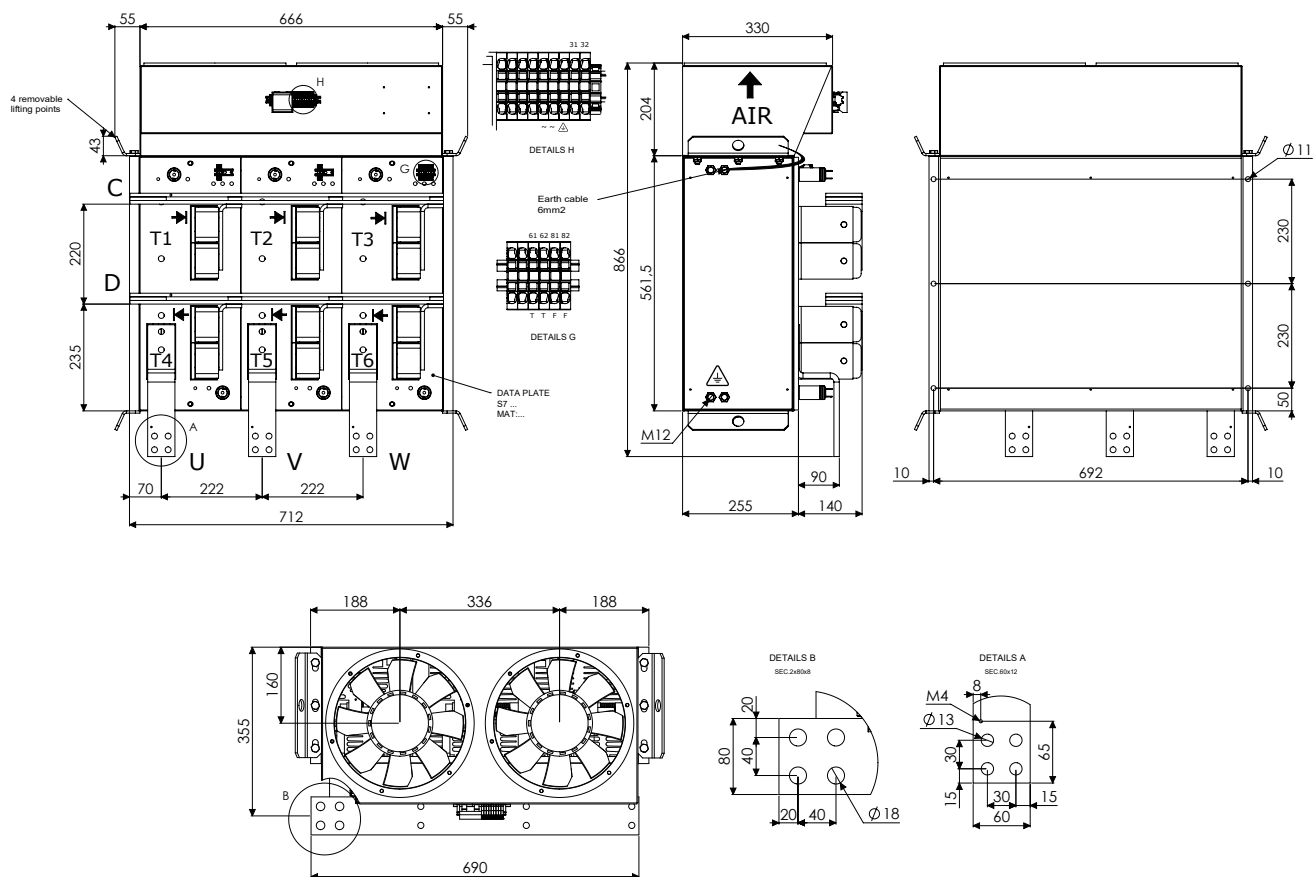


Figure 2-19: Dimensions - External bridge 690 Vac - 2400...2700 A - 2B

Table 2-27: Overall dimensions and weight - External bridge 690 Vac - 2400...2700 A - 2B

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lbs]
TPD500-690-02400-2B-E	776 x 866 x 395	30.55 x 34.09 x 15.55	155	341.7
TPD500-690-02700-2B-E				

2.4.8.6 External bridge 500 Vac - 2700 A - 2B

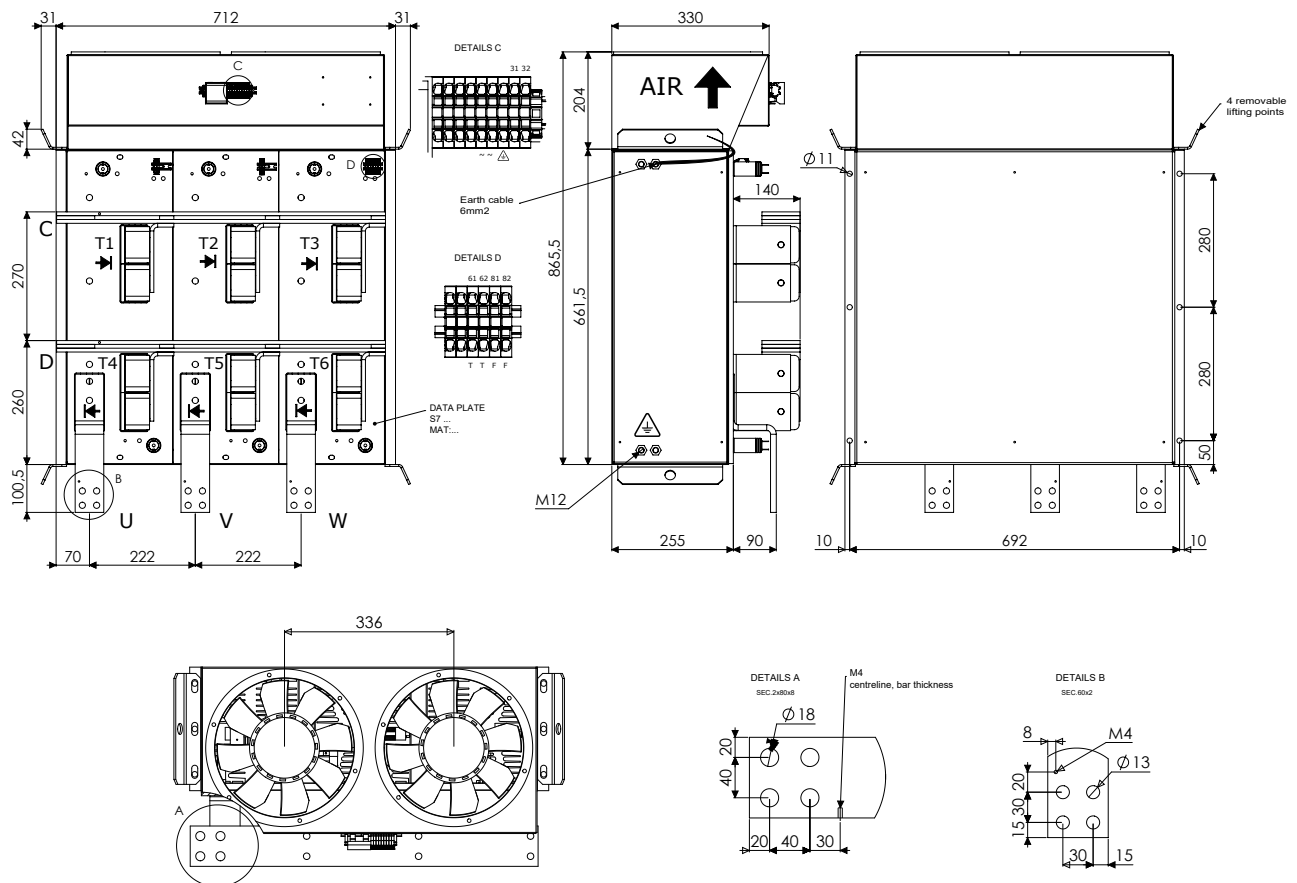


Figure 2-20: Dimensions - External bridge 500 Vac - 2700 A - 2B

Table 2-28: Overall dimensions and weight - External bridge 500 Vac - 2700 A - 2B

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lbs]
TPD500-500-02700-2B-E	774 x 966 x 395	30.47 x 38.03 x 15.55	155	341.7

2.4.8.7 External bridge 500 Vac - 2900 A - 2B

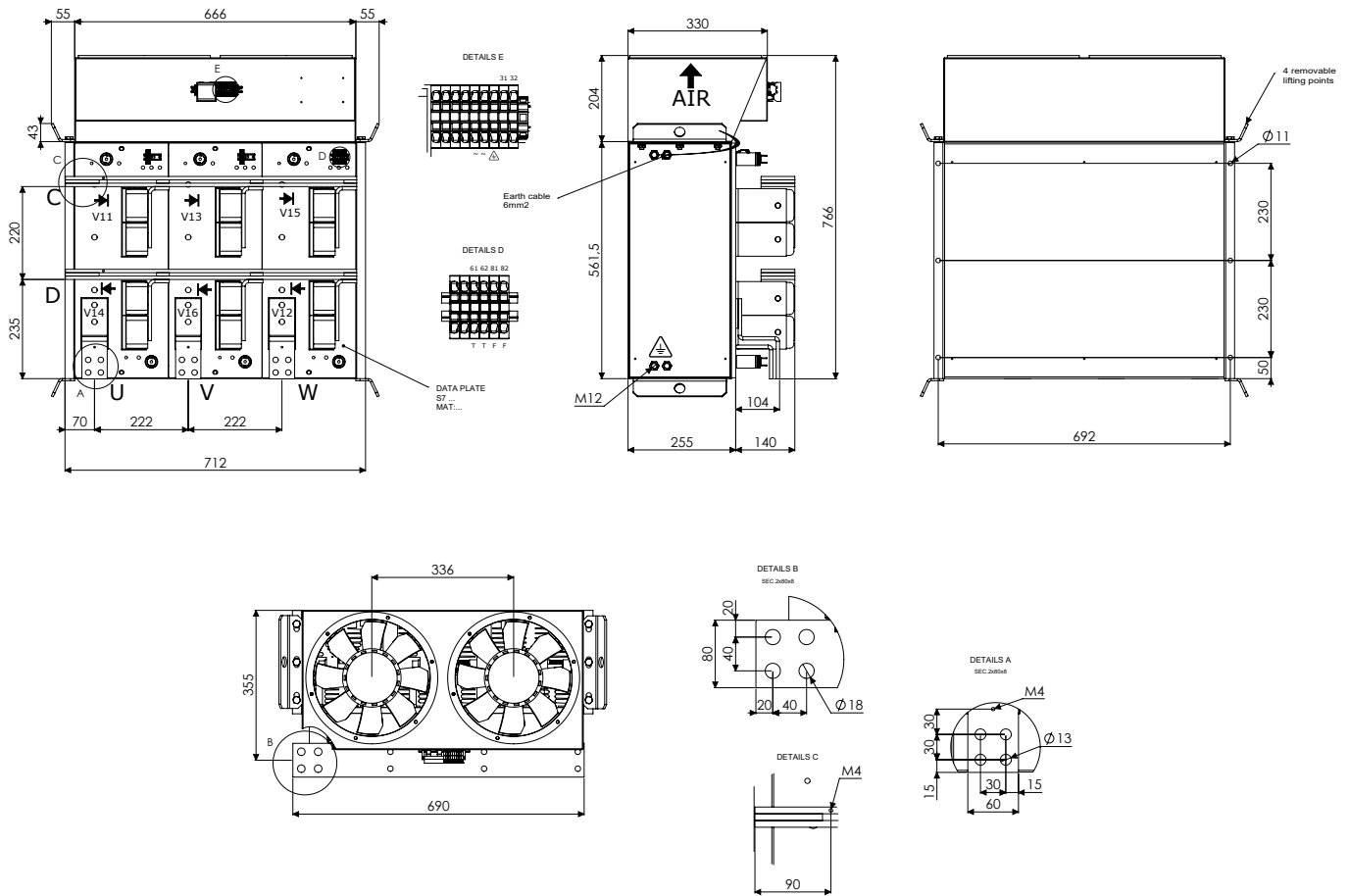


Figure 2-21: Dimensions - External bridge 500 Vac - 2900 A - 2B

Table 2-29: Overall dimensions and weight - External bridge 500 Vac - 2900 A - 2B

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lbs]
TPD500-500-02900-2B-E	776 x 809 x 395	30.55 x 31.85 x 15.55	155	341.7

2.4.8.8 External bridge 500/690 Vac - 3300 A - 2B

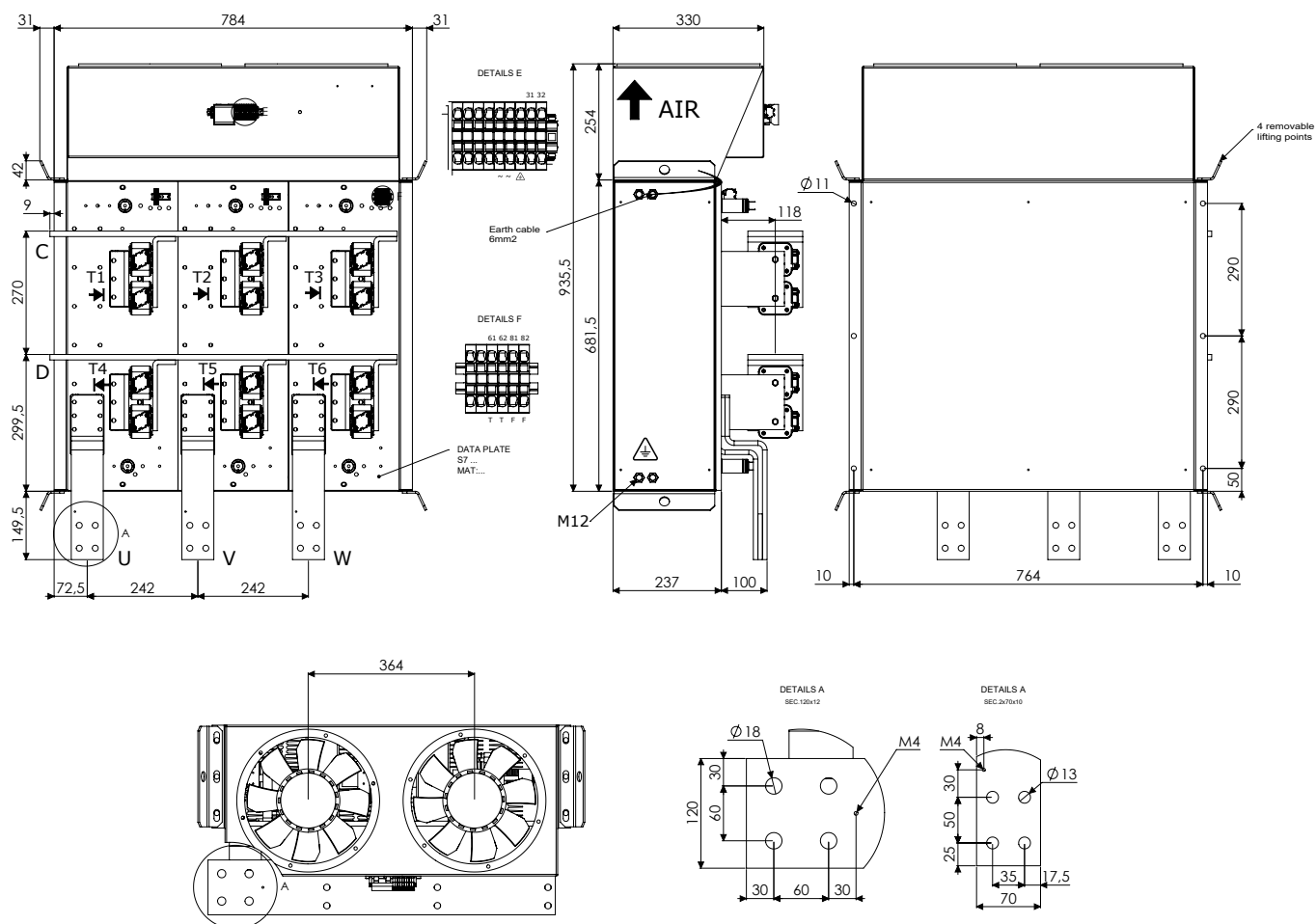


Figure 2-22: Dimensions - External bridge 500/690 Vac - 3300 A - 2B

Table 2-30: Overall dimensions and weight - External bridge 500/690 Vac - 3300 A - 2B

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lbs]
TPD500-500-03300-2B-E	846 x 1085 x 415	33.31 x 42.72 x 16.34	197	434.3
TPD500-690-03300-2B-E				

2.4.8.9 External bridge 690 Vac - 1010 A - 4B

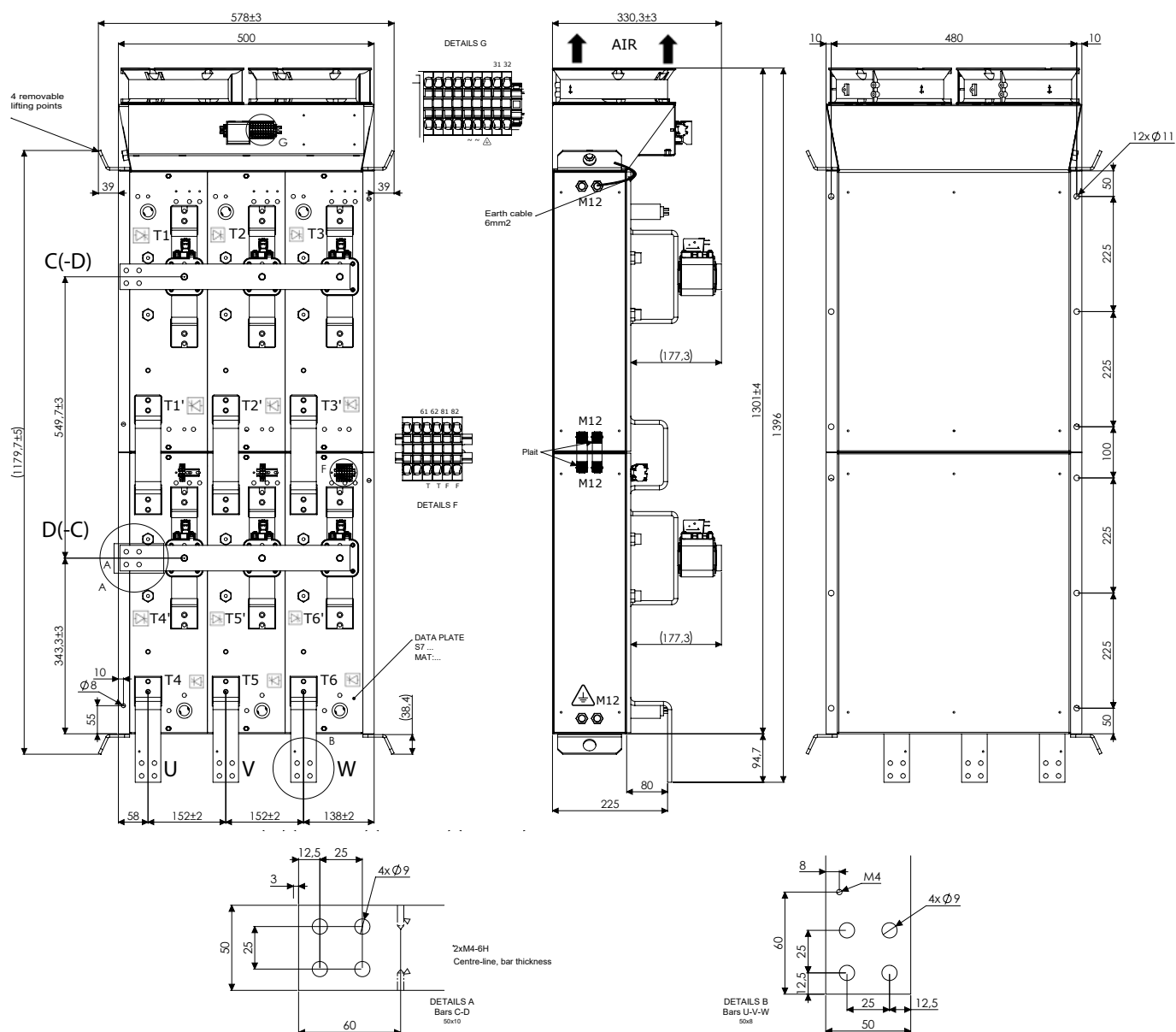


Figure 2-23: Dimensions - External bridge 690 Vac - 1010 A - 4B

Table 2-31: Overall dimensions and weight - External bridge 690 Vac - 1010 A - 4B

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lbs]
TPD500-690-01010-4B-E	578 x 1396 x 330	22.76 x 54.96 x 12.99	130	286.6

2.4.8.10 External bridge 690 Vac - 1400 A - 4B

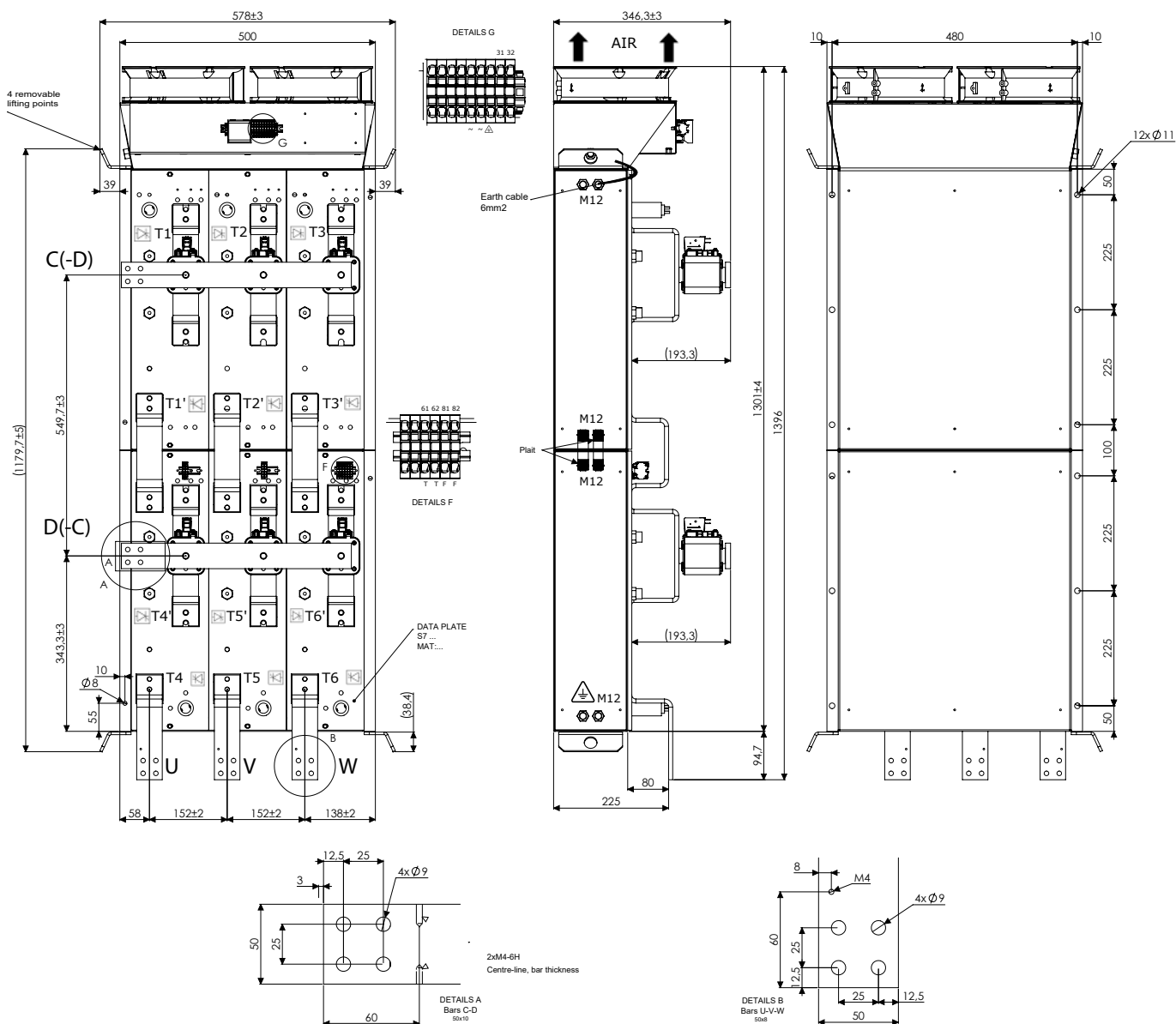


Figure 2-24: Dimensions - External bridge 690 Vac - 1400 A - 4B

Table 2-32: Overall dimensions and weight - External bridge 690 Vac - 1400 A - 4B

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lbs]
TPD500-690-01400-4B-E	578 x 1396 x 346	22.76 x 54.96 x 13.62	130	286.6

2.4.8.11 External bridge 500 Vac - 1500...2000 A - 4B

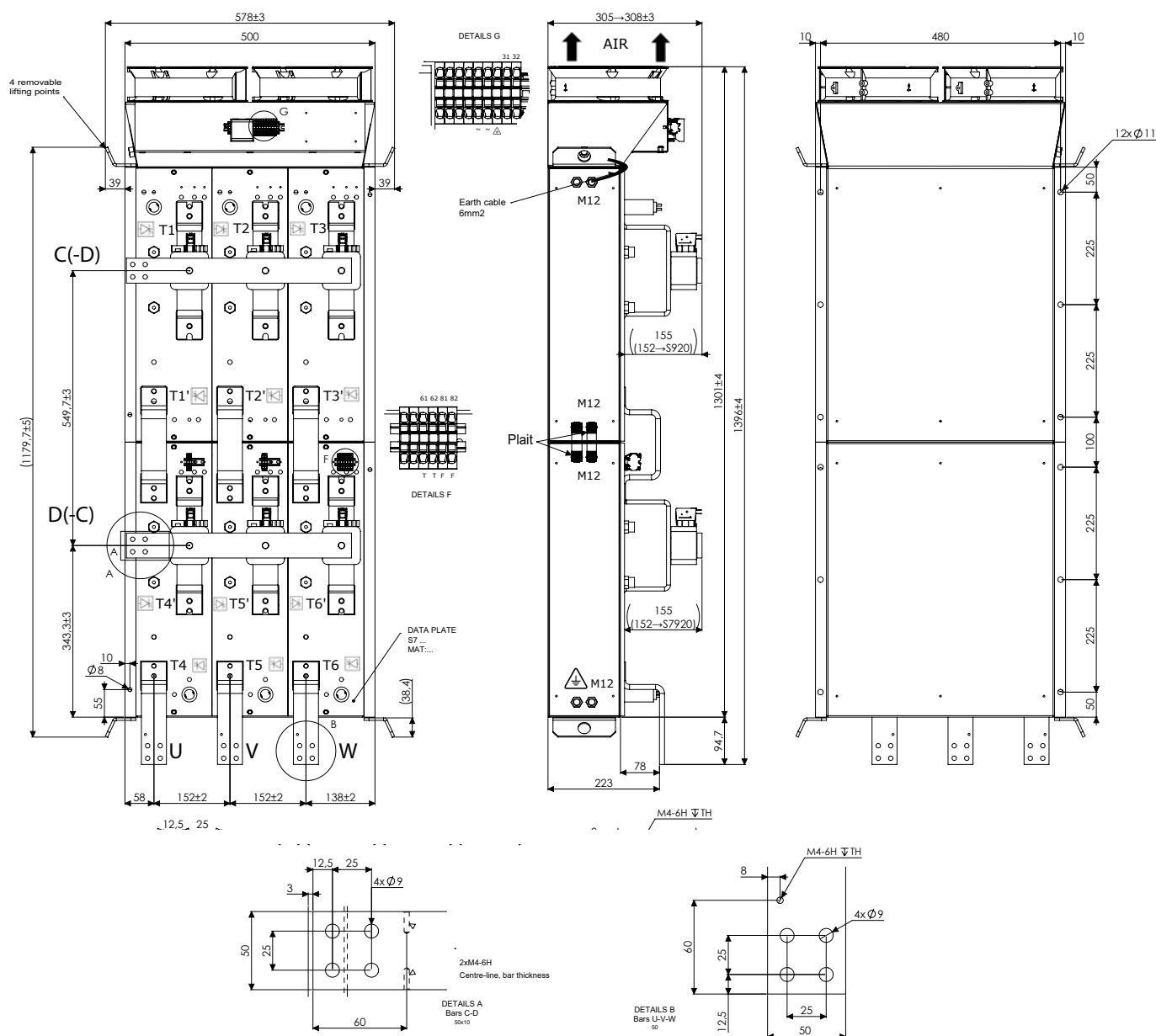


Figure 2-25: Dimensions - External bridge 500 Vac - 1500...2000 A - 4B

Table 2-33: Overall dimensions and weight - External bridge 500 Vac - 1500...2000 A - 4B

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lbs]
TPD500-500-01500-4B-E	578 x 1396 x 308	22.76 x 54.96 x 12.13	130	286.6
TPD500-500-01700-4B-E				
TPD500-500-02000-4B-E				

Technical drawing of the SEC 120dB unit, showing front, side, and detail views with dimensions and labels.

Front View Dimensions:

- Overall width: 620
- Overall height: 1305
- Top flange width: 31
- Top flange height: 42
- Bottom flange width: 31
- Bottom flange height: 97
- Internal width segments: 62.5, 192, 192
- Internal height segments: 550, 340
- Terminal block labels: T1, T2, T3, T4, T5, T6, U, V, W
- Control panel label: C
- Data plate label: DATA PLATE S7 - MAT....

Side View Dimensions:

- Overall width: 290
- Overall height: 1305
- Top flange width: 233
- Top flange height: 80
- Internal height segments: 205, 550, 550
- Internal width segments: 176, 10
- Bottom flange width: 10
- Bottom flange height: 50
- Internal width segments: 225, 225, 100, 225, 225
- Labels: AIR (with arrow), Earth cable 6mm², Plait, M12

Detail Views:

- DETAILS C:** Terminal block connection, 31 32, 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
- DETAILS D:** Terminal block connection, 61 62 81 82, T T F F
- DETAILS A:** Circular flange, Ø 18, M4, 120, 30, 60, 30, 30
- DETAILS B:** Circular flange, Ø 11, M4, 15, 30, 20, 8, 15, 30

Other Labels:

- A, C(-D), D(-C), B
- 4 removable lifting points

Table 2-34: Overall dimensions and weight - External bridge 690 Vac - 1700...2000 A - 4B

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lbs]
TPD500-690-01700-4B-E	682 x 1402 x 409	26.85 x 55.20 x 16.10	220	485
TPD500-690-02000-4B-E				

Technical drawing of the M12 control cabinet, showing front, side, and detail views.

Front View: Dimensions include 30, 712, 30, 219, 560, 341, 100.5, 70, 222, 222, 197, and 336. Components labeled include C, T1, T2, T3, T4, T5, T6, D, D(-C), U, V, W, and DATA PLATE S7 ... MAT....

Side View: Dimensions include 330, 205.5, 560, 1325.5, 560, 50, 255, 90, 176, 10, 692, 10, 50, 230, 230, 100, 230, 230, 50. Features include AIR, Earth cable 6mm², and 4 removable lifting points.

Details:

- DETAILS C:** 31 32
- DETAILS D:** 61 62 81 82
- DETAILS A:** SEC. 60x12, M4, Ø 13, 8, 20, 30, 15, 60
- DETAILS B:** SEC. 120x8, Ø 18, M4, 120, 60, 30, 30, 60, 40

Table 2-35: Overall dimensions and weight - External bridge 690 Vac - 2400...2700 A - 4B

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lbs]
TPD500-690-02400-4B-E	772 x 1426 x 481	30.39 x 56.14 x 18.94	280	617.3
TPD500-690-02700-4B-E				

The technical drawings illustrate the SEC 60x12 server cabinet from multiple perspectives:

- Front View:** Shows a 2U cabinet with a total height of 620mm. It features 12 horizontal slots for components, divided into two sections of 6 slots each. The top section is labeled C(-D) and the bottom section D(-C). The cabinet has a width of 600mm and a depth of 290mm. The front panel is 205mm high, and the main body is 550mm high. The bottom section has a height of 340mm, and the top section has a height of 550mm. The cabinet is equipped with 4 removable lifting points.
- Side View:** Shows the cabinet's profile with a total height of 1305mm. It includes an air intake at the top, an earth cable (6mm²) connection, and a plate. The cabinet has a width of 290mm and a depth of 80mm. The main body is 550mm high, and the top section is 205mm high. The bottom section has a height of 340mm. The cabinet is equipped with 4 removable lifting points.
- Rear View:** Shows the back of the cabinet with a total height of 620mm. It features 12 horizontal slots for components, divided into two sections of 6 slots each. The top section is labeled C(-D) and the bottom section D(-C). The cabinet has a width of 600mm and a depth of 290mm. The rear panel is 205mm high, and the main body is 550mm high. The bottom section has a height of 340mm, and the top section has a height of 550mm. The cabinet is equipped with 4 removable lifting points.
- Details:**
 - DETAILS C:** Shows the top of the cabinet with a width of 31mm and a height of 42mm. It includes a label "C" and a component "C".
 - DETAILS D:** Shows the bottom of the cabinet with a width of 31mm and a height of 42mm. It includes a label "D" and a component "D".
 - DETAILS A:** Shows the front panel with a width of 60mm and a height of 30mm. It includes a label "A" and a component "A".
 - DETAILS B:** Shows the rear panel with a width of 60mm and a height of 30mm. It includes a label "B" and a component "B".

Table 2-36: Overall dimensions and weight - External bridge 690 Vac - 2400 A - 4B

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lbs]
TPD500-500-02400-4B-E	682 x 1402 x 390	26.85 x 55.20 x 15.35	220	485

2.4.8.15 External bridge 500 Vac - 2700 A - 4B

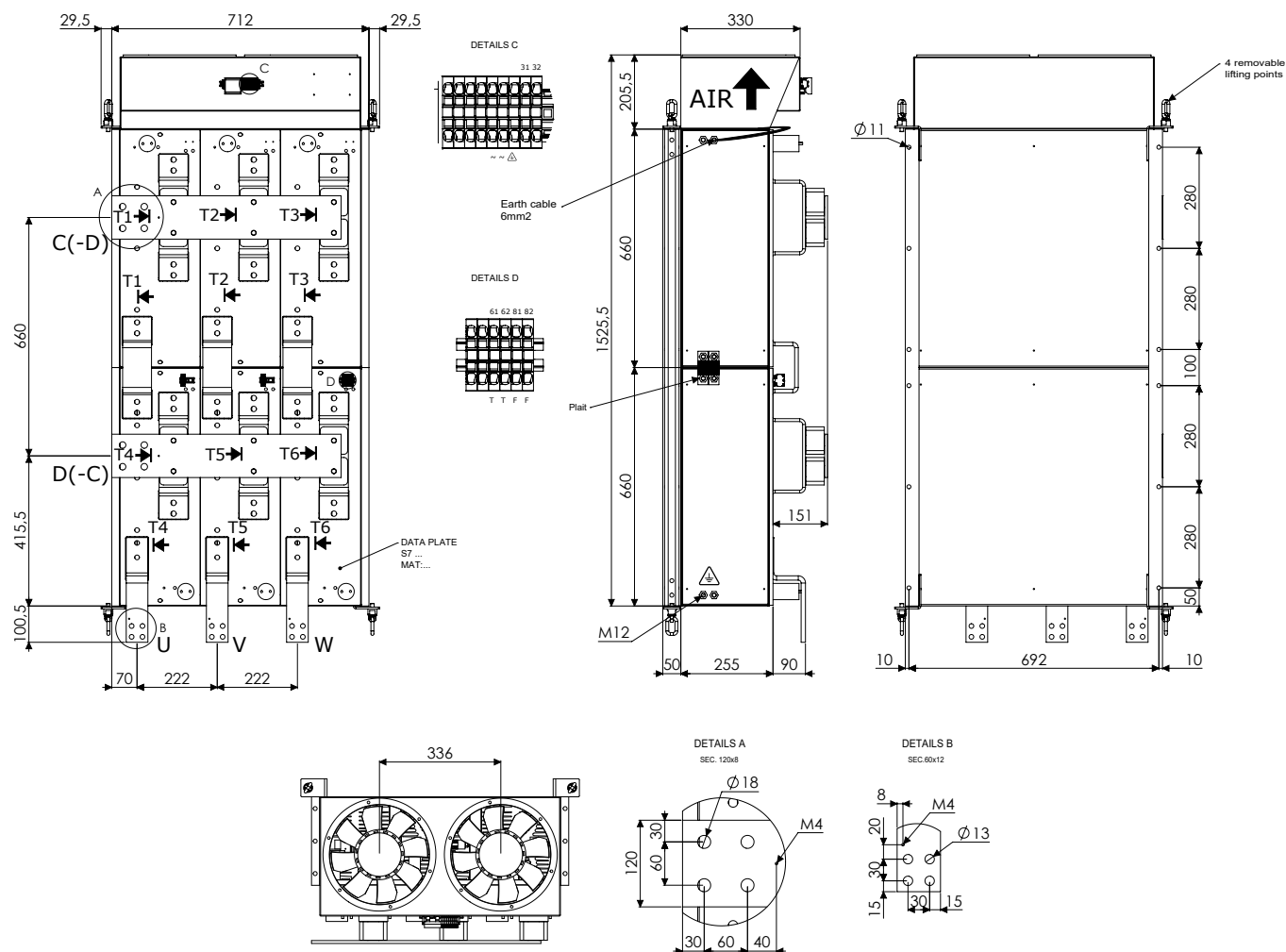


Figure 2-29: Dimensions - External bridge 500 Vac - 2700 A - 4B

Table 2-37: Overall dimensions and weight - External bridge 500 Vac - 2700 A - 4B

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lbs]
TPD500-500-02700-4B-E	771 x 1626 x 456	30.35 x 64.02 x 17.95	280	617.3

2.4.8.16 External bridge 500/690 Vac - 3300 A - 4B

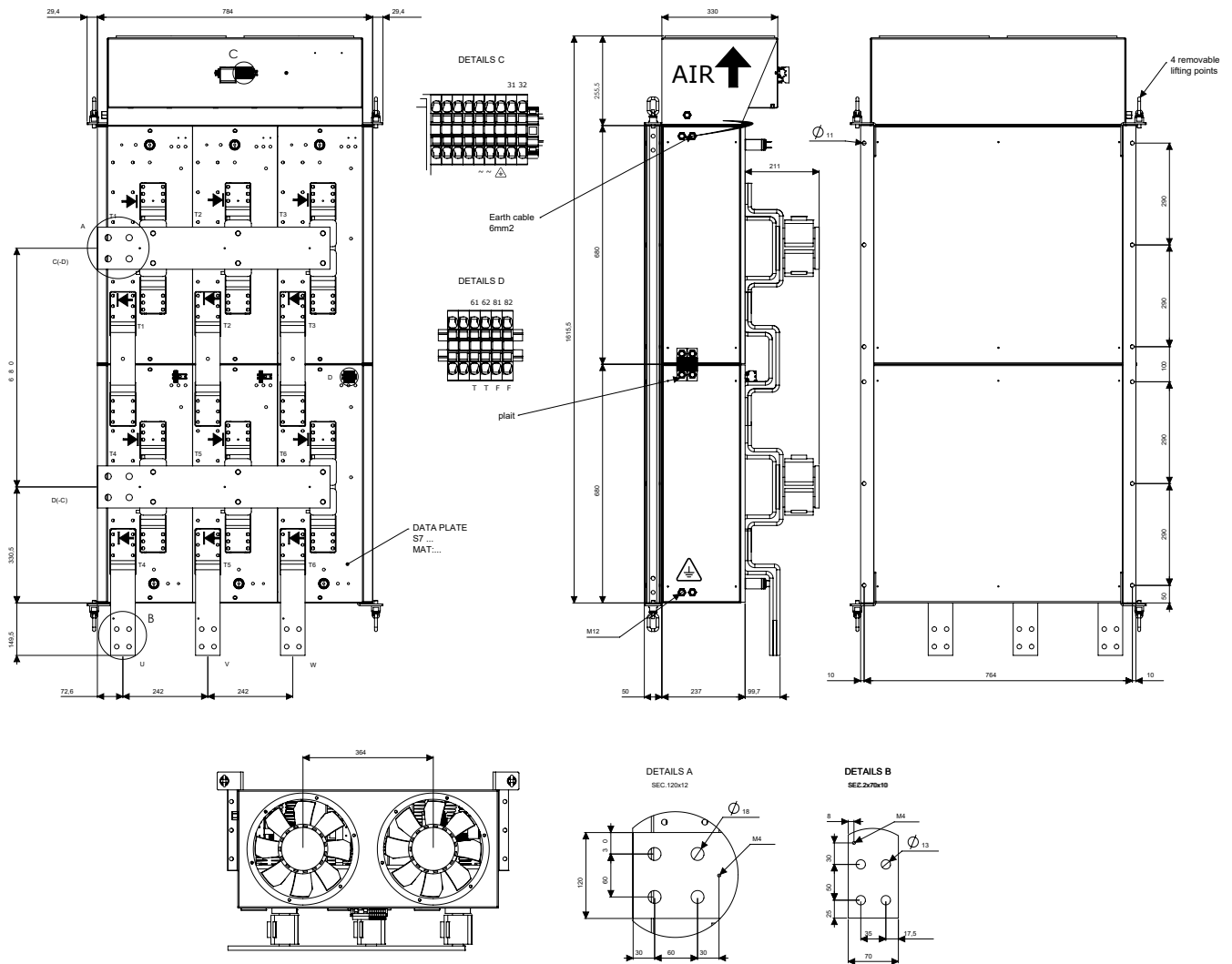


Figure 2-30: Dimensions - External bridge 500/690 Vac - 3300 A - 4B

Table 2-38: Overall dimensions and weight - External bridge 500/690 Vac - 3300 A - 4B

DRIVE	DIMENSIONS W x H x d		WEIGHT	
	[mm]	[inches]	[kg]	[lbs]
TPD500-500-03300-4B-E	784 x 1765 x 498	30.87 x 69.49 x 19.61	322	709.9
TPD500-690-03300-4B-E				

2.5 Power dissipation and internal fans

The power dissipated by the drive mainly depends on the output current. The power dissipation values shown in the following table refer to operation at nominal current.

NOTE!

Installation must allow for a free space of at least 150 mm above and below the unit to ensure proper air circulation.

Fans with external power supply must be powered with a single-phase voltage of 230 V, 50/60 Hz (terminals U3/V3).

Table 2-39: Power dissipation – TPD500 Series

Code	Power dissipation P_v [W]	Fans		
		Voltage [V]	Rated current [A]	Airflow rate [m³/h]
TPD500-...-00020-...-A	131	-	-	-
TPD500-...-00040-...-A	186			
TPD500-...-00070-...-A	254	Internal power supply	Internal power supply	80
TPD500-...-00110-...-A	408			160
TPD500-...-00140-...-A	476			
TPD500-...-00185-...-A	553			320
TPD500-...-00280-...-B	781			
TPD500-...-00350-...-B	939			
TPD500-...-00420-...-B	1038			
TPD500-...-00500-...-B	1248			680
TPD500-...-00650-...-B	1693			
TPD500-...-00560-...-C	2372	1ph 230	1	1050
TPD500-...-00700-...-C	3085			
TPD500-...-00770-...-C	2143			
TPD500-...-00900-...-C	3384			
TPD500-...-01000-...-C	2986			
TPD500-...-01050-...-C	3103			
TPD500-500-01200-2B-E	4100		0.21	1000
TPD500-500-01500-...-E	4200		0.21	1000
TPD500-500-01700-4B-E	4700		0.21	1000
TPD500-500-01800-2B-E	5000		0.21	1000
TPD500-500-02000-...-E	5700		0.21	1000
TPD500-500-02400-...-E	7300		0.24	1480
TPD500-500-02700-...-E	8700		0.51	3220
TPD500-500-02900-2B-E	9400		0.51	3220
TPD500-500-03300-...-E	9900		0.51	3220
TPD500-690-01010-...-E	3300		0.21	1000
TPD500-690-01400-...-E	4600		0.21	1000
TPD500-690-01700-...-E	6800		0.24	1480
TPD500-690-02000-...-E	7100		0.24	1480
TPD500-690-02400-...-E	7800		0.51	3220
TPD500-690-02700-...-E	9500		0.51	3220
TPD500-690-03300-...-E	10200		0.51	3220

Table 2-40: Power dissipation – TPD500-CU Series

Code	Dissipated power	
	Total for control unit [W]	External field fuses [W]
TPD500-CU-...-THY1-40	303	2 x 11
TPD500-CU-...-THY2-40	357	2 x 14
TPD500-CU-...-THY1-70	374	2 x 11
TPD500-CU-...-THY2-70	428	2 x 14

NOTE!

The control unit has external field fuses.

2.6 DC motor drive operation

Separately excited DC motors require careful consideration of their electrical and mechanical characteristics, which are specific to a given operating range. The key points listed below must be taken into account to ensure proper operation and protection of these motors.

Essential data for connecting a motor to the drive

Before connecting the motor to the drive, the following nameplate data must be clearly known:

- Armature nominal voltage
- Armature nominal current
- Field nominal current
- Motor nominal speed

These parameters are essential for proper system sizing and correct drive configuration.

2.6.1 Overload

The drive is designed to supply the nominal current continuously (continuous duty).

In some applications, it may be necessary, for a few seconds, to exceed the nominal current, before returning to operating conditions below the nominal value.

This operating mode can be enabled by setting parameter IPA 4300-**Overload mode** = I2T_Drive (see the parameter description in section **7.18.9 Overload**).

Once this mode is active, the current-related parameters, normally limited to 100%, can accept values up to 150%.

The following table shows, for each drive size, the allowable overload currents and durations in this mode.

Table 2-41: Nominal overload currents

Code	Curr limited			I2T Drive	
	I _n [A]	I _{nd} [A]	I _{ovl_60s} [A]	150% I _n [A]	T _{ovl} 150% I _n [s]
TPD500-500-00020-...-A	20	17	25.5	30	33.9
TPD500-500-00040-...-A	40	35	52.5	60	37.2
TPD500-500-00070-...-A	70	56	84	105	28.2
TPD500-500-00110-...-A	110	88	132	165	28.2
TPD500-500-00140-...-A	140	112	168	210	28.2
TPD500-500-00185-...-A	184	148	222	276	28.7
TPD500-500-00280-...-B	280	224	336	420	28.2
TPD500-500-00350-...-B	350	280	420	525	28.2
TPD500-500-00420-...-B	420	336	504	630	28.2
TPD500-500-00500-...-B	500	400	600	750	28.2
TPD500-500-00650-...-B	650	450	675	975	18.9
TPD500-500-00770-...-C	770	560	840	1155	21.6
TPD500-500-01000-2B-C	1000	800	1200	1500	28.2
TPD500-500-01050-4B-C	1050	850	1275	1575	29.2
TPD500-690-00560-2B-C	560	360	540	840	15.6
TPD500-690-00700-2B-C	700	490	735	1050	19.5
TPD500-690-00900-2B-C	900	650	975	1350	21.2
TPD500-500-01200-2B-E	1200	1000	1500	1800	31.9
TPD500-500-01500-...-E	1500	1300	1950	2250	36.1
TPD500-500-01800-2B-E	1800	1400	2100	2700	26.0
TPD500-500-02000-...-E	2000	1500	2250	3000	23.5
TPD500-500-02400-...-E	2400	1800	2700	3600	23.5
TPD500-500-02700-...-E	2700	2000	3000	4050	22.7
TPD500-500-02900-2B-E	2900	2200	3300	4350	24.2
TPD500-500-03300-...-E	3300	2350	3525	4950	20.4
TPD500-500-01700-4B-E	1700	1350	2025	2550	27.6
TPD500-690-01010-...-E	1010	900	1350	1515	39.5
TPD500-690-01400-...-E	1400	1150	1725	2100	30.5

Code	Curr limited			I2T Drive	
	I_n [A]	I_{nd} [A]	I_{ovl_60s} [A]	$150\% I_n$ [A]	$T_{ovl} 150\% I_n$ [s]
TPD500-690-01700-....-E	1700	1350	2025	2550	27.6
TPD500-690-02000-....-E	2000	1500	2250	3000	23.5
TPD500-690-02400-....-E	2400	1800	2700	3600	23.5
TPD500-690-02700-....-E	2700	2000	3000	4050	22.7
TPD500-690-03300-....-E	3300	2350	3525	4950	20.4

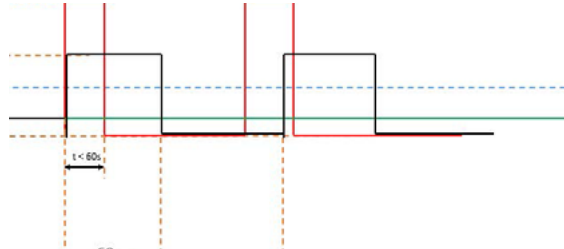


Figure 2-31: Maximum installation tilt

2.6.2 Motor protection

To protect the motor from overloads and malfunctions, it is essential to consider the following protection devices.

Motor thermal relay

The thermal overload relay must be installed upstream of the drive and sized correctly using the formula:

$$I_{DN} \cdot 0,82 \cdot 1,05$$

The relay contact can:

- block the drive directly via the control system;
- signal an external fault to the drive via terminal 15 (External Fault).

NOTE!

Please note that with a thermal relay, only motor heating due to overload can be controlled, but not that due to insufficient ventilation. For low-speed operation of the motor, we recommend the use of PTC thermistors or the insertion of thermal pads in the motor windings.

Thermistors and thermal pads

Thermistors or thermal pads can be connected to terminals 78 and 79 to monitor motor overheating. In the absence of a temperature sensor, an external 1 kΩ resistor must be connected to the terminals. It is essential to follow the connection instructions below.

- **Thermistors (PTC)**
PTC thermistors, which comply with DIN 44081 or 44082, can be connected directly to terminals 78 and 79 of the converter. In this case, the 1 kΩ resistor between the terminals must be removed.
- **Thermal pad contacts (Klixon®)**
The contacts of the Klixon® thermal pads integrated in the motor windings can:
 - block the drive via the auxiliary control circuits;
 - signal an alarm via terminals 78 and 79.
 In this case, the 1 kΩ resistor must be connected in series with the thermal pad contact.

NOTE!

The terminals 78 and 79 have are designed for double insulation.

Drive current limitation

The drive current limitation function is a crucial element in protecting the motor from inadmissible overloads. The current limit and overload control must be configured so that the current remains within acceptable values for the motor, thus ensuring safe and durable operation.

3. TRANSPORT, UNPACKING AND INSTALLATION

During handling, unpacking and installation of the device, follow the safety instructions provided in **Chapter 1 - SAFETY INSTRUCTIONS**.

NOTE!

During installation, the dimensions and weights specified in this manual must be taken into account. Appropriate handling equipment and tools must be used (such as hoists or cranes for heavy loads). Improper handling or the use of unsuitable tools may cause damage to the device and injury to personnel.

3.1 Transport and unpacking

TPD500 series drives are carefully packaged to ensure safe shipment. Transportation must be carried out using suitable equipment (refer to **Chapter 2.4 - Dimensions and weights**). These instructions also apply to devices that have been removed from their packaging for installation in control cabinets.

Upon delivery, immediately check the following:

- that the packaging is not visibly damaged;
- that the information on the delivery note matches the order placed.



When removing the packaging, pay special attention to ensure that the desiccant bags do not remain stuck inside the unit. They may get caught in the fans or block the cooling openings, potentially causing the drive to overheat.

In case of damage, missing items, or incorrect delivery, promptly notify the relevant sales office.

Storage must take place exclusively in dry locations and within the temperature limits specified in this manual (refer to **Chapter 2.2.1 - Environmental conditions**).

NOTE!

Temperature fluctuations may cause condensation to form inside the device. This is acceptable under certain conditions (refer to **Chapter 2.2.1 – Environmental conditions**), but condensation is not permitted during operation. Therefore, always ensure that the device is completely free of condensation before applying power!

3.2 Installation

The device is **Open type** unit with IP20 or IP00 protection rating, classified as UL type 1 or 0, and does not provide protection against airborne contaminants. It is designed to operate in clean, dry environments (PD II classification – refer to **Chapter 2.2.1 - Environmental conditions**). Contaminants such as oils, corrosive vapors, or abrasive particles must not enter the installation cabinets.

The maximum allowable tilt during installation is 30° on all axes.

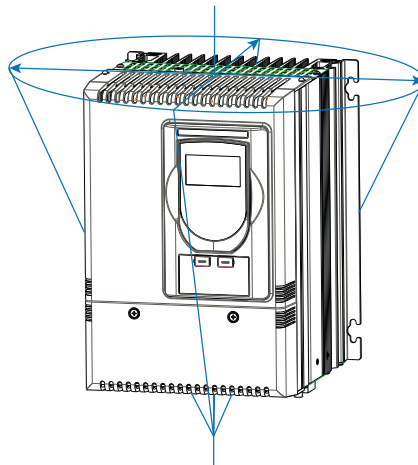


Figure 3-1: Max angle of inclination

Drives must be installed in a way that ensures proper airflow around the units.
 A minimum clearance of 150 mm must be maintained above and below the device, with at least 50 mm of free space at the front. On the sides, a minimum distance of 10 mm must be kept.
 In addition, the drives must not be installed near equipment that generates heat.

NOTE!

After a few days of operation, check the tightness of the terminal screws.

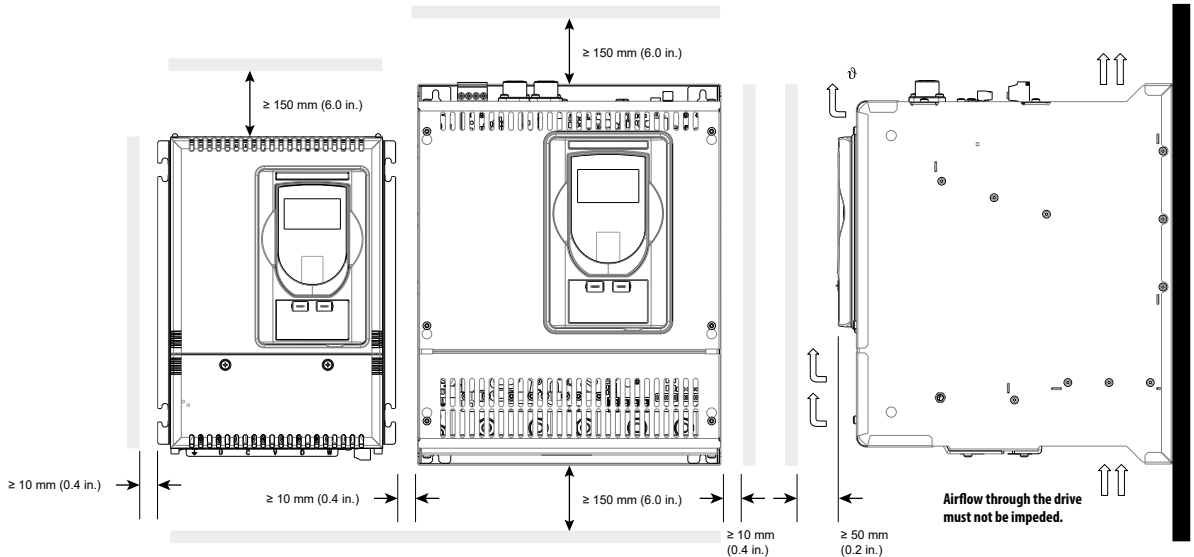
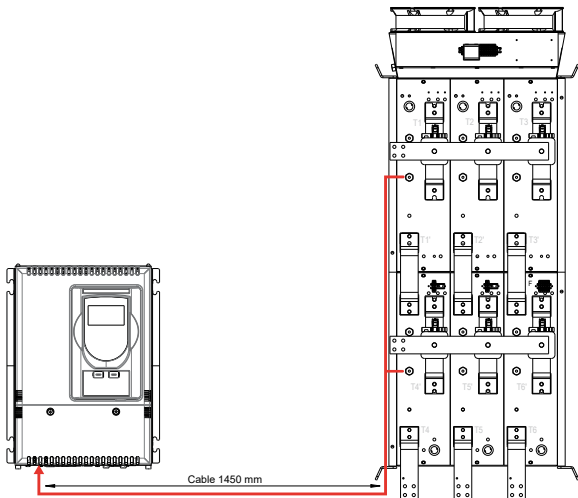


Figure 3-2: Mounting clearances

During installation and positioning of the equipment, it is recommended to consider not only the space required for proper heat dissipation, as shown in the figure, but also the space needed to ensure easy access to the device for installation, adjustment, and maintenance.
 The equipment is mounted to the panel or wall using the screws specified in the following table.

CONSTRUCTION TYPE	SCREWS
A, B, TPD500-CU	M6
C, E	M10

The **TPD500-Frame E** consists of a **TPD500-CU** and an external bridge, connected to each other by the cables supplied. Please refer to the instructions already provided regarding the **TPD500-CU**.
 When handling the external bridge, exercise the utmost caution; comply with all applicable regulations by selecting suitable lifting systems for the specified weights. Use the designated anchor points for handling.



In the case of the **TPD500-...-FRAME-E**, ensure that the mounting distance between the **TPD500-CU** and the external bridge is compatible with the maximum length of the supplied electrical connection cables, which is 1.45 m.

3.2.1 Disassembling the unit

This section provides detailed instructions for disassembling the device, allowing access to internal components for making the necessary connections (refer to **Chapter 4 - ELECTRICAL CONNECTION**), performing maintenance operations (refer to **Chapter 8 - MAINTENANCE**), and installing optional boards. It is essential to follow the instructions carefully to ensure proper and safe installation while preserving the integrity of the device.



Follow the safety instructions provided in this manual. The devices can be opened without the use of force. Use only the tools specified.

3.2.1.1 Drive Frame A and TPD500-CU

On **Frame A** and **TPD500-CU** drives, both the lower protective cover and the power terminal cover must be removed to access the power terminals.

Removal of the power terminal cover

Remove the two screws as shown, then slide the cover downward until it detaches from the frame.

TOOL	TIGHTENING TORQUE
PH2 screwdriver	1 Nm (8.9 lb·in)

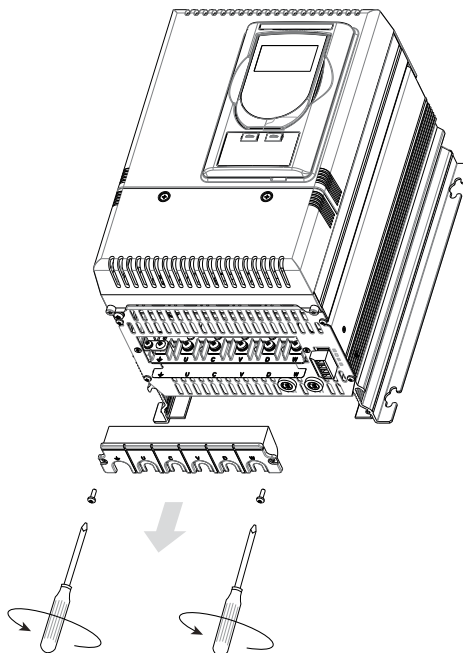


Figure 3-3: Removal of the power terminal protective cover - Frame A and TPD500-CU

Removal of the lower protective cover

Remove the two screws as shown and, gently lifting along the upper edge, slide the cover downward until it detaches from the frame.

TOOL	TIGHTENING TORQUE
PH2 screwdriver	1.5 Nm (13 lb·in)

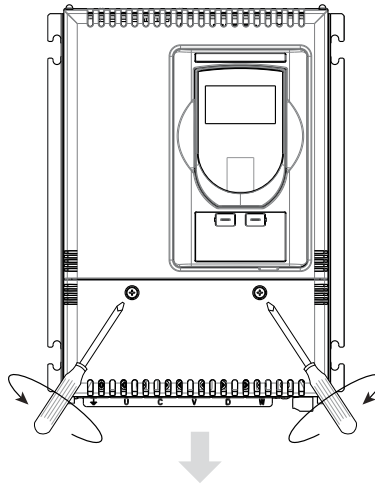


Figure 3-4: Removal of the lower protective cover - Frame A and TPD500-CU

3.2.1.2 Drive Frame B and C

- Loosen, but do not remove, the two screws securing the lower cover.
- Slide the cover downward until the screw heads align with the keyhole slots, then lift the cover to remove it from the frame.

TOOL	TIGHTENING TORQUE
Torx® T20 screwdriver	1.5 Nm (13 lb-in)

® Registered trademark of Camcar LLC, Acument Global Technologies.

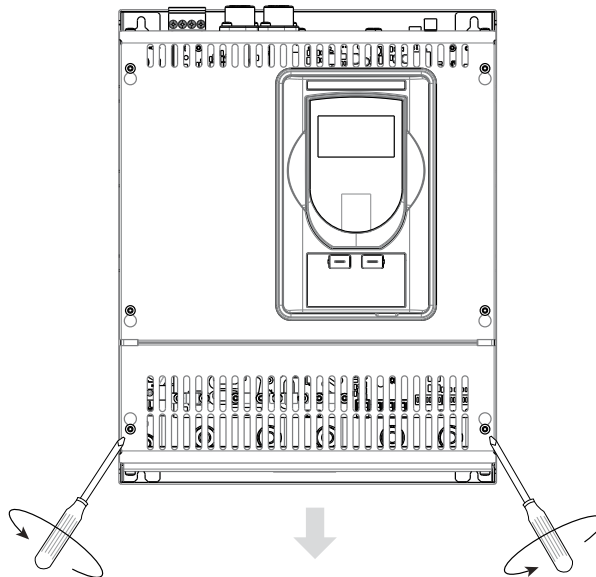


Figure 3-5: Removal of the lower protective cover - Frames B and C

4. ELECTRICAL CONNECTION

4.1 General information

TPD500 series drives are **Open Type** devices and offer no protection against environmental conditions. During installation, all necessary measures must be taken to protect the device from unsuitable environmental conditions (temperature, humidity, shock, etc.).

Electrical commissioning must be performed only by qualified personnel, who are also responsible for ensuring proper grounding and a protected power supply in compliance with local and national regulations.

WEG cannot assume responsibility for compliance with any national, local, or other codes regarding the correct installation of these devices or any associated equipment.

Failure to comply with applicable codes during installation may result in personal injury and equipment damage.

4.1.1 Electrical connection warnings

TPD500 series drives are designed to be powered by standard three-phase networks that are electrically symmetrical with respect to ground (TN or TT systems).

When supplied by IT networks, the use of a delta/star isolation transformer with the secondary neutral grounded is strictly required, in order to ensure proper operation and system insulation.

An example of the wiring is illustrated in the figure below.

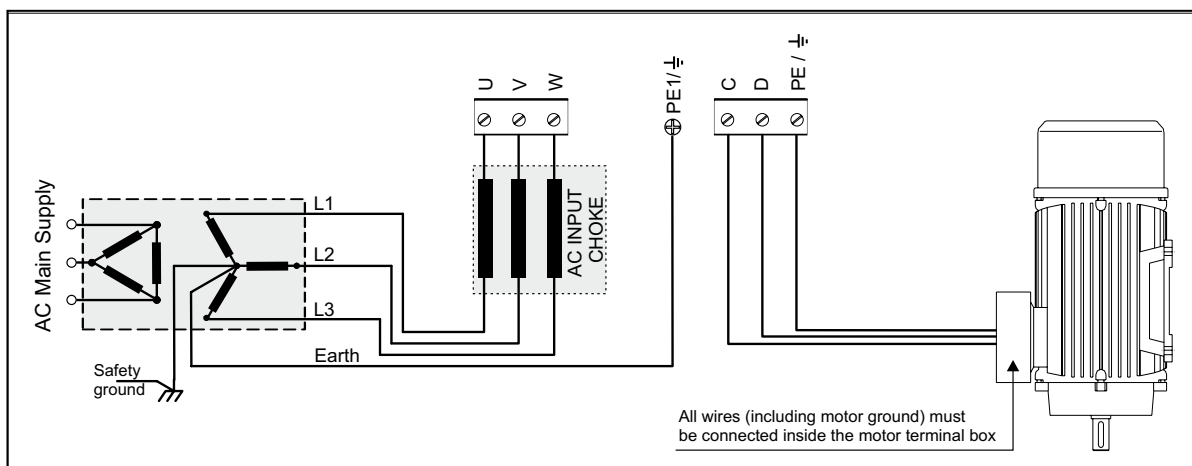


Figure 4-1: Wiring example

For IT networks, do not install an external EMI filter on the drive. The capacitors inside the standard EMI filter may become damaged and/or cause safety issues.

The power supply required for the control circuits, connected to terminals U2/V2, must come from an independent source, typically with one terminal grounded (PE).

Always connect the drive to protective earth (PE), using a properly sized cable in accordance with the applicable standards. Only permanent connections using cable rated for at least 75°C and compliant with the standards in force in the country of installation are allowed for system grounding.

TPD500 series drives and EMC filters have a leakage current to ground greater than 3.5 mA. If a residual current device (RCD) is required, use a Type B RCD.

Three-phase powered machines equipped with EMC filters must not be connected to the supply through an ELCB (Earth Leakage Circuit Breaker).

4.2 Device connection

The device must be connected according to the wiring diagrams shown below.

Control section potentials

The potentials of the control section are galvanically isolated from the power section.

As shown in **Figure 4-2: Control section potentials**, the connection between these sections can be visualized.

- The analog inputs are differential.
- The enable signals are isolated from the control section by optoisolators. Terminals 12 to 15 share terminal 16 as a common reference potential.
- The digital inputs are isolated from the control section by optoisolators. Terminals 31 to 34 share terminal 37 as a common reference potential.
- Terminal 11 is connected to the internal 0V potential, while terminal 10 is connected to ground.
- The analog outputs are isolated from the internal potential and share the same potential. When the optional TBO board is used, the potentials of the optional analog outputs are isolated from those of the standard outputs.
- The digital outputs share the same potential and are isolated via optoisolators. To operate them, a power supply must be connected to terminals 30 and 25.
- With the optional TBO board, the potentials of the optional digital outputs are separated from those of the standard outputs. In this case as well, a power supply must be connected to terminals 5 and 10.

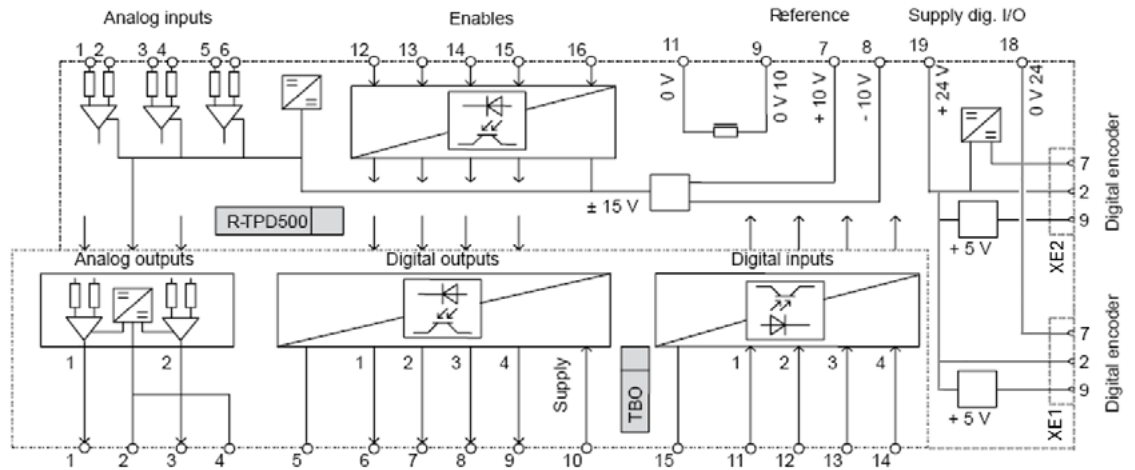


Figure 4-2: Control section potentials

External devices

For the installation of contactors, protection devices, inductors, filters, and other external components, refer to the drive connection diagrams provided in this manual, as well as to the specifications and instructions supplied by the respective component manufacturers.

Encoder wiring precautions

Encoder cables must be connected directly to the device, avoiding the use of intermediate terminal blocks.

Signal conductor shields should generally be grounded at both ends. However, for analog signals and digital signals with very long cable runs (outside the electrical cabinet), it is preferable to ground only the converter side to prevent interference caused by ground loop currents.

In specific cases, it may be necessary to ground the shield at both ends, ensuring equipotential bonding between the grounding points using appropriate bonding cables.

The encoder cable must consist of twisted pairs with an overall shield connected to ground. It is recommended to avoid grounding the shield at the motor-side connector.

In extreme cases (e.g., cable lengths exceeding 100 meters or the presence of strong electromagnetic interference), it may be necessary to use a cable with individual shields for each pair, connected to the power supply ground.

4.2.1 Typical wiring diagram

A typical two-buttons wiring diagram (Start - S2 and Stop - S11) is shown below, based on the factory configuration (IPA 500-Main commands = Terminals).

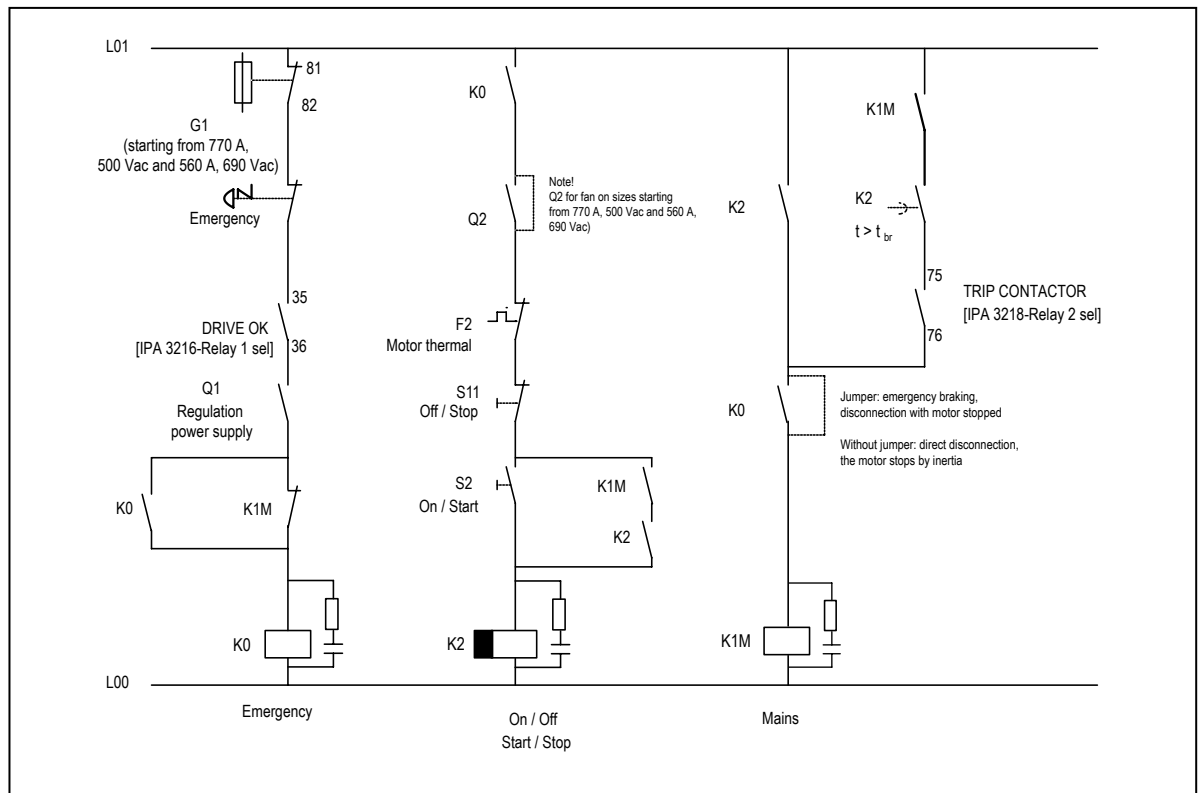


Figure 4-3: Command sequence

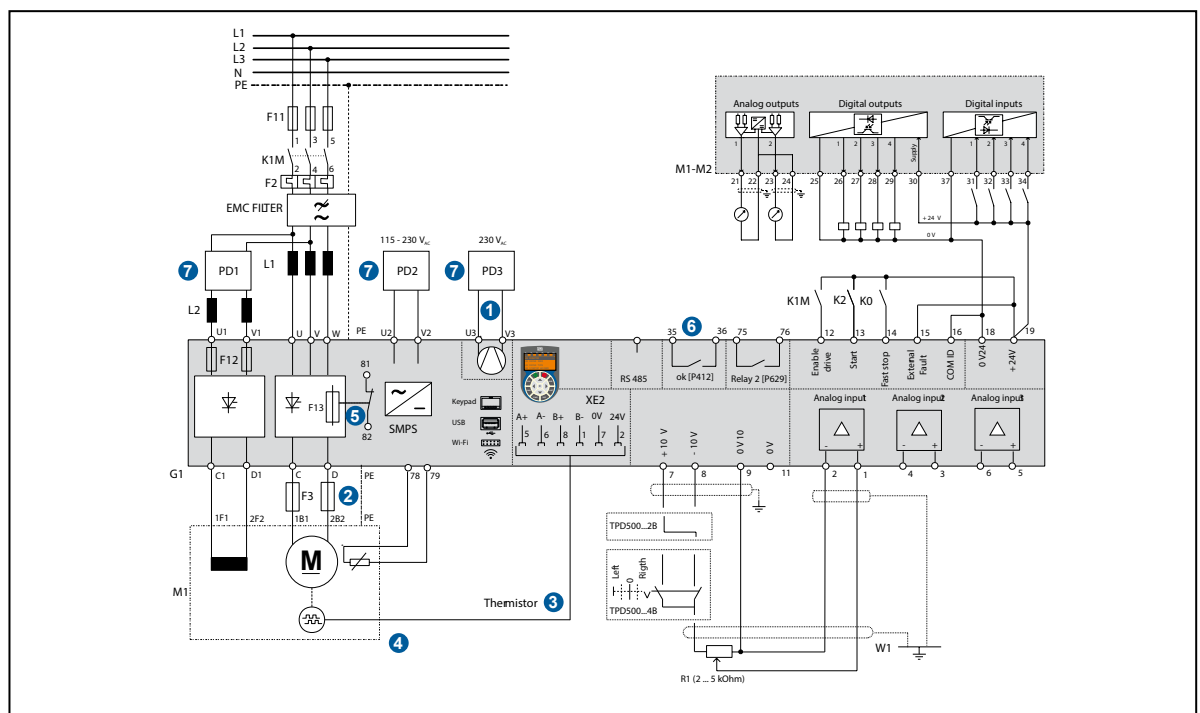


Figure 4-4: Typical wiring diagram

- [1] Ventilation units powered externally only for Frame C.
- [2] Fuses required only for TPD500-...-4B-... drives, Frame A and B.
- [3] A 1 kΩ resistor must be connected when the thermistor is not present.
- [4] The connections shown refer to the 24 V digital encoder XE2. For more information on encoder configuration, refer to **Chapter 4.4 - Control and regulation section**.
- [5] Only for Frame C.
- [6] On the FIR power board...
- [7] PDx is a generic line protection device (circuit breaker, fuses, etc.) that must be selected in compliance with local regulations applicable in the country of installation. For North America (cULus), refer to **Chapter 4.11 - Protection features**.

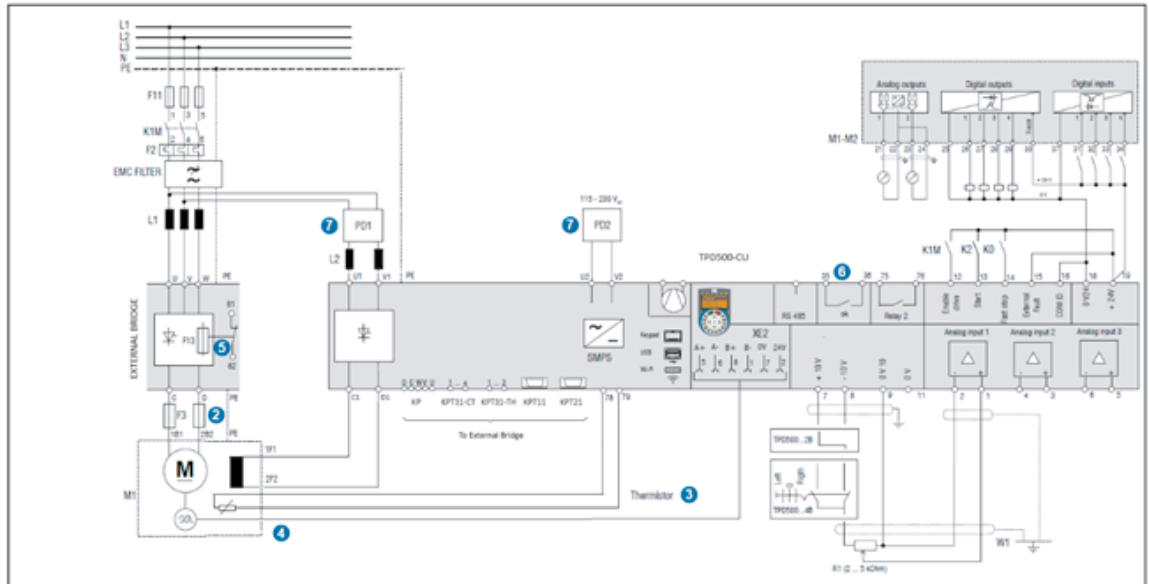


Figure 4-5: Typical wiring diagram with external armature bridge

[2] Fuses required only for TPD500-...-4B-... drives, Frame A and B.

[3] A 1 k Ω resistor must be connected when the thermistor is not present.

[4] The connections shown refer to the 24 V digital encoder XE2. For more information on encoder configuration, refer to **Chapter 4.4 - Control and regulation section**.

[5] Only for Frame C.

[6] On the FIR power board...

[7] PDx is a generic line protection device (circuit breaker, fuses, etc.) that must be selected in compliance with local regulations applicable in the country of installation. For North America (cULus), refer to **Chapter 4.11 - Protection features**.

NOTE!

The connections for the digital encoder XE1 and the tachogenerator are shown separately.

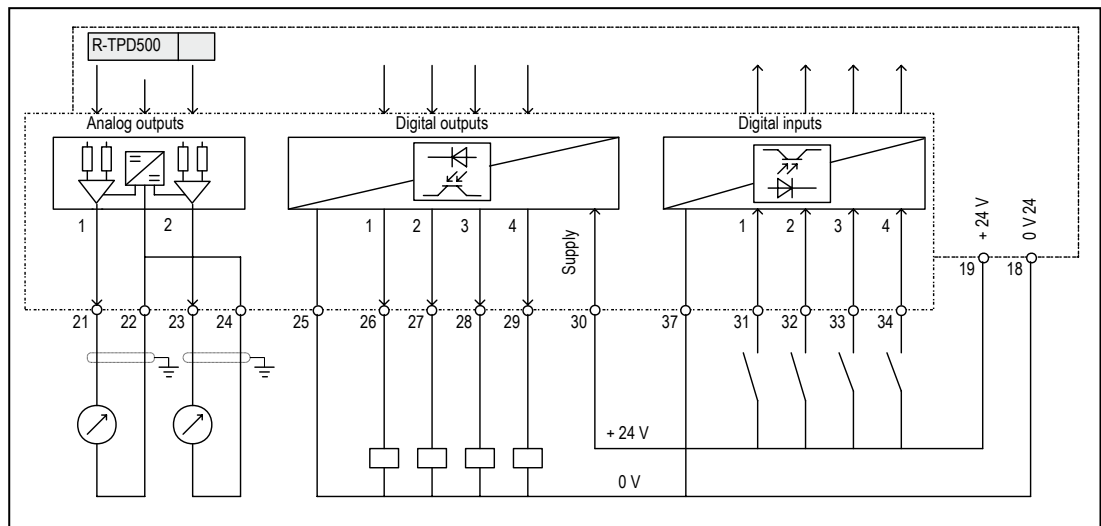


Figure 4-6: Relay and contact wiring with internal power supply

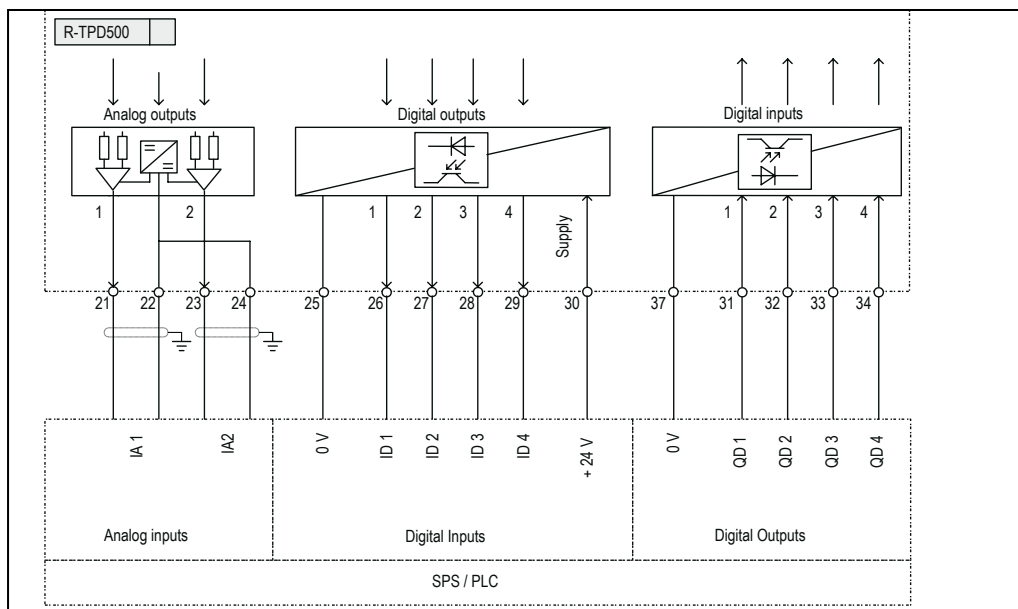


Figure 4-7: Relay and contact wiring with external power supply (PLC)

4.3 Power section

NOTE!

It is recommended that only copper conductors be used.

Table 4-1: Terminal description

DESIGNATION	FUNCTION	I/O	MAX VOLTAGE	MAX CURRENT	MIN CURRENT (recommended)
U, V, W	Armature circuit mains connection	I	3 x 690 Vac $\pm$ 10%	Chapter 2.3 – Electrical data	-
C, D	Armature connection	O	Chapter 2.3 – Electrical data		-
U1, V1	Field circuit mains connection	I	1 x 500 Vac $\pm$ 10%		-
C1, D1	Field circuit connection	O	390 Vdc		-
U2, V2	Control board power supply	I	1 x 115 Vac $\pm$ 10% 1 x 230 Vac $\pm$ 10%	1 Aac 0.5 Aac	-
U3, V3	Internal fan connection (Frame C drives only)	I	1 x 230 Vac	Chapter 2.5 – Power dissipation and internal fans	-
35, 36 ^{[1] [2]}	Potential-free contact of relay 1 (DRIVE OK), configurable via IPA 3216-Relay 1 sel	O	230 Vac	1 AAC11	100 mA
75, 76 ^{[1] [2]}	Potential-free contact of relay 2 (TRIP CONTACTOR), configurable via IPA 3218-Relay 2 sel	O	230 Vac	1 AAC11	100 mA
78, 79	Connection for the thermistor	I	-	-	-
81, 82 ^{[1] [2]}	Indication of internal ultrafast fuse tripping (Frame C drives only)	O	230 Vac	1 AAC11	50 mA

[1] To maintain reinforced insulation, the relay outputs and the fuse trip signal terminals must not be connected to a SELV (Safety Extra-Low Voltage) power supply or signal.

[2] For North America market (cULus) the relay outputs and the fuse trip signal terminals shall be connected to the same source as terminals U2 and V2. This source must be rated 115/230 Vac.

4.3.1 Armature circuit power section

The input and output power connections for the armature circuit of Frames B and C can be made using a copper busbar of the same cross-section as that on the equipment.

Alternatively, copper cables with cable lugs may be used.

4.3.1.1 EN standard

The cables to be used to connect the power part of the devices must be calculated according to the converter currents following the regulations of the country of installation.

4.3.1.2 UL standard

The following table lists the cable cross-sections with the corresponding terminals required for each model to make the drive UL compliant.

For Frame B and C devices, the use of copper bars of the same cross-section as the corresponding drive connections is permitted.

The indicated cable cross-sections, provided as a guideline for the installer, have been determined based on the following parameters, in accordance with UL61800-5-1 standards:

- definition of the machine's rated current;
- 125% oversizing of the considered current;
- selection of the equivalent cable cross-section rated for 75°C, according to the standard table, rounded up to the next size.

The resulting value represents the nominal cross-section to be considered, calculated in compliance with the drive's safety requirements. The installer is responsible for calculating the actual cable cross-sections during installation, in accordance with the regulations in force in the country of installation.

NOTE!

Only stranded copper conductors with a minimum temperature rating of 75°C are recommended.

Table 4-2: Connection type and technical data

DRIVE	CONNECTION TYPES AND DIMENSIONS						The maximum cable dimensions refer to the rated current with stranded copper wires at 75°C.											
							U, V, W				C, D				PE			
TPD500	Type	U, V, W	C, D	PE	Wire stripping [mm]	Terminal Block AWG min	Cable [AWG]	Tightening torque [Nm]	LUG (North America) ILSCO [1]	LUG (North America) BURNDY [1]	Cable [AWG]	Tightening torque [Nm]	LUG (North America) ILSCO [1]	LUG (North America) BURNDY [1]	Cable [AWG]	Tightening torque [Nm]	LUG (North America) ILSCO [1]	LUG (North America) BURNDY [1]
500-00020-xB-A	Screw	M5	M5	M5	-	-	10	3.5	BRBR-10-14-P50	YAV10T 3BOX	10	3.5	BRBR-10-14-P50	YAV10T 3BOX	10	3.5	BRBR-10-14-P50	YAV10T 3BOX
500-00040-xB-A	Screw	M5	M5	M5	-	-	8	3.5	CSWS-8-14	YA8CL 1BOX	8	3.5	CSWS-8-14	YA8CL 1BOX	8	3.5	CSWS-8-14	YA8CL 1BOX
500-00070-xB-A	Screw	M5	M5	M5	-	-	4	3.5	CSWS-4-14	YA4CL BOX	3	3.5	CSWS-3-14	-	4	3.5	CSWS-4-14	YA4CL BOX
500-00110-xB-A	Terminal block [2]	-	-	-	17	6	1/0	9	-	-	1/0	9	-	-	2	9	-	-
500-00140-xB-A	Terminal block [2]	-	-	-	17	6	2/0	9	-	-	2/0	9	-	-	2	9	-	-
500-00185-xB-A	Terminal block [2]	-	-	-	17	6	3/0	9	-	-	4/0	9	-	-	2	9	-	-
500-00280-xB-B	Bar (bolt / nut)	M10	M10	M8	-	-	2x1/0	25	CSWS-1/0-12	Y25L6	2x3/0	25	CSWS-3/0-12	YA27L	1/0	15	CSWS-1/0-38	YA25L4

DRIVE	CONNECTION TYPES AND DIMENSIONS						The maximum cable dimensions refer to the rated current with stranded copper wires at 75°C.											
							U, V, W				C, D				PE			
TPD500	Type	U, V, W	C, D	PE	Wire stripping [mm]	Terminal Block AWG min	Cable [AWG]	Tightening torque [Nm]	LUG (North America) ILSCO [1]	LUG (North America) BURNDY [1]	Cable [AWG]	Tightening torque [Nm]	LUG (North America) ILSCO [1]	LUG (North America) BURNDY [1]	Cable [AWG]	Tightening torque [Nm]	LUG (North America) ILSCO [1]	LUG (North America) BURNDY [1]
500-00350-xB-B	Bar (bolt/nut)	M10	M10	M8	-	-	2x3/0	25	CSWS-3/0-12	YA27L	2x4/0	25	CSWS-4/0-12	YA28L	3/0	15	CSWS-3/0-38	YA27L4
500-00420-xB-B	Bar (bolt/nut)	M10	M10	M8	-	-	2x4/0	25	CSWS-4/0-12	YA28L	2x300	25	CSWS-300-12	YA30L	4/0	15	CSWS-4/0-38	YA28L4
500-00500-xB-B	Bar (bolt/nut)	M10	M10	M8	-	-	2x300	25	CSWS-300-12	YA30L	2x400	25	CSWS-400-12	YA32LN	300	15	CSWS-300-38	YA30L24
500-00650-xB-B	Bar (bolt/nut)	M10	M10	M8	-	-	2x400	25	CSWS-400-12	YA32LN	2x600	25	CSWS-600-12	YA36L11	400	15	CSWS-400-38	YA32L14
500-00770-xB-C	Bar (bolt/nut)	M10	M10	M8	-	-	4x250	25	CSWS-250-12	YA29L	4x350	25	CSWS-350-12	YA31L	1/0	15	CSWS-1/0-38	YA25L4
500-01000-2B-C	Bar (bolt/nut)	M10	M10	M8	-	-	4x400	25	CSWS-400-12	YA32LN	4x500	25	CSWS-500-12	YA36L11	2/0	15	CSWS-2/0-38	YA26L
500-01050-4B-C	Bar (bolt/nut)	M10	M10	M8	-	-	4x500	25	CSWS-500-12	YA34L6	4x600	25	CSWS-600-12	YA36L11	2/0	15	CSWS-2/0-38	YA26L
690-00560-xB-C	Bar (bolt/nut)	M10	M10	M8	-	-	4x3/0	25	CSWS-3/0-12	YA27L	4x4/0	25	CSWS-4/0-12	YA28L	2	15	CSWS-2-38	YA2CL4
690-00700-xB-C	Bar (bolt/nut)	M10	M10	M8	-	-	4x4/0	25	CSWS-4/0-12	YA28L	4x300	25	CSWS-300-12	YA30L	1/0	15	CSWS-1/0-38	YA25L4
500-00900-xB-C	Bar (bolt/nut)	M10	M10	M8	-	-	4x350	25	CSWS-350-12	YA31L	4x500	25	CSWS-500-12	YA34L6	1/0	15	CSWS-1/0-38	YA25L4

[1] Crimping tool reference: ILSCO – <https://www.ilSCO.com/> and BURNDY – <https://www.hubbell.com/burndy>

[2] Terminal block with bare wire

* Non-UL Product

NOTE!

TPD500 series drives comply with North American standards only when installed using the cable lugs specified in the table. These lugs must be tightened according to the parameters and using the tools specified in the documentation provided by the manufacturers.

For convenience, note [1] below **Table 4-2: Connection types and technical data** includes a link to the manufacturer's website, where the technical specifications and required installation tools can be found.

4.3.1.2.1 Option to reduce cable cross-section

For the NEC NFPA 70 standard taken into account by the UL standard, the input cables must be those indicated in the table because the drive's nominal input current must be considered for the relevant calculation.

For the drive's output cables connecting the motor's armature circuit, it is possible to calculate their cross-section using the motor's nominal current rather than the drive's nominal output current.

This current value must be increased by 125%, and using the following table, the corresponding ampacity value can be found in the third column rounded up to the next size.

The corresponding cross-section value is shown in the first two columns.

This reduction in cross-section for the output cable should be confirmed by the installing engineer and the Authority Having Jurisdiction (AHJ).

Table 4-3: Cable sizing criteria

AWG CABLE	CABLE CROSS-SECTION [mm ²]	75°C (167°F)
		AMPACITY [A] Copper [1]
24	0.2	-
22	0.3	-
20	0.5	-
18	0.8	-
16	1.3	-
14	2.1	15
12	3.3	20
10	5.3	30
8	8.4	50
6	13.3	65
4	21.2	85
3	26.7	100
2	33.6	115
1	42.4	130
1/0	53.4	150
2/0	67.4	175
3/0	85.0	200
4/0	107.2	230
250	127	255
300	152	285
350	177	310
400	203	335
500	253	380
600	304	420
700	355	460
750	380	475
800	405	490
900	456	520
1000	506	545
1250	633	590
1500	760	625
1750	887	650
2000	1013	665

[1] The listed values are the rated current multiplied by a factor of 1.25.

Table 4-5: Jumpers and Dip-Switches on the control board

REFERENCE	FUNCTION	FACTORY SETTING
RST	Regulation board hardware RESET	OPEN
	Not used (only for R&D tests)	
CFG1	Configuration Jumper - uController Motion Control (DSP)	OPEN
	Not used (only for R&D tests)	
CFG2	Configuration Jumper - uController Human Interface (HMI)	OPEN
	Not used (only for R&D tests)	
AI1 (terminals 1-2) AI2 (terminals 3-4) AI3 (terminals 5-6)	Analogue input V/I selection OFF: Voltage (0 ... 10 V / -10 ... +10 V) ON: Current (0 ... 20 mA / 4 ... 20 mA)	OFF
+24VE1 / +24VE2	Encoder power supply 1/2 (+24V)	ON
	OFF: Power output disabled ON: Power output enabled	
RT	Enabling RS485 serial interface termination resistor	ON
	OFF: Resistance not switched on ON: Resistance switched on (120 Ω)	
S4	Tachometer input voltage selection	
	Refer to Table 4-6: Dip-switch S4 - Tacho Response Input Voltage Adaptation	
S14	Rated field current selection	
	See Chapter 2.3.3 - Field Circuit Calibration	
S15	Selection/configuration of control board (drive size setting)	
	See Table 4-7: Dip-switch S15 - Factory setting of drive size	

NOTE!For improved readability in the following tables, the **OFF** state of the dip switches is denoted by the symbol “-”.

Table 4-6: Dip-switch S4 - Tachogenerator feedback input voltage adjustment

Tacho Voltage full scale [V]	S4-1 S4-8	S4-2 S4-7	S4-3 S4-6	S4-4 S4-5
22.7	ON	ON	ON	ON
45.4	ON	ON	ON	-
90.7	ON	ON	-	-
181.6	ON	-	-	-
302.9	-	-	-	-

Table 4-7: Dip-switch S15 - Factory setting of the drive size

NOTE!

S15 configuration is factory-set. Do not modify.

Standard	S15-8	S15-7	S15-6	S15-5	S15-4	S15-3	S15-2	S15-1
TPD500-500-00020-...-A	-	ON	-	-	-	-	-	-
TPD500-500-00040-...-A	-	ON	-	-	-	-	-	ON
TPD500-500-00070-...-A	-	ON	-	-	-	-	ON	-
TPD500-500-00110-...-A	-	ON	-	-	-	-	ON	ON
TPD500-500-00140-...-A	-	ON	-	-	-	ON	-	-
TPD500-500-00185-...-A	-	ON	-	-	-	ON	-	ON
TPD500-500-00280-...-B	-	ON	-	-	-	ON	ON	-
TPD500-500-00350-...-B	-	ON	-	-	-	ON	ON	ON
TPD500-500-00420-...-B	-	ON	-	-	ON	-	-	-
TPD500-500-00500-...-B	-	ON	-	-	ON	-	-	ON
TPD500-500-00650-...-B	-	ON	-	-	ON	-	ON	-
TPD500-500-00770-...-C	-	ON	-	-	ON	-	ON	ON
TPD500-500-01000-2B-C	-	ON	-	-	ON	ON	-	-
TPD500-500-01050-4B-C	-	ON	-	-	ON	ON	-	-
TPD500-690-00560-2B-C	ON	-	-	ON	ON	-	ON	-
TPD500-690-00560-4B-C	ON	-	-	ON	-	ON	ON	-
TPD500-690-00700-2B-C	ON	-	-	ON	ON	-	ON	ON
TPD500-690-00700-4B-C	ON	-	-	ON	-	ON	ON	ON

Standard	S15-8	S15-7	S15-6	S15-5	S15-4	S15-3	S15-2	S15-1
TPD500-690-00900-2B-C	ON	-	-	ON	ON	ON	-	-
TPD500-690-00900-4B-C	ON	-	-	ON	ON	-	-	-
TPD500-500-01200-2B-E	-	ON	-	-	ON	ON	-	ON
TPD500-500-01500-2B-E	-	ON	-	ON	-	-	-	ON
TPD500-500-01800-2B-E	-	ON	-	ON	-	-	ON	ON
TPD500-500-02000-2B-E	-	ON	-	ON	-	ON	-	-
TPD500-500-02400-2B-E	-	ON	-	ON	-	ON	-	ON
TPD500-500-02700-2B-E	-	ON	-	ON	-	ON	ON	-
TPD500-500-02900-2B-E	-	ON	-	ON	-	ON	ON	ON
TPD500-500-03300-2B-E	-	ON	-	ON	ON	-	-	-
TPD500-500-01500-4B-E	-	ON	-	-	ON	ON	ON	ON
TPD500-500-01700-4B-E	-	ON	-	ON	-	-	-	-
TPD500-500-02000-4B-E	-	ON	-	ON	-	-	-	ON
TPD500-500-02400-4B-E	-	ON	-	ON	-	-	ON	-
TPD500-500-02700-4B-E	-	ON	-	ON	-	-	ON	ON
TPD500-500-03300-4B-E	-	ON	-	ON	-	ON	-	ON
TPD500-690-01010-2B-E	ON	-	-	-	ON	ON	ON	ON
TPD500-690-01400-2B-E	ON	-	-	ON	-	-	-	-
TPD500-690-01700-2B-E	ON	-	-	ON	-	-	ON	-
TPD500-690-02000-2B-E	ON	-	-	ON	-	ON	-	-
TPD500-690-02400-2B-E	ON	-	-	ON	-	ON	-	ON
TPD500-690-02700-2B-E	ON	-	-	ON	-	ON	ON	-
TPD500-690-03300-2B-E	ON	-	-	ON	ON	-	-	-
TPD500-690-01010-4B-E	ON	-	-	-	ON	ON	-	ON
TPD500-690-01400-4B-E	ON	-	-	-	ON	ON	ON	-
TPD500-690-01700-4B-E	ON	-	-	ON	-	-	-	-
TPD500-690-02000-4B-E	ON	-	-	ON	-	-	-	ON
TPD500-690-02400-4B-E	ON	-	-	ON	-	-	ON	-
TPD500-690-02700-4B-E	ON	-	-	ON	-	-	ON	ON
TPD500-690-03300-4B-E	ON	-	-	ON	-	ON	-	ON
TPD500-CU-500-THY1-FC40	-	ON	ON	ON	ON	ON	ON	ON
TPD500-CU-500-THY1-FC70	-	ON	ON	ON	ON	ON	ON	ON
TPD500-CU-500-THY2-FC40	-	ON	ON	ON	ON	ON	ON	ON
TPD500-CU-500-THY2-FC70	-	ON	ON	ON	ON	ON	ON	ON
TPD500-CU-690-THY1-FC40	ON	-	ON	ON	ON	ON	ON	ON
TPD500-CU-690-THY1-FC70	ON	-	ON	ON	ON	ON	ON	ON
TPD500-CU-690-THY2-FC40	ON	-	ON	ON	ON	ON	ON	ON
TPD500-CU-690-THY2-FC70	ON	-	ON	ON	ON	ON	ON	ON

4.4.2 Terminal blocks

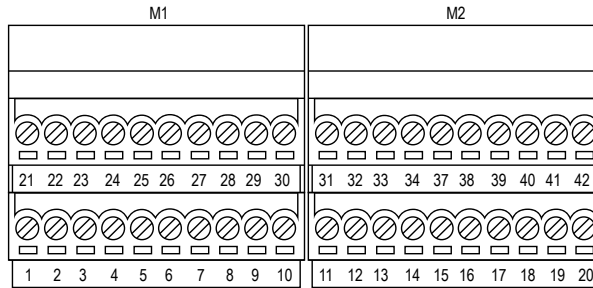


Figure 4-9: Layout of terminals 1 to 42

Table 4-8: Meaning of terminal block signals (terminals 1 to 20)

TERMINAL / DESCRIPTION	FUNCTION	I/O	MAX VOLTAGE	MAX CURRENT
1+2 Analog input 1	Configurable differential analogue input Signal: terminal 1 Reference: terminal 2 Factory-configured for Ramp ref 1*	I	±10 V	0.25 mA - voltage reference 20 mA - current reference
3+4 Analog input 2	Configurable differential analogue input Signal: terminal 3 Reference: terminal 4 Not pre-configured at factory*	I	±10 V	0.25 mA - voltage reference 20 mA - current reference
5+6 Analog input 3	Configurable differential analogue input Signal: terminal 5 Reference: terminals 6 Not factory-configured*	I	±10 V	0.25 mA - voltage reference 20 mA - current reference
7 +10 V	Reference voltage +10 V Reference potential: terminal 9	O	+10 V	10 mA
8 -10 V	Reference voltage -10 V Reference potential: terminal 9	O	-10 V	10 mA
9 0 V 10	Reference for voltages at terminals 7 and 8	-	-	-
10	Screen connection (PE) (connected with metal housing)	-	-	-
11	0V internal	-	-	-
12 Enable drive	General converter unlock 0 V Converter locked +15 ... +30 V Converter unlocked	I	+30 V	3.2 mA @15 V 5 mA @24 V 6.4 mA @30 V
13 Start	Start command 0 V None Start +15 ... +30 V Start	I	+30 V	3.2 mA @15 V 5 mA @24 V 6.4 mA @30 V
14 Fast stop	Fast stop 0 V Fast stop +15 ... +30 V No Fast stop	I	+30 V	3.2 mA @15 V 5 mA @24 V 6.4 mA @30 V
15 External fault	External alarm 0 V External alarm present +15...30 V No external alarm present	I	+30 V	3.2 mA @15 V 5 mA @24 V 6.4 mA @30 V
16 COM ID	Common of digital inputs at terminals 12 to 15	-	-	-
18 0 V 24	24 V voltage reference at terminal 19	-	-	-
19 +24 V	Voltage +24 V Reference potential: terminal 18	O	+20 ... +30 V	200 mA**
20	Shield connection (PE) (connected with metal housing)	-	-	-

* The terminal block configuration and wiring can be adapted by the user to suit the specific application.

** Maximum current for digital I/O, including both the control board and the TBO-32 option card (code S5V62).

Table 4-9: Meaning of terminal block signals (terminals 21 to 42)

TERMINAL / DESCRIPTION	FUNCTION	I/O	MAX VOLTAGE	MAX CURRENT
21 Analog output 1	Analogue output 1 Reference potential: terminal 22 Factory-configured for Motor speed nofilt	O	±10 V	5 mA
22 COM analog output 1	Reference potential for analogue output 1	-	-	-
23 Analog out 2	Analogue output 2 Reference potential: terminal 24 Factory-configured for Arm curr nofilt	O	±10 V	5 mA
24 COM analog output 2	Reference potential for analogue output 2	-	-	-
25 COM digital outputs	Common of the digital outputs of terminals 26 to 29	-	-	-
26 Digital output 1	Digital output 1 Common: terminal 25 Factory-configured for Ramp +	0	+30 V	50 mA
27 Digital output 2	Digital output 2 Common: terminal 25 Factory-configured for Ramp -	0	+30 V	50 mA
28 Digital output 3	Digital output 3 Common: terminal 25 Factory-configured for Speed threshold	0	+30 V	50 mA
29 Digital output 4	Digital output 4 Common: terminal 25 Factory-configured for Motor overload free	0	+30 V	50 mA
30 Supply digital output	Supply voltage for digital outputs	I	+30 V	Depends on load max 80 mA
31 Digital input 1	Digital input 1 Common: terminal 37 Not factory-configured	I	+30 V	15 V / 3.2 mA 24 V / 5 mA 30 V / 6.4 mA
32 Digital input 2	Digital input 2 Common: terminal 37 Not preset at factory	I	+30 V	15 V / 3.2 mA 24 V / 5 mA 30 V / 6.4 mA
33 Digital input 3	Digital input 3 Common: terminal 37 Not preset at factory	I	+30 V	15 V / 3.2 mA 24 V / 5 mA 30 V / 6.4 mA
34 Digital input 4	Digital input 4 Common: terminal 37 Not preset at factory	I	+30 V	15 V / 3.2 mA 24 V / 5 mA 30 V / 6.4 mA
37 COM digital inputs	Common of digital inputs at terminals 31 to 34	-	-	-
39-40-41-42	RS485 39 - RxA/TxA 40 - RxB/TxB 41 - GND 42 - PE (screen)	See Chapter 4.6 - RS485 - Modbus RTU Serial Communication		
17-38	Not used	-	-	-

Table 4-10: Permissible cable cross-section for removable control terminal blocks

TERMINALS	MAXIMUM CABLE CROSS-SECTION			TIGHTENING TORQUE [Nm]
	FLEXIBLE [mm²]	SEMI-RIGID [mm²]	AWG	
1...20, +, -	0.14...1.5	0.14...1.5	26...16	0.4

In order to make the connections to the terminal blocks correctly, it is recommended to follow the instructions below:

- Use a flat-blade screwdriver with dimensions of 75 x 2.5 x 0.4 mm.
- Remove the cable insulation to a length of 6.5 mm.
- Only connect one cable per terminal; the cable must be untreated, i.e. without cable lugs.

Table 4-11: Terminal block for connecting an analog tachogenerator

DESIGNATION	FUNCTION	I/O	MAX VOLTAGE	MAX CURRENT
-	Tachymetric input refinement	I	-	-
+	Tachometer positive input Clockwise rotation: positive Counterclockwise rotation: negative	I	302.9 V ^{[1] [2]} 300 V (cULus)	8 mA

[1] Maximum voltage set via dip-switch **S4**

[2] 300 V as the maximum voltage for the North American market (cULus)

Table 4-12: Description of connectors XE1/XE2

DESIGNATION ^[1]	FUNCTION	I/O	MAX VOLTAGE	MAX CURRENT
PIN 1	Channel B-	I	30 Vpp ^[2]	17 mA pp
PIN 2	+24 V supply voltage for the encoder ^[4]	O	24 V	150 mA ^[3]
PIN 3	Channel C+(zero pulse)	I	30 Vpp ^[2]	17 mA pp
PIN 4	Channel C- (zero pulse)	I	30 Vpp ^[2]	17 mA pp
PIN 5	Channel A+	I	30 Vpp ^[2]	17 mA pp
PIN 6	Channel A-	I	30 Vpp ^[2]	17 mA pp
PIN 7	Reference for 5 V / 24 V	O	-	-
PIN 8	Channel B+	I	30 Vpp ^[2]	17 mA pp
PIN 9	+5 V supply voltage for the encoder ^[5]	O	6.5 V	150 mA

[1] 9-DSUB female connector mounted on the device. Connect/wire using a 9-DSUB male connector (DIN 41 652).

[2] The maximum input voltage for the encoder channels is 30 Vpp with HTL selection (default), and +5.5 Vpp with TTL selection.

[3] The maximum output current with HTL selection (+24 V) is 150 mA per encoder, 300 mA total.

[4] HTL encoder supply, enabled via Dip-Switch +24VE1/+24VE2 = ON.

[5] TTL encoder supply, enabled via parameters IPA 704-**Enc 1 supply enable** and IPA 754-**Enc 2 supply enable**.

4.5 EtherNet - ModbusTCP/IP communication

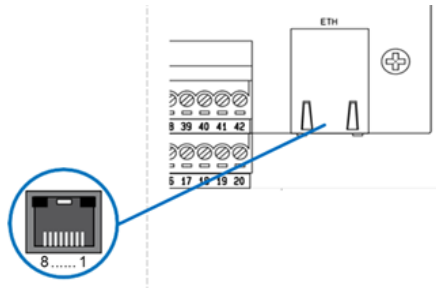


Figure 4-10: RJ45 port on the R-TPD500 control board

TPD500 series drives are equipped with an RJ45 port as standard, supporting the **ModbusTCP/IP** protocol for drive-to-PC communication (via the **WEG_DriveLabs** configuration software).

The minimum requirements for the Ethernet cable are: shielded Category 5E, maximum length of 10 meters, and a data transfer rate of 100 Mbit/s.

Table 4-13: Meaning of the ETH port signals

PIN	SIGNAL	DESCRIPTION	IN/OUT
1	EN0TX+	Data transmission (+)	OUT
2	EN0TX-	Data transmission (-)	OUT
3	EN0RX+	Data reception (+)	IN
4	N.C.	n.c.	-
5	N.C.	n.c.	-
6	EN0RX-	Data reception (-)	IN
7	N.C.	n.c.	-
8	N.C.	n.c.	-

4.5.1 EtherNet configuration

At startup, based on the EtherNet configuration, the drive acquires an IP address that remains valid until the next reboot. Any changes to the EtherNet configuration will only take effect after the drive is restarted.

The IP address is assigned according to the configuration parameters found in the **COMMUNICATION/NETWORK CONFIG** menu (see [Chapter 7 – FUNCTION PARAMETERS](#)).

4.5.2 Point-to-point network topology

In this topology, the PC is connected directly to the drive.

If the drive is configured in **DHCP** mode (parameter IPA 9604-**IP assignment** set to *Static*, the default setting), and since no DHCP server is present in this configuration, the TPD500 will automatically acquire the local IP address **169.254.10.10**. Most PCs support a link-local protocol, so if the PC is also set to DHCP mode, it will obtain a local IP address in the same **169.254.x.y**, range and will be able to communicate with the drive.

IP address acquisition may take up to 2 minutes. If the PC does not support the link-local protocol or fails to obtain a valid address, it is possible to manually configure a static IP address compatible with the link-local addressing range. In this case, the PC should be configured as follows:

- Set the PC to use a static IP address;
- Assign an IP address in the format **169.254.x.y**, avoiding 169.254.10.10, which is reserved for the drive;
- Set the PC's subnet mask to **255.255.0.0**.

If the drive is configured to use a **static** IP address (parameter IPA 9604-**IP assignment** set to *Static*), it will be reachable at the address specified in parameter IPA 9556-**IP address set**, within the network defined by the subnet mask set in parameter IPA 9558-**IP netmask set**.

The PC must also be configured with a compatible address, as follows:

- Set the PC to use a static IP address;
- Configure the PC's subnet mask with the same value defined in parameter IPA 9558-**IP netmask set**;
- Assign the PC an IP address within the same subnet as the drive, but different from the drive's IP address.

4.6 RS485 - Modbus RTU serial communication

4.6.1 Description

TPD500 series drives are also equipped with a port (terminal M2, pins 39–42) for connecting the RS485 serial line, provided as standard.

The communication protocol used is **Modbus RTU**, with the following default settings:

- Serial Address = 1
- Serial Baudrate = 38400 bps
- Serial Frame = 8-N-1

For different settings, refer to the **COMMUNICATION/RS485** menu (see [Chapter 7 - FUNCTION PARAMETERS](#)).

NOTE!

The standard communication for the TPD500 is ModbusTCP/IP over the Ethernet port. RS485 serial communication is maintained for compatibility with TPD32-EV series drives.

NOTE!

Register addresses are indexed as IPA minus 1.
Example: IPA 600 – Output Current [A] – The Modbus register is 599.

To access the terminals, the front cover of the drive must be removed (see [Chapter 3.2.1 – Disassembling the unit](#)).

4.6.1.1 Point-to-point connection drive–RS485 port (non-isolated)



The indicated connection is not galvanically isolated!
This connection method is not recommended when the drive is enabled (Enable drive = ON).

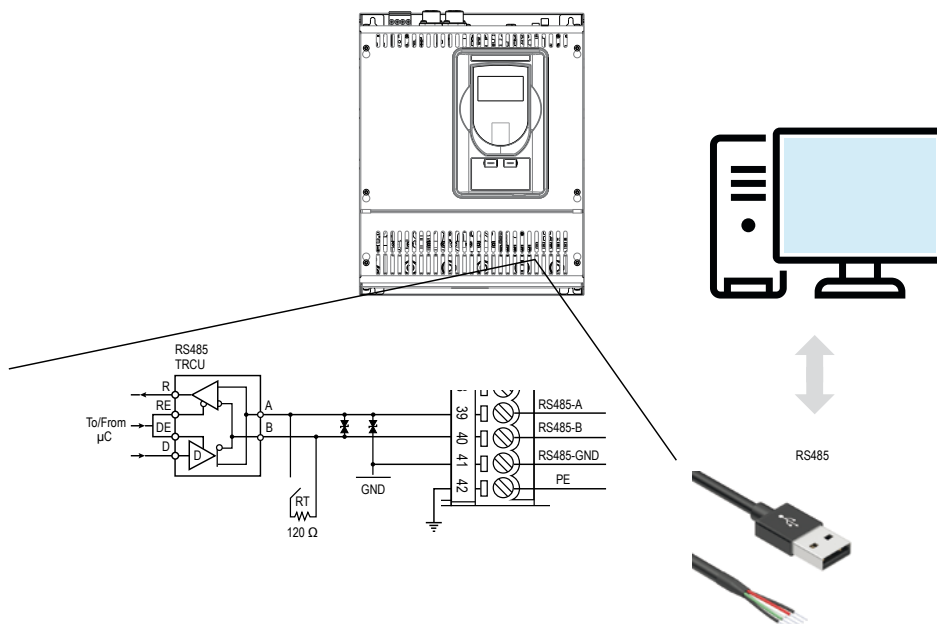


Figure 4-11: Point-to-point connection (non-isolated)

For the connection:

- Use a twisted pair with two symmetrical conductors and a common shield, plus a conductor for equipotential grounding (GND).
- Connect the shield of the twisted pair or cable (if present) to PE.
- Enable the termination resistor by setting dip-switch RT to ON (see [Table 4-5: Jumpers and Dip-Switches on the control board](#)).
- Connect the USB port to the PC (see figure).

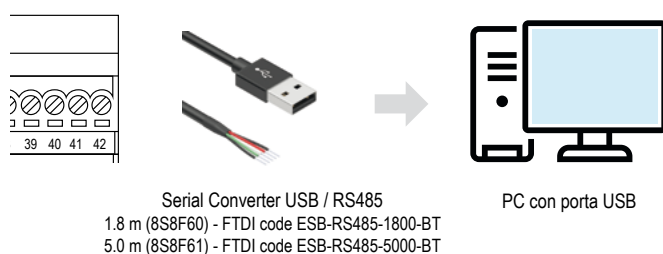


Figure 4-12: RS485 connection to PC

NOTE!

WEG offers a range of approved cables, whose part numbers are listed in Figure 4-12.

4.6.1.2 Point-to-point connection drive-RS485 port (isolated)

To establish a galvanically isolated connection, a commercial external RS485 isolator must be used.

4.6.1.3 Multidrop connection drive-RS485 port (isolated)

To set up a multidrop connection, an external isolator must be installed on each drive (node) involved. It is important to place a termination resistor at both ends of the connection. For **TPD500** drives, this is done by setting the RT dip-switch to ON. Up to 20 drives can be connected, with a total maximum cable length of 200 meters.

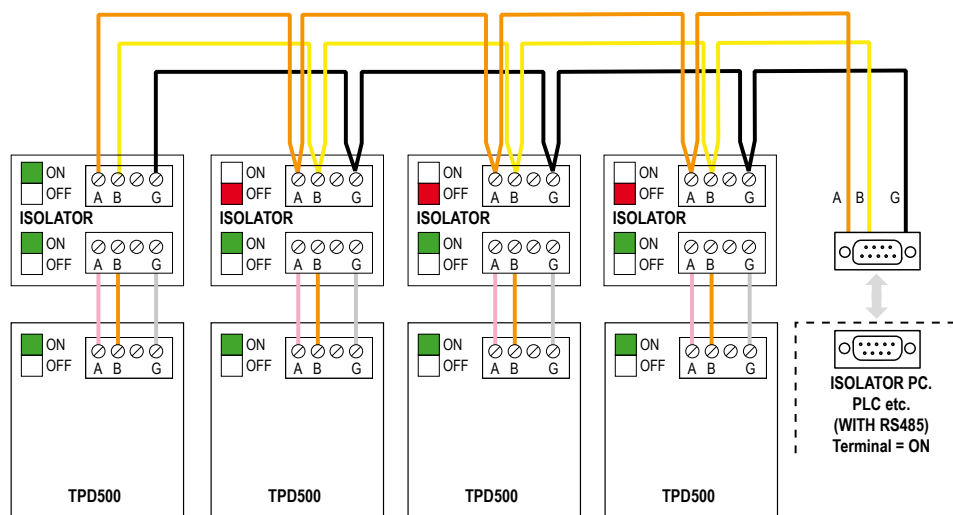


Figure 4-13: RS485 multidrop connection

4.7 Removable keypad

The female RJ45 port located on the front of the drive allows for the connection and mechanical fastening of the **KB-TPD500** keypad (**Figure 4-14: Keypad and its housing, ①**). The keypad is always included as standard equipment and the drive is not intended to be configured or operated without it.



Figure 4-14: Keypad and its housing

To remote the keypad up to a maximum distance of 10 meters (e.g., on the door of the electrical cabinet), the following optional kits are available:

- **REMOTING KIT KB-TPD500 5 m** (code S5P12TK1)
- **REMOTING KIT KB-TPD500 10 m** (code S5P12TK2)

NOTE!

The remoting kit does not allow remote access to the USB port or the Wi-Fi port.

4.8 USB Interface

NOTE!

The USB port does not support connection to a PC.

USB 2.0 port for data transfer using a USB flash drive with Type-A connector (**Figure 4-14: Keypad and its housing, ②**):

- Maximum available current: 150 mA
- Memory format: FAT32

For more information, refer to **Chapter 6.1.2 - Navigation via keypad**.

4.9 Wi-Fi module interface

TPD500 series drives support an optional external module for Wi-Fi connection, called **Wi-Fi Drive Link** (code S52969WF). The module is connected to the 10-pin connector (**Figure 4-14: Keypad and its housing, ③**) located on the keypad housing.

The Wi-Fi module creates a WLAN network, enabling communication with the TPD500 via the **Modbus TCP/IP** protocol. Once properly configured, the **WEG_DriveLabs** software can perform all configurator functions using the Wi-Fi connection.

Wi-Fi module insertion is handled automatically. To remove the module, use the command via parameter IPA 496-**Wi-fi safe removal** to cut power to the module before unplugging it.

NOTE!

The Wi-Fi module cannot be considered a stable and secure communication method and therefore must not be used for controlling an operational machine. It is intended to be used only as a wireless interface to the product for commissioning and temporary monitoring purposes.

For further information on the installation and use of the module, refer to the dedicated manual (code 1S5WDLT500).

4.10 Fieldbus communication

TPD500 series drives are compatible with standard industrial communication networks, commonly known as fieldbuses. Each fieldbus requires specific network hardware and dedicated configuration parameters.

The following table lists the supported fieldbuses, the required hardware options, and the corresponding reference documentation.

Table 4-14: Available fieldbus option boards

FIELDBUS	KIT CODE	MANUAL CODE
PROFIBUS DP EXP-PDP-TPD500	S729771	1S5PBT500
PROFINET EXP-ETH-PN-TPD500	S729772	1S5PNT500
EtherNet/IP EXP-ETH-IP-TPD500	S729773	1S5IPT500

For usage details, refer to the instructions provided in the manuals.

The parameters related to fieldbus management are grouped under the **COMMUNICATION\FIELDBUS CONFIG** menu.

4.11 Protection features

4.11.1 Fuses

NOTE!

Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Manufacturer Instructions, National Electrical Code and any additional local codes.

La protection intégrée contre les courts-circuits à semi-conducteurs n'assure pas la protection des circuits de dérivation. La protection du circuit de dérivation doit être assurée conformément aux instructions du fabricant, au Code national de l'électricité et à tout autre code local.

Power section fuses

To ensure proper protection of the thyristors in the power bridge, it is essential to always use appropriately rated ultra-fast fuses.

Frame A and B

- Ultra-fast fuses F_A and F_B are mounted externally and are not included in the standard supply. For procurement, refer to the tables provided later in this chapter.
- Ultra-fast fuses F_D , on the other hand, are already installed inside the device.

NOTE!

F_A fuses are designed to protect only the semiconductors against short circuits. Protection against any overloads must be provided by suitable devices (circuit breakers or power supply line fuses).
The internal F_D fuses also provide short-circuit protection for the field circuit's semiconductors. The U1 V1 power supply line must be protected against overloads using suitable devices (circuit breakers or power supply line fuses).

Frame C

- Ultra-fast fuses F_C and F_D are already installed inside the device.

NOTE!

The internal fuses F_C and F_D are designed to protect only the semiconductors against short circuits. Protection against any overloads must be provided by suitable devices (circuit breakers or protective fuses for the power supply lines).

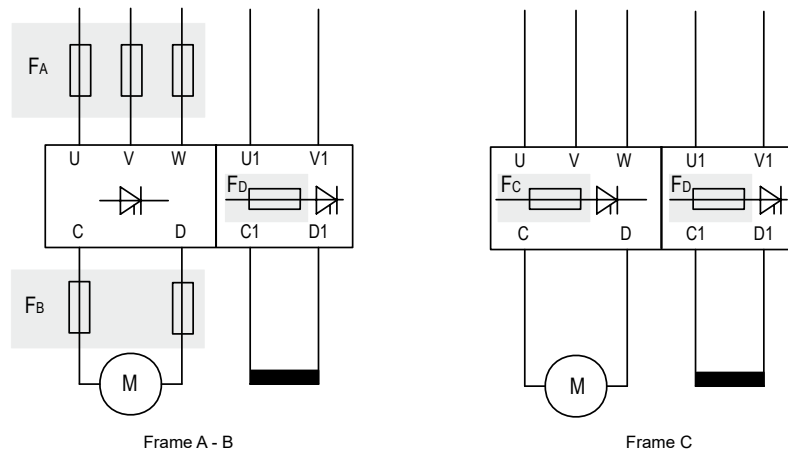


Figure 4-15: Arrangement of ultra-fast fuses - Frame A-B-C

Frame E and Control Unit

- Ultra-fast fuses F_D are already installed inside the device.
- Ultra-fast fuses $F_{U1/V1}$ are mounted externally and are not included in the standard supply. For procurement, refer to the tables provided later in this chapter.

NOTE!

The internal fuses F_E and external fuses $F_{U1/V1}$ are designed to protect only the semiconductors against short circuits. Protection against any overloads must be provided by suitable devices (circuit breakers or protective fuses for the power supply lines).

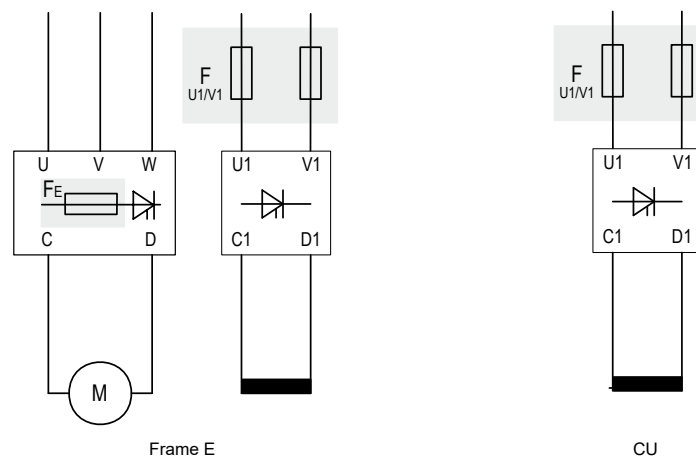


Figure 4-16: Arrangement of ultra-fast fuses - Frame E and Control Unit

NOTE!

The power supply cables must be protected in accordance with the regulations of the country of installation. For devices installed in North America, the requirements established during certification (cULus) must be observed.

The following tables list the protection devices required for installations in North America.

NOTE!

Technical data for the fuses – such as dimensions, weight, power dissipation, heat generation, etc. – are available in the respective fuse manufacturer catalogs.

NOTE!

If it is necessary to replace the armature fuses for Frame C (F_c) or Frame E (F_e), please contact technohelp@weg.net

Table 4-15: F_{Ae} , external input-side fuses

DRIVE	QUANTITY	MANUFACTURER	TYPE	cULus	CE
TPD500-500-00020-nB-A	3	MERSEN	A70QS25		x
		MERSEN	A70P25		x
		MERSEN	N1027330		x
TPD500-500-00040-nB-A	3	MERSEN	A70QS40	x	x
		MERSEN	A70P40		x
		MERSEN	B1027319		x
TPD500-500-00070-nB-A	3	MERSEN	A70QS80	x	x
		MERSEN	A70P80		x
		MERSEN	T094823		x
TPD500-500-00110-nB-A	3	MERSEN	A70QS100	x	x
		MERSEN	A70P100		x
		JEAN MÜLLER	R5184353		x
TPD500-500-00140-nB-A	3	MERSEN	A70QS150	x	x
		MERSEN	A70P150		x
		JEAN MÜLLER	R5184653		x
TPD500-500-00185-nB-A	3	MERSEN	A70QS175	x	x
		MERSEN	A70P175		x
		JEAN MÜLLER	R5185223		x
TPD500-500-00280-nB-B	3	MERSEN	A70QS300	x	x
		MERSEN	A70P300		x
		JEAN MÜLLER	R1185621		x
TPD500-500-00350-nB-B	3	MERSEN	A70QS350	x	x
		MERSEN	A70P350		x
		JEAN MÜLLER	R1185921		x
TPD500-500-00420-nB-B	3	MERSEN	A70QS400	x	x
		MERSEN	A70P400		x
		JEAN MÜLLER	R2186221		x
TPD500-500-00500-nB-B	3	MERSEN	A70QS500	x	x
		MERSEN	A70P500		x
		JEAN MÜLLER	R2186621		x
TPD500-500-00650-nB-B	3	MERSEN	A70QS600	x	x
		MERSEN	A70P600		x
		JEAN MÜLLER	R2186921		x

Table 4-16: F_g , external fuses for the armature circuit

DRIVE	QUANTITY	MANUFACTURER	TYPE
TPD500-500-00020-4B-A	2	MERSEN	A70QS25
		MERSEN	A70P25
		MERSEN	N1027330
TPD500-500-00040-4B-A	2	MERSEN	A70QS70
		MERSEN	A70P70
		MERSEN	T094823

DRIVE	QUANTITY	MANUFACTURER	TYPE
TPD500-500-00070-4B-A	2	MERSEN	A70QS100
		MERSEN	A70P100
		JEAN MÜLLER	R5184353
TPD500-500-00110-4B-A	2	MERSEN	A70QS125
		MERSEN	A70P125
		JEAN MÜLLER	R5184653
TPD500-500-00140-4B-A	2	MERSEN	A70QS175
		MERSEN	A70P175
		JEAN MÜLLER	R5184953
TPD500-500-00185-4B-A	2	MERSEN	A70QS200
		MERSEN	A70P200
		JEAN MÜLLER	R5185223
TPD500-500-00280-4B-B	2	MERSEN	A70QS350
		MERSEN	A70P350
		JEAN MÜLLER	R1185921
TPD500-500-00350-4B-B	2	MERSEN	A70QS400
		MERSEN	A70P400
		JEAN MÜLLER	R2186221
TPD500-500-00420-4B-B	2	MERSEN	A70QS500
		MERSEN	A70P500
		JEAN MÜLLER	R2186621
TPD500-500-00500-4B-B	2	MERSEN	A70QS600
		MERSEN	A70P600
		JEAN MÜLLER	R2186921
TPD500-500-00650-4B-B	2	MERSEN	A70QS700
		MERSEN	A70P700
		JEAN MÜLLER	R2087021

NOTE!

Required only for four-quadrant operation.

NOTE!

UL does not provide specific requirements for the output fuses of the armature circuit.

Table 4-17: F_{α} , internal fuses for the field circuit

DRIVE	QUANTITY	MANUFACTURER	TYPE	cULus	CE
TPD500-...-...-A	2	COOPER BUSSMANN	FWH-016A6F	x	x
		SIBA	70 125 40.16	x	x
TPD500-...-...-B	2	COOPER BUSSMANN	FWC-25A10F	x	x
		SIBA	60 033 05.25	x	x
TPD500-...-...-C	2	COOPER BUSSMANN	FWC-25A10F	x	x
		SIBA	60 033 05.25	x	x

NOTE!

These fuses are mounted internally and are included as part of the standard supply.

Table 4-18: FU1, FV1, External field circuit fuses for TPD500 Frame E

DRIVE	QUANTITY	MANUFACTURER	TYPE	cULus	CE
TPD500-...-01010-...-E ... TPD500-...-02000-...-E	2	BUSSMANN	FWP-50A22Fa		x
		SIBA	URZ 5014006.50		x
		MERSEN	6.900CPURD22x58/50 W094779		x
			A70QS50-22F		x

TPD500-...-02400-...-E ... TPD500-...-03300-...-E	2	BUSSMANN	FWP-100A22Fa		x
		SIBA	URZ 5014006.100		x
		MERSEN	6.900CPURD22x58/100 Y094827		x
			A70QS100-22F		x

Table 4-19: FU1, FV1, External field circuit fuses for TPD500-CU

DRIVE	QUANTITY	MANUFACTURER	TYPE	cULus	CE
TPD500-CU-...-...-FC40	2	BUSSMANN	FWP-50A22Fa		x
		SIBA	URZ 5014006.50		x
		MERSEN	6.900CPURD22x58/50 W094779		x
			A70QS50-22F		
TPD500-CU-...-...-FC70	2	BUSSMANN	FWP-100A22Fa		x
		SIBA	URZ 5014006.100		x
		MERSEN	6.900CPURD22x58/100 Y094827		x
			A70QS100-22F		

Table 4-20: Other internal fuses

FRAME	DESIGNATION	FUNCTION	FUSES	CODE	APPLICATION
A, TPD500-CU	F1	+ 24V power supply output	IEC 250 V 2.50 A slo-blo 0.2" x 0.8" (5 x 20 mm)	S8B29	SW1-31
B	F1 ⁽¹⁾	Control power input (115 Vac or 230 Vac)	IEC 250 V 2.50 A slo-blo 0.2" x 0.8" (5 x 20 mm)	S8B29	SW2-32
	F2	+ 24V power supply output			
	F1 ⁽¹⁾ / F2 ⁽¹⁾ / F3 ⁽¹⁾	Varistor fuse	IEC 500 V 16 A fast acting 0.24" x 1.26" (6 x 32 mm)	S824B	FIRS2-XX
C	F1 ⁽¹⁾	Regulation power input (115 Vac or 230 Vac)	IEC 250 V 2.50 A slo-blo 0.2" x 0.8" (5 x 20 mm)	S8B29	SW3-32
	F2	+ 24V power supply output			
	F1 ⁽¹⁾ / F2 ⁽¹⁾ / F3 ⁽¹⁾	Varistor fuse	IEC 690 V 25 A fast acting 0.55" x 2" (14 x 51 mm)	F4M09	FLS-50 (TPD500-500-...) FLS-60 (TPD500-690-...)

(1) Type and characteristics must not be changed when the product is used under North American directives (cULus).

4.11.2 Line contactors

NOTE!

The size of the contactors must be selected based on the drive's rated current. Sizing must be performed according to the thermal current drawn by the drive under nominal operating conditions (AC1 category).

NOTE!

Technical data for the contactors – such as weight, power dissipation, auxiliary contacts, etc. – can be found in the corresponding technical datasheets.

4.11.3 Control board circuit protection

The 115 V / 230 V input for the control power supply (terminals U2 and V2) must be protected against short circuits. Protection can be implemented using either standard fuses or circuit breakers. The circuit breaker and/or fuse must be selected based on the short-circuit current of the power source and the inrush current of the drive. They must therefore be sized to avoid nuisance tripping during inrush conditions.

The following table shows the control circuit current consumption for the different drive sizes.

Table 4-21: Control circuit current consumption

DRIVE	CONTROL BOARD POWER SUPPLY					
	BOARD	POWER	NOMINAL CURRENT CONSUMPTION		INRUSH CURRENT	
			115 V	230 V	115 V	230 V
TPD500-...-A TPD500-...-E TPD500-CU-...	SW1-31	90 W	1 A	0.5 A	20 A	10 A
TPD500-...-B TPD500-...-C	SW2-32	110 W	1 A	0.5 A	15 A	7.5 A

It is recommended that the control power supply be provided by a source separate from the main power supply. In systems with multiple drives, a single source may be used, provided that the associated protection devices are properly sized.

For installations in North America, fuses must be of type JDDZ/7, class CC, with a minimum short-circuit current rating (SCCR) of 50 kA for Frame A and B, and 100 kA for Frame C.

4.11.4 Field circuit protection

The power supply line for the field circuits (terminals U1 and V1) must be protected against short circuits. Protection can be implemented using standard fuses or circuit breakers, which must be selected based on the short-circuit current of the power source and the drive's inrush current. They must therefore be properly sized to avoid nuisance tripping during inrush.

Follow the applicable standards and regulations of the country where the product is installed. For the rated voltage and current values of each frame size, refer to **Table 4-22: Line inductors at 400 Vac**.

For installations in North America, fuses must be Class J or Class L, with a minimum short-circuit current rating (SCCR) of 50 kA for Frame A and B, and 100 kA for Frame C.

4.12 Inductors and filters

To enhance the operational safety of **TPD500** series drives, prevent network disturbances and mutual interference between drives, and ensure compliance with applicable standards (EN 60146-1-1, IEC 146-1-2, EN 61136-1), it is recommended to install a three-phase line inductor upstream of the equipment.

Considering that in most cases a relative short-circuit power of at least 100 kA and a simultaneity factor of 1 can be assumed (EN 50178, A 6.3.6), the addition of a commutation inductor (or transformer) with a relative voltage drop of $u_k = 4\%$ ensures that the commutation dips at the point of common coupling (PCC) remain below 20%.

4.12.1 Line inductors

In accordance with standard EN 61800-3 (Table B.1), the maximum acceptable depth of commutation dips at the point of common coupling must be limited between 20% and 40%, depending on the installation environment. This can be achieved by installing appropriate decoupling reactors or transformers.

To ensure proper operation, the drive must be connected to a power supply line with a reactance that causes a relative voltage drop between 2% and 10%. The decoupling reactance must be specifically calculated based on the relative short-circuit power (R_{sc}) at the point of connection and on the system configuration, which may include single or multiple drives, isolation transformers, etc.

As a reference, the following tables show the decoupling reactance values L_d (line inductors) corresponding to a 2% or 4% voltage drop. These values refer to the drive's rated output current but can also be calculated based on the motor's rated DC current. The line current is calculated as follows:

$$I_{LN} = I_{DN} \cdot 0.82$$

The listed values include a safety margin of +5% in the calculations. It is also important to note that drives operating with such a high voltage drop are generally classified under the "second environment."

The calculation formulas are as follows:

$$L_D = \frac{U_{KD} \cdot U_{LN}}{I_{DN} \cdot \sqrt{2} \cdot 2\pi \cdot f_N} [H]$$

$$L_D = \frac{U_{KD} \cdot U_{LN}}{I_{LN} \cdot \sqrt{3} \cdot 2\pi \cdot f_N} [H]$$

Table 4-22: Line inductors at 400 Vac

DRIVE	DRIVE RATED CURRENT	NOMINAL INDUCTANCE $U_{KD} = 2\%$	NOMINAL INDUCTANCE $U_{KD} = 4\%$	INDUCTOR RATED CURRENT
	[A]	[μH]	[μH]	[A]
Mains voltage 400 Vac, 3ph, 50 Hz				
TPD500-500-00020-...-A	20	900.3	See Table 4-25: Coded line inductors	17
TPD500-500-00040-...-A	40	450.2		34
TPD500-500-00070-...-A	70	257.2		60
TPD500-500-00110-...-A	110	163.7		95
TPD500-500-00140-...-A	140	128.6		121
TPD500-500-00185-...-A	184	97.3		159
TPD500-500-00280-...-B	280	64.3		241
TPD500-500-00350-...-B	350	51.4		301
TPD500-500-00420-...-B	420	42.9		362
TPD500-500-00500-...-B	500	36.0		431
TPD500-500-00650-...-B	650	27.7		560
TPD500-500-00770-...-C	770	23.4		663
TPD500-500-01000-...-C	1000	18.0		861
TPD500-500-01050-...-C	1050	17.1		904
TPD500-500-01200-...-E	1200	15.0	30.0	1033
TPD500-500-01500-...-E	1500	12.0	24.0	1292
TPD500-500-01700-...-E	1700	10.6	21.2	1464
TPD500-500-01800-...-E	1800	10.0	20.0	1550
TPD500-500-02000-...-E	2000	9.0	18.0	1722
TPD500-500-02400-...-E	2400	7.5	15.0	2066
TPD500-500-02700-...-E	2700	6.7	13.3	2325
TPD500-500-02900-...-E	2900	6.2	12.4	2497
TPD500-500-03300-...-E	3300	5.5	10.9	2841
Mains voltage 400 Vac, 3ph, 60 Hz				
TPD500-500-00020-...-A	20	750.3	1500.5	17
TPD500-500-00040-...-A	40	375.1	750.3	34
TPD500-500-00070-...-A	70	214.4	428.7	60
TPD500-500-00110-...-A	110	136.4	272.8	95
TPD500-500-00140-...-A	140	107.2	214.4	121
TPD500-500-00185-...-A	185	81.1	162.2	159
TPD500-500-00280-...-B	280	53.6	107.2	241
TPD500-500-00350-...-B	350	42.9	85.7	301
TPD500-500-00420-...-B	420	35.7	71.5	362
TPD500-500-00500-...-B	500	30.0	60.0	431
TPD500-500-00650-...-B	650	23.1	46.2	560
TPD500-500-00770-...-C	770	19.5	39.0	663
TPD500-500-01000-...-C	1000	15.0	30.0	861
TPD500-500-01050-...-C	1050	14.3	28.6	904

DRIVE	DRIVE RATED CURRENT	NOMINAL INDUCTANCE $U_{KD} = 2\%$	NOMINAL INDUCTANCE $U_{KD} = 4\%$	INDUCTOR RATED CURRENT
	[A]	[μH]	[μH]	[A]
TPD500-500-01200-...-E	1200	12.5	25.0	1033
TPD500-500-01500-...-E	1500	10.0	20.0	1292
TPD500-500-01700-...-E	1700	8.8	17.7	1464
TPD500-500-01800-...-E	1800	8.3	16.7	1550
TPD500-500-02000-...-E	2000	7.5	15.0	1722
TPD500-500-02400-...-E	2400	6.3	12.5	2066
TPD500-500-02700-...-E	2700	5.6	11.1	2325
TPD500-500-02900-...-E	2900	5.2	10.3	2497
TPD500-500-03300-...-E	3300	4.5	9.1	2841

Table 4-23: Line inductors at 500 Vac

DRIVE	DRIVE RATED CURRENT	NOMINAL INDUCTANCE $U_{KD} = 2\%$	NOMINAL INDUCTANCE $U_{KD} = 4\%$	INDUCTOR RATED CURRENT
	[A]	[μH]	[μH]	[A]
Mains voltage 500 Vac, 3ph, 50 Hz				
TPD500-500-00020-...-A	20	1125.4	2250.8	17
TPD500-500-00040-...-A	40	562.7	1125.4	34
TPD500-500-00070-...-A	70	321.5	643.1	60
TPD500-500-00110-...-A	110	204.6	409.2	95
TPD500-500-00140-...-A	140	160.8	321.5	121
TPD500-500-00185-...-A	184	121.7	243.3	159
TPD500-500-00280-...-B	280	80.4	160.8	241
TPD500-500-00350-...-B	350	64.3	128.6	301
TPD500-500-00420-...-B	420	53.6	107.2	362
TPD500-500-00500-...-B	500	45.0	90.0	431
TPD500-500-00650-...-B	650	34.6	69.3	560
TPD500-500-00770-...-C	770	29.2	58.5	663
TPD500-500-01000-...-C	1000	22.5	45.0	861
TPD500-500-01050-...-C	1050	21.4	42.9	904
TPD500-500-01200-...-E	1200	18.8	37.5	1033
TPD500-500-01500-...-E	1500	15.0	30.0	1292
TPD500-500-01700-...-E	1700	13.2	26.5	1464
TPD500-500-01800-...-E	1800	12.5	25.0	1550
TPD500-500-02000-...-E	2000	11.3	22.5	1722
TPD500-500-02400-...-E	2400	9.4	18.8	2066
TPD500-500-02700-...-E	2700	8.3	16.7	2325
TPD500-500-02900-...-E	2900	7.8	15.5	2497
TPD500-500-03300-...-E	3300	6.8	13.6	2841
Mains voltage 500 Vac, 3ph, 60 Hz				
TPD500-500-00020-...-A	20	937.8	1875.7	17
TPD500-500-00040-...-A	40	468.9	937.8	34
TPD500-500-00070-...-A	70	268.0	535.9	60
TPD500-500-00110-...-A	110	170.5	341.0	95
TPD500-500-00140-...-A	140	134.0	268.0	121
TPD500-500-00185-...-A	185	101.4	202.8	159
TPD500-500-00280-...-B	280	67.0	134.0	241
TPD500-500-00350-...-B	350	53.6	107.2	301
TPD500-500-00420-...-B	420	44.7	89.3	362
TPD500-500-00500-...-B	500	37.5	75.0	431
TPD500-500-00650-...-B	650	28.9	57.7	560
TPD500-500-00770-...-C	770	24.4	48.7	663
TPD500-500-01000-...-C	1000	18.8	37.5	861
TPD500-500-01050-...-C	1050	17.9	35.7	904
TPD500-500-01200-...-E	1200	15.6	31.3	1033
TPD500-500-01500-...-E	1500	12.5	25.0	1292
TPD500-500-01700-...-E	1700	11.0	22.1	1464
TPD500-500-01800-...-E	1800	10.4	20.8	1550
TPD500-500-02000-...-E	2000	9.4	18.8	1722
TPD500-500-02400-...-E	2400	7.8	15.6	2066

DRIVE	DRIVE RATED CURRENT	NOMINAL INDUCTANCE $U_{KD} = 2\%$	NOMINAL INDUCTANCE $U_{KD} = 4\%$	INDUCTOR RATED CURRENT
	[A]	[μH]	[μH]	[A]
TPD500-500-02700-...-E	2700	6.9	13.9	2325
TPD500-500-02900-...-E	2900	6.5	12.9	2497
TPD500-500-03300-...-E	3300	5.7	11.4	2841

Table 4-24: Line inductors at 690 Vac

DRIVE	DRIVE RATED CURRENT	NOMINAL INDUCTANCE $U_{KD} = 2\%$	NOMINAL INDUCTANCE $U_{KD} = 4\%$	INDUCTOR RATED CURRENT
	[A]	[μH]	[μH]	[A]
Mains voltage 690 Vac, 3ph, 50 Hz				
TPD500-690-00560-...-C	560	55.5	110.9	482
TPD500-690-00700-...-C	700	44.4	88.7	603
TPD500-690-00900-...-C	900	34.5	69.0	775
TPD500-690-01010-...-E	1010	30.8	61.5	870
TPD500-690-01400-...-E	1400	22.2	44.4	1205
TPD500-690-01700-...-E	1700	18.3	36.5	1464
TPD500-690-02000-...-E	2000	15.5	31.1	1722
TPD500-690-02400-...-E	2400	12.9	25.9	2066
TPD500-690-02700-...-E	2700	11.5	23.0	2325
TPD500-690-03300-...-E	3300	9.4	18.8	2841
Mains voltage 690 Vac, 3ph, 60 Hz				
TPD500-690-00560-...-C	560	46.2	92.4 (**)	482
TPD500-690-00700-...-C	700	37.0	74.0	603
TPD500-690-00900-...-C	900	28.8	57.5 (**)	775
TPD500-690-01010-...-E	1010	25.6	51.3	870
TPD500-690-01400-...-E	1400	18.5	37.0	1205
TPD500-690-01700-...-E	1700	15.2	30.5	1464
TPD500-690-02000-...-E	2000	12.9	25.9	1722
TPD500-690-02400-...-E	2400	10.8	21.6	2066
TPD500-690-02700-...-E	2700	9.6	19.2	2325
TPD500-690-03300-...-E	3300	7.8	15.7	2841

NOTE!

Tables 4-20, 4-21, and 4-22 generally list only the electrical data of the line inductors without any product codes. Please contact our sales network directly for ordering information.

Table 4-25: Coded line inductors

DRIVE	THREE-PHASE MAINS INDUCTANCE									
	RATED INDUCTANCE	RATED CURRENT	SATURATION CURRENT	FREQUENCY	DISSIPATED POWER @ 50 Hz	DISSIPATED POWER @ 60 Hz	INDUCTANCE TYPE	CODE	DIMENSIONS [w x h x d]	WEIGHT
	[mH]	[A]	[A]	[Hz]	[W]	[W]			[mm]	[kg]
Mains voltage 400-460 V, 3ph, 50 Hz										
TPD500-...-00020-...-A	1.62	22	42	50	68	74	LR3-011	S7FF6	180 x 183 x 125	8
TPD500-...-00040-...-A	0.68	41	61	50	95	104	LR3-41-61-0.68	S7D03	180 x 165 x 160	10
TPD500-...-00070-...-A	0.45	61	91	50	109	121	LR3-61-91-0.45	S7D04	180 x 165 x 185	15
TPD500-...-00110-...-A	0.3	90	135	50	142	157	LR3-90-135-0.30	S7D05	180 x 165 x 185	14
TPD500-...-00140-...-A	0.26	107	160	50	125	143	LR3-107-160-0.26	S7D06	180 x 165 x 190	15
TPD500-...-00185-...-A	0.17	163	244	50	202	214	LR3-163-244-0.17	S7D07	240 x 216 x 240	27
TPD500-...-00280-...-B	0.11	253	380	50	239	257	LR3-253-380-0.11	S7D09	300 x 265 x 230	34
TPD500-...-00350-...-B	0.1	287	430	50	268	288	LR3-287-430-0.1	S7D10	300 x 265 x 250	40
TPD500-...-00420-...-B	0.076	368	552	50	278	305	LR3-368-552-0.076	S7D11	300 x 270 x 280	47
TPD500-...-00500-...-B	0.06	458	687	50	347	373	LR3-458-687-0.06	S7D12	300 x 265 x 320	56
TPD500-...-00650-...-B	0.05	605	910	50	470	517	LR3-605-910-0.05	S7D27	380 x 415 x 220	78
TPD500-...-00770-...-C	0.04	685	1027	50	533	573	LR3-685-1027-0.04	S7D14	386 x 410 x 270	77

DRIVE	THREE-PHASE MAINS INDUCTANCE									
	RATED INDUCTANCE	RATED CURRENT	SATURATION CURRENT	FREQUENCY	DISSIPATED POWER @ 50 Hz	DISSIPATED POWER @ 60 Hz	INDUCTANCE TYPE	CODE	DIMENSIONS [W x H x d]	WEIGHT
	[mH]	[A]	[A]	[Hz]	[W]	[W]			[mm]	[kg]
TPD500-...-01000-...-C	0.03	869	1303	50	560	625	LR3-869-1303-0.03	S7D15	420 x 495 x 270	110
TPD500-...-01050-...-C	0.03	869	1303	50	560	625	LR3-869-1303-0.03	S7D15	420 x 495 x 270	110

To calculate the value of the line inductor for the field circuit, the following simplified formula is used, providing a value that should be evenly divided between the two supply phases.

The following table shows the inductance values for the nominal sizes of the field circuit.

The current for thermal sizing is given by $I_{FN} \cdot ff$.

$$L_{DF} = \frac{U_{KD} \cdot U_{LN}}{I_{FN} \cdot ff \cdot 2\pi \cdot f_N} [H]$$

Where:

- U_{KD} is the relative voltage drop (typically 2% or 4%)
- U_{LN} is the supply voltage
- I_{FN} is the field circuit current
- ff is the form factor, typically 1.2
- f_N is the supply frequency

The resulting value is the total inductance, which must be evenly divided between the two supply phases.

Table 4-26: Line inductors for the field circuit

FRAME	SIZES	RATED FIELD CURRENT	POWER SUPPLY VOLTAGE 400 Vac				POWER SUPPLY VOLTAGE Vac			
			FIELD POWER FREQUENCY							
			50 Hz		60 Hz		50 Hz		60 Hz	
			U _{KD} 2%	U _{KD} 4%	U _{KD} 2%	U _{KD} 4%	U _{KD} 2%	U _{KD} 4%	U _{KD} 2%	U _{KD} 4%
			L [mH]				L [mH]			
A	20	6.25	3.395	6.791	2.830	5.659	4.244	8.489	3.537	7.074
A	40 - 70	8.33	2.548	5.095	2.123	4.246	3.184	6.369	2.654	5.307
A	110 ... 185	12.5	1.698	3.395	1.415	2.830	2.122	4.244	1.768	3.537
B	ALL	20	1.061	2.122	0.884	1.768	1.326	2.653	1.105	2.211
C	ALL	25	0.849	1.698	0.707	1.415	1.061	2.122	0.884	1.768

4.12.2 EMI filters

TPD500 series drives must be equipped with an external EMI filter to limit radio frequency emissions to the mains supply. The choice of filter depends on the drive size and the characteristics of the installation environment.

Refer to the **Electromagnetic Compatibility Guide** (code 1S5E84), which provides installation standards for the electrical cabinet (filter wiring, line inductors, cable shielding, grounding connections, etc.) required to ensure EMC compliance according to Directive 2014/30/EU.

The document also outlines the regulatory framework for electromagnetic compatibility and describes the compliance tests carried out on WEG Automation Europe equipment.

Table 4-27: EMI filters

DRIVE	FILTER TYPE	CODE	DIMENSIONS W x H x d [mm]	WEIGHT [kg]	CATEGORY/ ENVIRONMENT/ MOTOR CABLE LENGTH (max)	DISSIPATED POWER @ 25 °C / 50 Hz [W]
Mains voltage 230-400 Vac ± 10%						
TPD500-500-00020-xB-A	EMI-FTF-480-42	S7GOA	310x50x85	1.3	C3/2"/30 m	18

DRIVE	FILTER TYPE	CODE	DIMENSIONS W x H x d [mm]	WEIGHT [kg]	CATEGORY/ ENVIRONMENT/ MOTOR CABLE LENGTH (max)	DISSIPATED POWER @ 25 °C / 50 Hz [W]
TPD500-500-00040-xB-A	EMI-FTF-480-42	S7GOA	310x50x85	1.3	C3/2°/30 m	18
TPD500-500-00070-xB-A	EMI-FTF-480-75	S7GOC	270x80x135	2.6	C3/2°/30 m	26
TPD500-500-00110-xB-A	EMI-FTF-480-100	S7GOD	270x90x150	3	C3/2°/30 m	30
TPD500-500-00140-xB-A	EMI-FTF-480-130	S7GOE	270x90x150	3.6	C3/2°/30 m	38
TPD500-500-00185-xB-A	EMI-FTF-480-130	S7GOE	270x90x150	3.6	C3/2°/30 m	38
TPD500-500-00280-xB-B	EMI-480-320	S7DGH	300x260x135	13.2	C3/2°/100 m	40
TPD500-500-00350-xB-B	EMI-480-400	S7DGI	300x260x135	13.2	C3/2°/100 m	50
TPD500-500-00420-xB-B	EMI-480-400	S7DGI	300x260x135	13.2	C3/2°/100 m	50
TPD500-500-00500-xB-B	EMI-480-600	S7DGL	300x260x135	13.6	C3/2°/100 m	65
TPD500-500-00650-xB-B	EMI-480-600	S7DGL	300x260x135	13.6	C3/2°/100 m	65
TPD500-500-00770-xB-C	EMI-480-800	S7DGM	350x280x150	23.7	C3/2°/100 m	80
TPD500-500-01000-xB-C	EMI-480-1000	S7DGN	350x280x150	24	C3/2°/100 m	91
TPD500-500-01200-xB-E	EMI-690-1600	S7DGK	300x260x140	24.5	C3/2°/100 m	328
TPD500-500-01500-xB-E	EMI-690-1600	S7DGK	300x260x140	24.5	C3/2°/100 m	328
TPD500-500-01800-xB-E	EMI- FN-3359-480-2500	S7EMI5	450x370x200	69	C3/2°/100 m	300
TPD500-500-02000-xB-E	EMI- FN-3359-480-2500	S7EMI5	450x370x200	69	C3/2°/100 m	300
TPD500-500-02400-xB-E	EMI- FN-3359-480-2500	S7EMI5	450x370x200	69	C3/2°/100 m	300
TPD500-500-02700-xB-E	EMI- FN-3359-480-2500	S7EMI5	450x370x200	69	C3/2°/100 m	300
TPD500-500-02900-xB-E	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
TPD500-500-03300-xB-E	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Mains voltage 480 Vac ± 10%						
TPD500-500-00020-xB-A	EMI-FTF-480-42	S7GOA	310x50x85	1.3	C3/2°/30 m	18
TPD500-500-00040-xB-A	EMI-FTF-480-42	S7GOA	310x50x85	1.3	C3/2°/30 m	18
TPD500-500-00070-xB-A	EMI-FTF-480-75	S7GOC	270x80x135	2.6	C3/2°/30 m	26
TPD500-500-00110-xB-A	EMI-FTF-480-100	S7GOD	270x90x150	3	C3/2°/30 m	30
TPD500-500-00140-xB-A	EMI-FTF-480-130	S7GOE	270x90x150	3.6	C3/2°/30 m	38
TPD500-500-00185-xB-A	EMI-FTF-480-130	S7GOE	270x90x150	3.6	C3/2°/30 m	38
TPD500-500-00280-xB-B	EMI-480-320	S7DGH	300x260x135	13.2	C3/2°/100 m	40
TPD500-500-00350-xB-B	EMI-480-400	S7DGI	300x260x135	13.2	C3/2°/100 m	50
TPD500-500-00420-xB-B	EMI-480-400	S7DGI	300x260x135	13.2	C3/2°/100 m	50
TPD500-500-00500-xB-B	EMI-480-600	S7DGL	300x260x135	13.6	C3/2°/100 m	65
TPD500-500-00650-xB-B	EMI-480-800	S7DGM	350x280x150	23.7	C3/2°/100 m	80
TPD500-500-00770-xB-C	EMI-480-800	S7DGM	350x280x150	23.7	C3/2°/100 m	80
TPD500-500-01000-xB-C	EMI-480-1000	S7DGN	350x280x150	24	C3/2°/100 m	91
TPD500-500-01200-xB-E	EMI-690-1600	S7DGK	300x260x140	24.5	C3/2°/100 m	328
TPD500-500-01500-xB-E	EMI-690-1600	S7DGK	300x260x140	24.5	C3/2°/100 m	328
TPD500-500-01800-xB-E	EMI- FN-3359-480-2500	S7EMI5	450x370x200	69	C3/2°/100 m	300
TPD500-500-02000-xB-E	EMI- FN-3359-480-2500	S7EMI5	450x370x200	69	C3/2°/100 m	300
TPD500-500-02400-xB-E	EMI- FN-3359-480-2500	S7EMI5	450x370x200	69	C3/2°/100 m	300
TPD500-500-02700-xB-E	EMI- FN-3359-480-2500	S7EMI5	450x370x200	69	C3/2°/100 m	300
TPD500-500-02900-xB-E	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
TPD500-500-03300-xB-E	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Mains voltage 500 Vac ± 10%						
TPD500-500-00020-xB-A	EMI-FTF-480-42	S7GOA	310x50x85	1.3	C3/2°/30 m	18
TPD500-500-00040-xB-A	EMI-FTF-480-42	S7GOA	310x50x85	1.3	C3/2°/30 m	18
TPD500-500-00070-xB-A	EMI-FTF-480-75	S7GOC	270x80x135	2.6	C3/2°/30 m	26
TPD500-500-00110-xB-A	EMI-FTF-480-100	S7GOD	270x90x150	3	C3/2°/30 m	30
TPD500-500-00140-xB-A	EMI-FTF-480-130	S7GOE	270x90x150	3.6	C3/2°/30 m	38
TPD500-500-00185-xB-A	EMI-FTF-480-130	S7GOE	270x90x150	3.6	C3/2°/30 m	38
TPD500-500-00280-xB-B	EMI-480-320	S7DGH	300x260x135	13.2	C3/2°/100 m	40

DRIVE	FILTER TYPE	CODE	DIMENSIONS W x H x d [mm]	WEIGHT [kg]	CATEGORY/ ENVIRONMENT/ MOTOR CABLE LENGTH (max)	DISSIPATED POWER @ 25 °C / 50 Hz [W]
TPD500-500-00350-xB-B	EMI-480-400	S7DGI	300x260x135	13.2	C3/2°/100 m	50
TPD500-500-00420-xB-B	EMI-480-400	S7DGI	300x260x135	13.2	C3/2°/100 m	50
TPD500-500-00500-xB-B	EMI-480-600	S7DGL	300x260x135	13.6	C3/2°/100 m	65
TPD500-500-00650-xB-B	EMI-480-800	S7DGM	350x280x150	23.7	C3/2°/100 m	80
TPD500-500-00770-xB-C	EMI-480-800	S7DGM	350x280x150	23.7	C3/2°/100 m	80
TPD500-500-01000-xB-C	EMI-480-1000	S7DGN	350x280x150	24	C3/2°/100 m	91
TPD500-500-01200-xB-E	EMI-690-1600	S7DGK	300x260x140	24.5	C3/2°/100 m	328
TPD500-500-01500-xB-E	EMI-690-1600	S7DGK	300x260x140	24.5	C3/2°/100 m	328
TPD500-500-01800-xB-E	Schaffner FN 3359HV- 2500-99 (or TDK-EPCOS B84143B2500S024)	-	450x370x200 (650x320x221.5)	69 (142)	C3/2°/100 m	300 (547)
TPD500-500-02000-xB-E						
TPD500-500-02400-xB-E						
TPD500-500-02700-xB-E						
TPD500-500-02900-xB-E	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
TPD500-500-03300-xB-E	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Mains voltage 690 Vac ± 10%						
TPD500-690-00560-xB-C	EMI-690-600	S7DGS	230x190x116	7.8	C3/2°/100 m	79
TPD500-690-00700-xB-C	EMI-690-1600	S7DGK	300x260x140	24.5	C3/2°/100 m	328
TPD500-690-00900-xB-C	EMI-690-1600	S7DGK	300x260x140	24.5	C3/2°/100 m	328
TPD500-690-01010-xB-E	EMI-690-1600	S7DGK	300x260x140	24.5	C3/2°/100 m	328
TPD500-690-01400-xB-E	EMI-690-1600	S7DGK	300x260x140	24.5	C3/2°/100 m	328
TPD500-690-01700-xB-E	TDK-EPCOS B84143B2500S021	-	650x385x221.5	142	C3/2°/100 m	328
TPD500-690-02000-xB-E						
TPD500-690-02400-xB-E						
TPD500-690-02700-xB-E						
TPD500-690-03300-xB-E	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

4.12.3 Mains harmonic currents generated by drives

The following information refers to the harmonic currents generated by AC/DC drives using SCRs in a fully controlled three-phase bridge (6-pulse configuration).

Due to their nonlinear load characteristics, SCR-based AC/DC drives draw non-sinusoidal currents from the mains supply, thus generating harmonic currents.

The exact harmonic current values in a given installation depend on several factors, including the specific system configuration and the drive's operating point. Further details can be found in standards EN 61800-3, IEC 146-1-2, and EN 61800-1.

The table below shows typical harmonic current values, expressed as a percentage of the fundamental current (I_1), for reference purposes only.

Table 4-28: Typical values of harmonic currents

HARMONIC ORDER [h]	I_h / I_1 [%]
5	24 ... 28
7	5 ... 10
11	8 ... 9
13	4 ... 6
17	4,5 ... 5
19	3 ... 3.5

5. TPD500 CONTROL UNIT

5.1 General description

The **TPD500-CU** is an electronic control unit designed to be used with one or more six-pulses power bridge SCR AC/DC converters both two or four quadrants. It is supplied as a stand-alone unit for systems that already have a power bridge. The control unit regulates the armature voltage and current, generates SCR gate command signals and also contains a 40 A or 70 A field power supply circuit. It is suitable for power bridges connected to a 230 Vac to 690 Vac 50/60 Hz three-phase voltage supply. It interfaces directly with the three-phase power line, armature voltage and armature current; the latter shall be measured by two current transducers that must be included on the power bridge. It covers armature currents ranging from 4 Adc to 20,000 Adc.

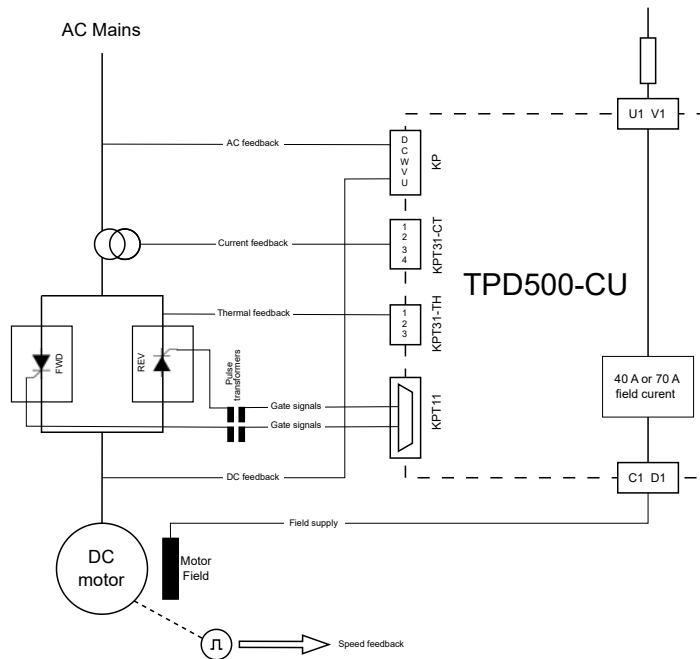


Figure 5-1: Typical single-wire connection diagram

5.2 Connection cables supplied

All the models listed above are supplied with three cables for connection to the power bridge in standard situations. However, additional cables may be necessary in certain conditions. These are described below. The scheme, the flow chart and tables below will help you decide which control unit is the best for your particular application and whether you need any additional cables.

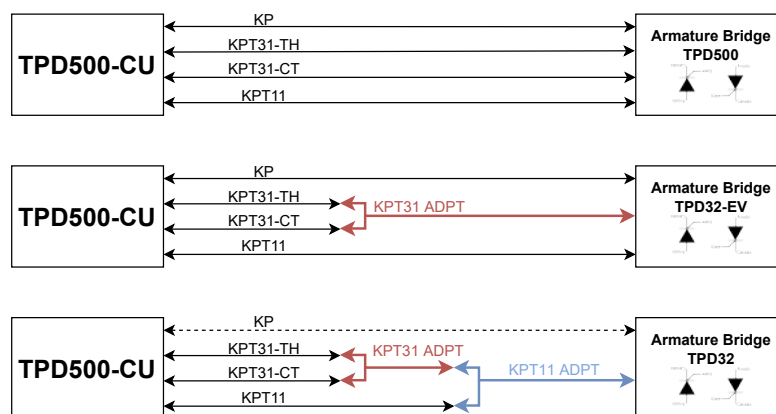


Figure 5-2: Connection cables for TPD500-CU

NOTE!

If it is necessary to use a TPD500-CU with an armature bridge originally designed for the previous TPD32 family, the KP connection must be modified. Since no adapter is available, please contact technohelp@weg.net for support.

Table 5-1: Connection cables for TPD500-CU

Name	Description	Supplied as standard	Code
KP Connector Interface	Cable, 5-pin, AWG14, total length 2.5 m, sheathing for 1.5 m. Link between mains voltage and armature voltage. KP connector.	Yes	S72762
KPT31-CT Connector Interface	Cable, 2 twisted pairs, 4-pin, AWG18, tot. length 2.5 m, sheathing for 1.5 m. Link between current sensors (CT). KPT31-CT connector.	Yes	S727632
KPT31-TH Connector Interface	Cable, 1 twisted pairs, 3-pin, AWG18, tot. length 2.5 m, sheathing for 1.5 m. Link with thermal contact on power bridge(s). KPT31-TH connector.	Yes	S727633
KPT11 Connector Interface	Cable, 10-pin, AWG22, tot. length 2.5 m, sheathing for 1.5 m. Link between pulse transformers. KPT11 15-pin D connector.	Yes	S72764
KPT11 Connector Adapter	Y cable, to connect a new TPD500-CU control unit to a native armature bridge with a TPD32-CU.	Upon request	S72761
KPT31 Connector Adapter to CT/TH	Y cable, to connect a new TPD500-CU control unit to a native armature bridge with a TPD32-EV-CU.	Upon request	S727611

5.3 Choosing the right model for your application

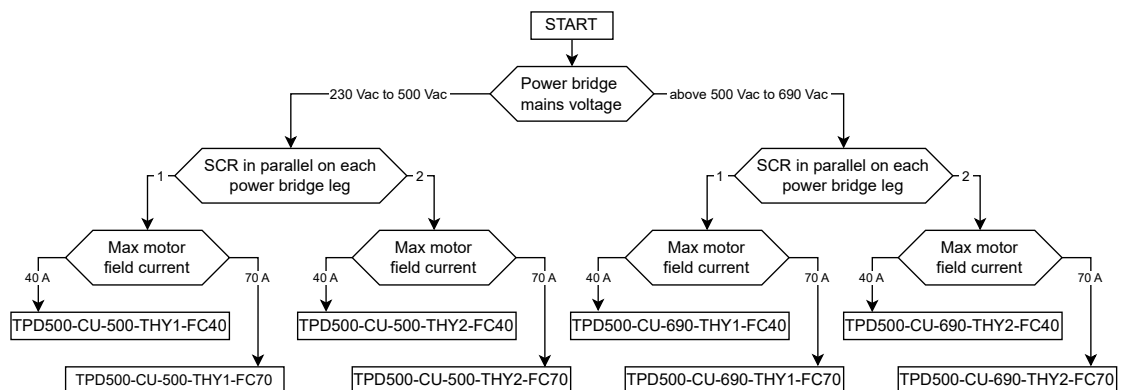


Figure 5-3: TPD500-CU selection

The flow chart illustrates the choice of unit, based on the rated supply voltage, the need to control pulse transformers with one or two secondary windings and the maximum field current requested.

There is no need to make a distinction between two or four-quadrant drives; this is done by configuring jumper S1 on the FIRSXP-XX power card. ON=4Q (default), OFF=2Q (see **Figure 5-3: TPD500-CU selection**).

The control unit is capable of controlling SCR power bridges with four possible configurations, which must also be taken into account when choosing the appropriate CU with the relative connection cables and pulse transformers. These four possible configurations, referring to two-quadrant bridges, are illustrated below (the same choices apply to four-quadrant bridges). Likewise, the mains voltage and max. field current are not considered.

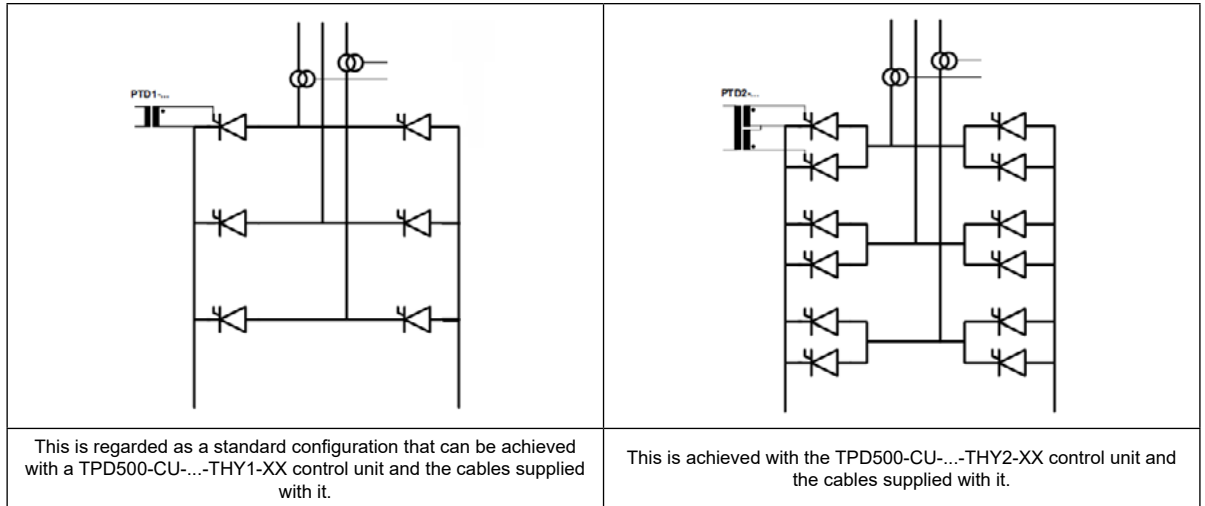


Figure 5-4: Configuration 1 - Single bridge with 1 SCR per branch

Figure 5-5: Configuration 2 - 1 single bridge with 1 SCR per branch in parallel

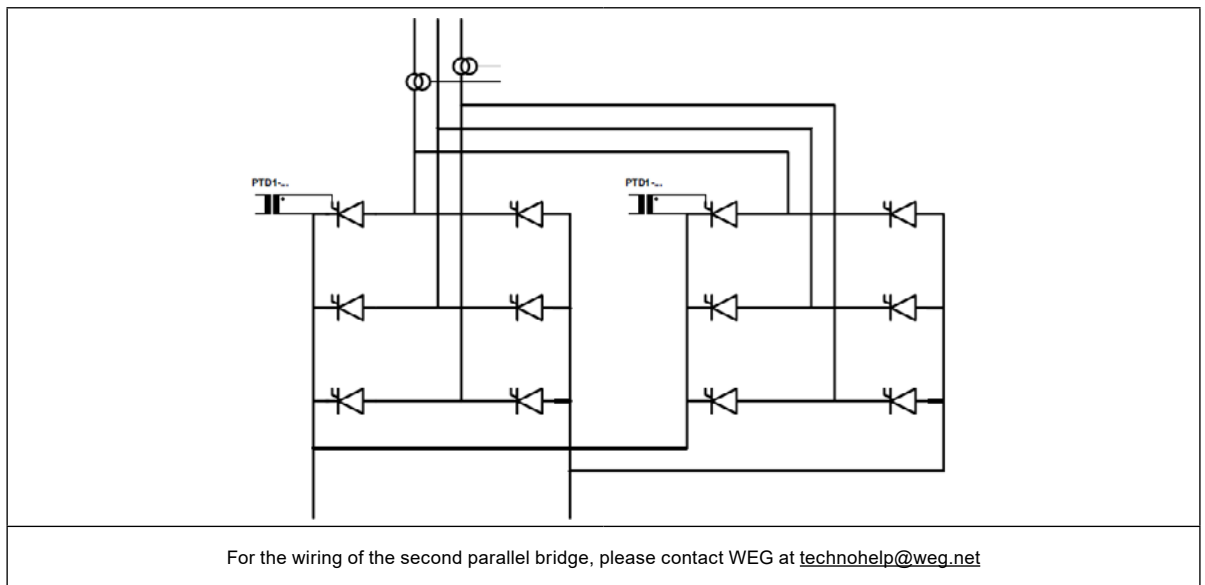


Figure 5-6: Configuration 3 - 2 single bridges with 1 SCR per branch in parallel

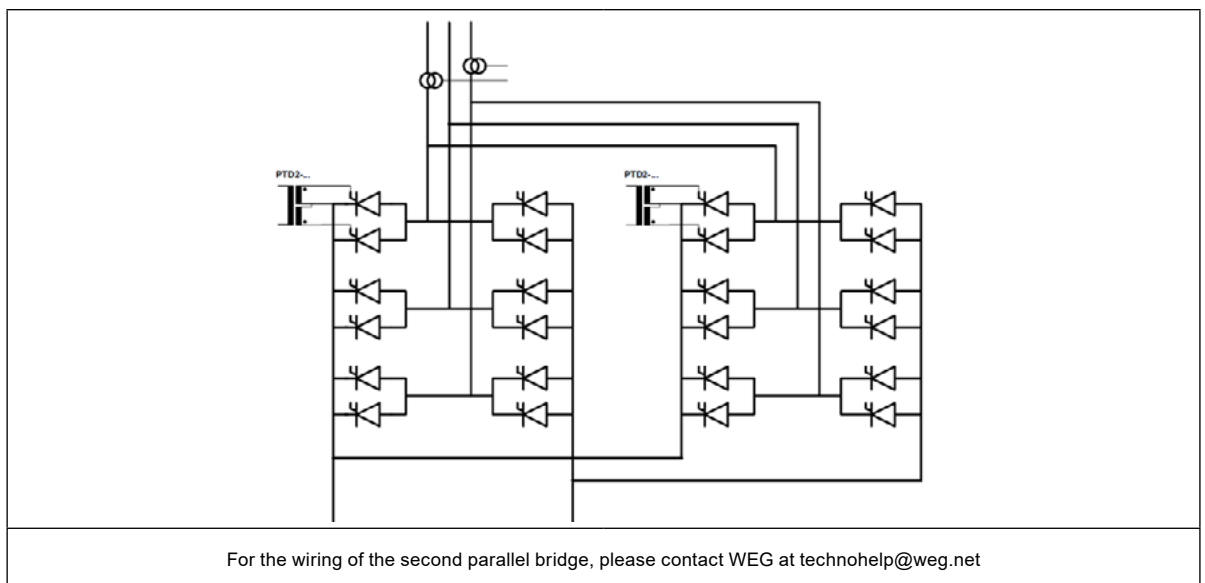


Figure 5-7: Configuration 4 - 2 single bridges with 2 SCRs per branch in parallel

The table below lists all the cables required for the scenario in question.

Table 5-2: TPD500-CU cables

Type	Power bridge(s)			
	Single bridge with 1 SCR per branch	Single bridge with 2 SCRs per branch in parallel	2 single bridges with 1 SCR per branch in parallel	2 single bridges with 2 SCRs per branch in parallel
TPD500-CU-...-THY1-XX	TPD500-CU-...-THY1-XX	TPD500-CU-...-THY2-XX	TPD500-CU-...-THY1-XX	TPD500-CU-...-THY2-XX
3 Standard cables	Yes	Yes	Yes	Yes
Additional cables	No	No	For the wiring of the second parallel bridge, please contact WEG.	For the wiring of the second parallel bridge, please contact WEG.
Pulse transformers (upon request)	Use the PTD1, PTD1-1, or PTD1-1K pulse transformer, depending on the supply voltage.	Use the PTD2, PTD2-1, or PTD2-1K pulse transformer, depending on the supply voltage.	Use the PTD1, PTD1-1, or PTD1-1K pulse transformer, depending on the supply voltage.	Use the PTD2, PTD2-1, or PTD2-1K pulse transformer, depending on the supply voltage.
State of S2 [*]	Closed (default)	Closed (default)	Cut	Cut

[*] If the Control Unit drives 2 single bridges, open jumper S2 on the FIRS4/5P-XX card to correctly read the thermal protector on the second bridge to be connected to terminals 2 and 3 of connector KPT31.

NOTE!

Considering terminal KPT31-TH, if the NC thermal contact (bimetal thermostat) connected between terminals 1 and 2 is not used, these must be jumpered. Terminal 3 is already jumpered internally with terminal 2 via jumper S2 on the FIRSXP-XX power card, as standard.

5.4 Pulse transformers

Pulse transformers with the following characteristics are available upon request.

Table 5-3: Pulse transformer characteristics

PULSE TRANSFORMERS	Electrical diagram	Code	Rated working voltage	Imax secondary winding		Transformation ratio (P:S:S)
			[Vrms]	[A]	[Arms]	
PTD1	ESE5948-1	S5C370	500	1.2 Peak	0.75	3 : 1
PTD2	ESE5948-2	S5C371	500		0.5	3 : 1 : 1
PTD1-1	ESE5948-3	S5C372	750		0.75	3 : 1
PTD2-1	ESE5948-4	S5C373	750		0.5	3 : 1 : 1
PTD1-1K	ESE5948-5	S5C374	1000		0.75	3 : 1
PTD2-1K	ESE5948-6	S5C375	1000		0.5	3 : 1 : 1

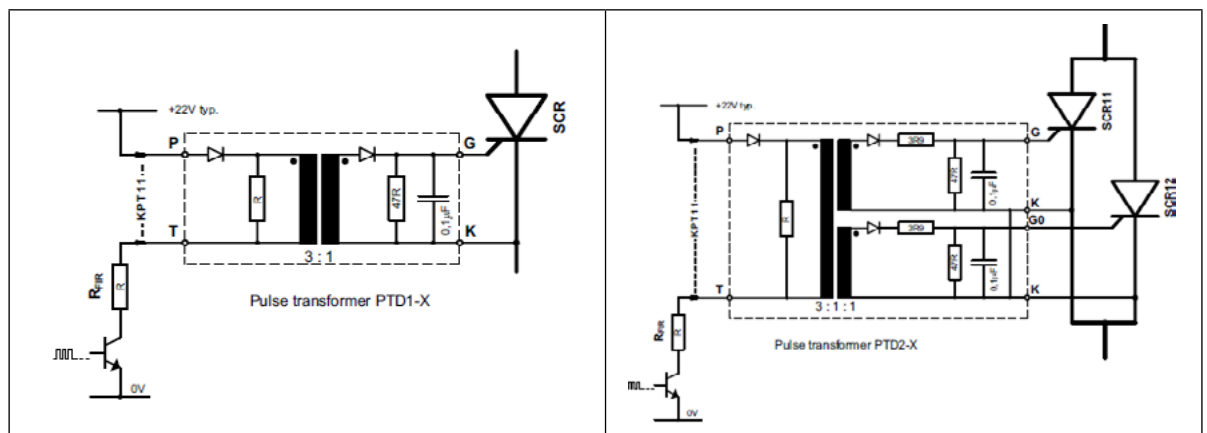


Figure 5-8: Typical connection for PTDX-X transformers

5.5 Current transducers (CT or TA)

The armature current of the motor is measured by two AC current transducers inserted on the line side of the power bridge; see, for example, **Figure 5-10: TPD500-CU typical connection**.

Transducers with different primary/secondary current ratios are available on the market and can be used with the TPD500-CU. The TPD500 series uses a CT with standard current values of 0.4 A or 0.5 A on the secondary winding. We recommend the use of current transducers with a secondary current of not more than 1 A.

Some of the current transducers available upon request are listed below with the relative technical data.

Table 5-4: Current transducers characteristics

Code	Type	Rated voltage and frequency	Winding ratio	Rated primary current	Rated secondary current	Rated power	IdN	Maximum bar opening	Measurement accuracy class
		Vrms/Hz		A	A	VA		mm/["]	
S7H22	TAS2-1600A/0.4A	690 40 ... 60	1:4000	1600	0.4	≤ 30	≤ 1800	60 x 15 [2.36 x 0.59]	1
S7H23	TAS2-2400A/0.5A	690 40 ... 60	1:4800	2400	0.5	≤ 30	≤ 2700	60 x 15 [2.36 x 0.59]	1
S7H16	TAS3-2400A/0.5A 1300 Vac	1300 40 ... 60	1:4800	2400	0.5	15	≤ 2700	127 x 51 [5 x 2]	0.5
S7H30	TAS3-4000A/0.5A 1300 Vac	1300 40 ... 60	1:8000	4000	0.5	15	≤ 4500	127 x 51 [5 x 2]	0.5
S7E73	TAS3-5000A/0.4A 1300 Vac	1300 40 ... 60	1:12500	5000	0.4	15	≤ 5600	127 x 51 [5 x 2]	0.5
S7E74	TAS3-6000A/0.5A 1300 Vac	1300 40 ... 60	1:12000	6000	0.5	15	≤ 6700	127 x 51 [5 x 2]	0.5

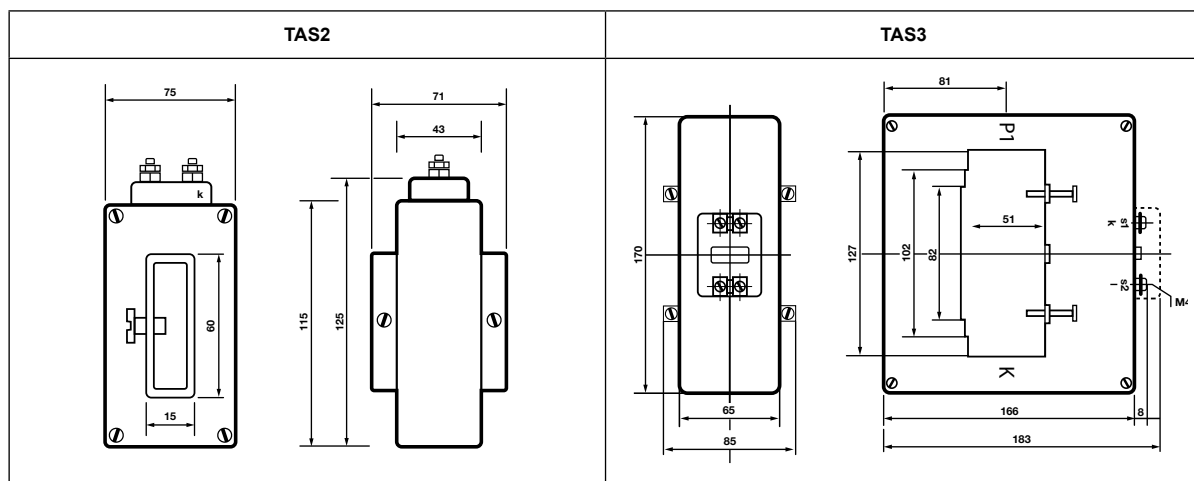


Figure 5-9: TA mechanical dimensions

5.6 Installation, connection and configuration

5.6.1 Installation

See **Chapter 3 - TRANSPORT, UNPACKING AND INSTALLATION**.

5.6.2 Electrical connections

The block diagram below shows the typical connection of a CU with a 4Q SCR bridge. Parts shown in blue are NOT part of the TPD500-CU.

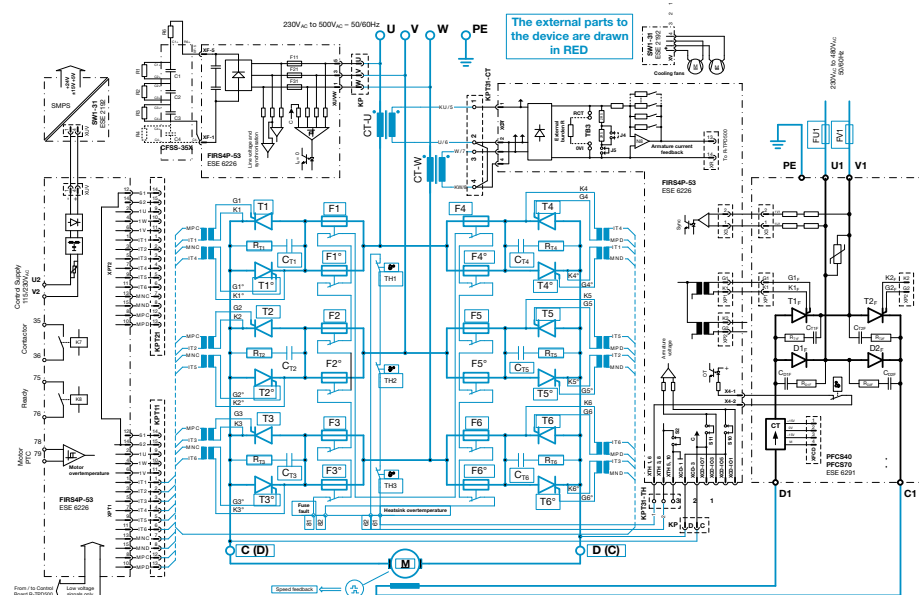


Figure 5-10: TPD500-CU typical connection

5.6.2.1 Field circuit and ground connection

The unit contains a semi-controlled single-phase motor field power supply circuit. As shown, the input and output connections are in the lower part.

We recommend the use of an adapter transformer for the input power supply to terminals U1-V1. The fuses listed in the table are mandatory.

Use dip-switches S14 on the regulation card to set the field current full scale value, see **Table 2-14: Field current resistors sizes TPD500-CU-...-FC40** and **Table 2-15: Field current resistors sizes TPD500-CU-...-FC70**.

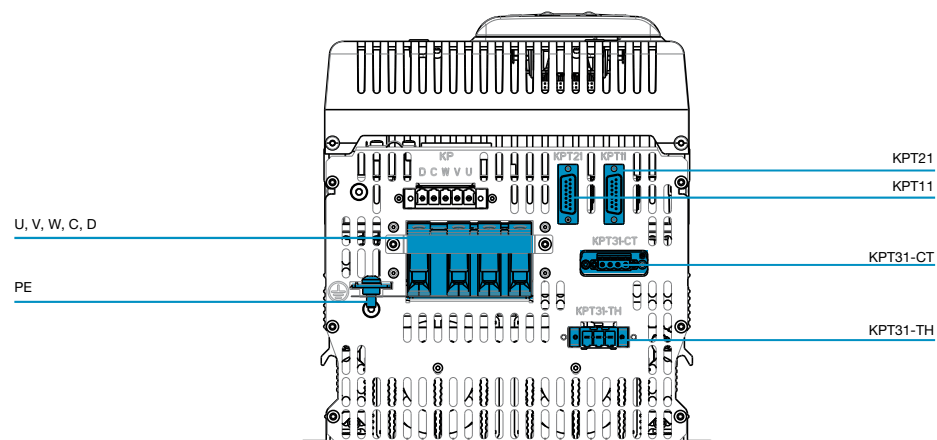


Figure 5-11: Position of terminals

Table 5-5: Cable cross-sections and tightening torque

Terminal	Function	Min. cable cross-section	Max. cable cross section	Tightening torque
U1, V1	AC power input	6 mm ² (10 AWG UL)	35 mm ² (2 AWG UL)	4 ... 4.5 Nm
C1, D1	Motor field DC power output			
PE	Protective earth	6 mm ² (10 AWG)	16 mm ² (6 AWG)	5 ... 5 Nm

The protective earth PE connector must be connected to the system's ground circuit according to the laws in force.

5.6.2.2 Interface with three-phase power supply (mains) and motor armature voltage

The CU requires a mains voltage and armature voltage feedback from the controlled power bridge. It is connected to terminals U V W and C D, respectively, of the KP connector. As mentioned previously, the CU is supplied with a specific cable already fitted with the relative KP connector at the CU end and free conductors at the other end ("KP connector interface cable for TPD500-CU", EAM2762).

Table 5-6: Interface and motor armature voltage

Terminal	Function	Cable cross-section			Tightening torque
		Minimum	Maximum	Reccomended	
U, V, W	Mains voltage feedback	0.2 mm ² (24 AWG)	6 mm ² (10AWG)	2.5 mm ² (14 ... 12 AWG)	0.7 ... 0.8 Nm
C, D	Armature voltage feedback				

5.6.2.3 Connection of current transducers and thermal switch(es)

The secondary windings of the two AC current transducers and any thermal circuit breakers (bimetal thermostats) on the power bridges are connected to the KPT31-CT and KPT31-TH connectors respectively. A specific cable already fitted with the relative KPT31-CT and KPT31-TH connectors at the CU end and free conductors at the other end is supplied.

Table 5-7: Current transducers and thermal switch(es)

Connector	Terminal	Function	Cable cross-section			Tightening torque	Reference drawing
			Minimum	Maximum	Reccomended		
KPT31-TH	1, 2, 3	Thermal switches connection	0.2 mm ² (24 AWG)	6 mm ² (10 AWG)	1 mm ² (18 AWG)	0.7 ... 0.8 Nm	EAM2763-3
KPT31-CT	1, 2, 3, 4	Current transducers connection	0.25 mm ² (24 AWG)	2.5 mm ² (12 AWG)		0.5 ... 0.6 Nm	EAM2763-2

NOTE!

Considering KPT31-TH connection, if the NC thermal contact (bimetal thermostat) connected between terminals 1 and 2 is not used, these must be jumpered.

Terminal 3 is already jumpered internally with terminal 2 via jumper S2 on the FIRSXP-XX power card, as standard. It is used only when a second parallel bridge is connected and its thermal pad needs to be monitored. In this case, the S2 jumper on the FIRSXP-XX board must be cut.

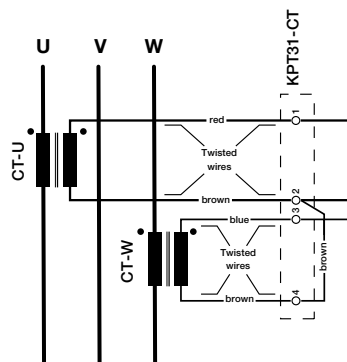


Figure 5-12: Detail of connection of current transducers

5.6.2.4 Connection of pulse transformers

The primary circuits of the pulse transformers are connected to connector KPT11 (and KPT21, where applicable) for switching the SCRs on. A specific cable already fitted with the relative KPT11 connector at the CU end and free conductors at the other end is supplied ("KP11 connector interface cable for TPD500-CU", EAM2764). For details of wiring, see ESE5771 showing the connection of a 4Q bridge (reversible). With a 2Q bridge, the two conductors labelled "MN" are not used. Their free end must therefore not be connected but electrically isolated.

5.6.2.5 Regulation power supply

As for the entire TPD500 series, the regulation power supply is connected to terminals U2-V2 on the FIRSXP-XX power card. To access this, remove the plastic cover at the bottom. This card also contains terminals 35-36, 75-76 and 78-79 which have the same function on all units in the TPD500 series and have already been described in chapter "[4.4 Control and regulation section](#)".

Table 5-8: Cable cross-sections and tightening torque

Connector	Terminal	Function	Min. cable cross-section	Max. cable cross-section	Tightening torque
TB1	U2, V2	Regulation power supply	0.25 mm ² (24 AWG)	2.5 mm ² (12 AWG)	0.5 ... 0.6 Nm
	35, 36	Contact OK Relay			
	75, 76	Relay 2 contact			
TB2	78, 79	Motor thermistor			

5.6.2.6 Electrical data for all of the terminals and connector listed

Table 5-9: Electrical data of terminals and connectors

Connector	Terminal	Function	IN/OUT	Voltage	Current
-	U1, V1	Motor field circuit AC power input	IN	1 x 230 ... 460 Aac, 50/60Hz	40 / 70 Aac
	C1, D1	Motor field DC power output	OUT	0 ... 360 Vdc	40 / 70 Adc
KP	U, V, W	Mains voltage feedback	IN	3 x 230 ... 690 Aac, 50/60Hz	200 mA
	C, D	Armature voltage feedback	IN	0 ... 810 Vdc	10 mA
KPT31-TH	1, 2, 3	Thermal switches connection	IN	-	4 mA
KPT31-CT	1, 2, 3, 4	Current transducers connection	IN	-	0 ... 5 Aac
KPT11, KPT21	15 poli Sub-D	Pulse transformer primary winding side circuits	OUT	-	1 A peak
TB1	U2, V2	Regulation power supply	IN	1 x 115/230 Aac, 50/60Hz	1 / 0.5 Aac
	35, 36	Contact OK Relay	OUT	250 Aac max	1 A AC11
	75, 76	Relay 2 contact	OUT	250 Aac max	1 A AC11
TB2	78, 79	Motor thermistor	IN	-	-
XCT	0VI, 0VI, RCT, RCT	Connection of external CT burden resistor with secondary current of >1 Aac (see "5.6.3 Configuration of the armature current feedback circuit")	OUT	-	5 A max

5.6.2.7 Dissipated power

See chapter "[Table 2-40: Power dissipation - TPD500-CU Series](#)".

5.6.2.8 Regulation and control section

General information is provided in chapter "[4.4 Control and regulation section](#)".

- Dip-switch S14, see "[Table 4-6: Dip-switch S4 - Tachogenerator feedback input voltage adjustment](#)".
- Dip-switch S15, see "[Table 4-7: Dip-switch S15 - Factory setting of the drive size](#)".

5.6.3 Configuration of the armature current feedback circuit

5.6.3.1 Overview

The current feedback signal is sent to the control unit by two current transducers (CT) inserted on phases U and W of the controlled power bridge. It is rectified on the FIRSXP-XX card by a three-phase diode bridge and applied to a burden resistor that converts it into a voltage signal proportional to the DC motor current value. This is then applied to the armature current regulator which compares it with the reference value.

The standard FIRSXP-XX card offers a choice of two burden resistor (RB) values, 2.5 Ohm or 5 Ohm, which are suitable in the majority of cases. Otherwise an external burden resistor can be used, connected between terminals RCT and OVI. In order to enable precise adjustment to the many possible rated current values (size of the controlled power bridge), a programmable gain amplifier (N8) is inserted between the burden resistor and the current regulator. The gain is set by means of a 12-bit binary number selected with dip-switches S3 and S4.

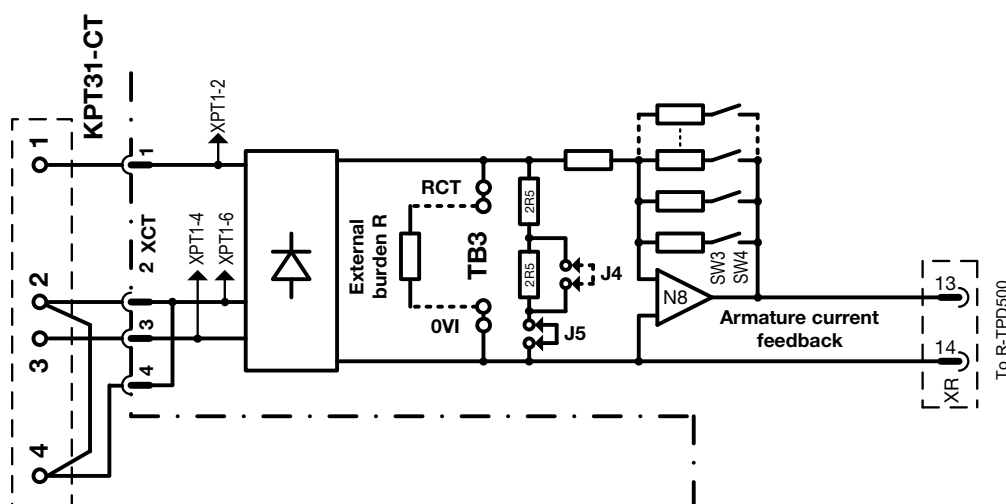


Figure 5-13: Detail of current transducer circuit

If the secondary current of the CTs installed is < 1 A, the 2.5 Ohm or 5 Ohm burden resistors already provided on the card can be used; for secondary currents of > 1 A and < 5 A the burden resistor must be connected between terminals RCT and OVI, excluding the internal resistors. In table form:

Table 5-10: Current transducers settings

	CT secondary current		
	< 0.5 A	> 0.5 A, < 1 A	> 1 A, < 5 A
Jumper J4	J4A (OFF)	J4 (ON)	irrelevant
Jumper J5	J5 (ON)	J5 (ON)	J5A (OFF)
Ext. resistor RCT	Not connected	Not connected	See example of calculation
R resulting load (Rb)	5 Ohm	2.5 Ohm	

NOTE!

Sometimes, especially in revamping projects, current transducers with a 5 A secondary current may already be installed on the power bridges. It is still possible to use just the internal resistors: simply insert two more 5 A / 1 A or 5 A / 0.5 A current transducers, although this could affect the ultimate accuracy of current measurement.

- At 100% of the drive's rated current (I_{dN}), the average reaction voltage, applied between pins XR-13 / XR-14 (0 V) is **0.612 V**.
- Dip-switch S3-1 represents the most significant bit (MSB) and dip-switch S4-8 the least significant bit (LSB). A closed switch ("ON") means binary value 1, an open switch ("OFF") means 0. In graph form:

SW3-1	SW3-2	SW3-3	SW3-4	SW4-1	SW4-2	SW4-3	SW4-4	SW4-5	SW4-6	SW4-7	SW4-8
bit 11 MSB	bit 10	bit 9	bit 8	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0 LSB

- The maximum gain of the amplifier is 51.2 (in actual fact -51.2) and the minimum gain is 0.0125005 with possible values of 212 - 1.
- The binary configuration 00 ... 000 (all S3 and S4 switches open), is not allowed!
- The relation between amplifier gain ("Gain_required") and binary number ("Binary_switch_setting") is given by:

$$\text{Binary_switch_setting} = \frac{1}{\text{Gain_required}} \times 51.2 = \frac{51.2}{\text{Gain_required}}$$

Clearly, only the whole number of the result of the above equation is converted into a binary number.

The variables used in the following examples of calculation are:

- **Idn** = drive armature rated current in A
- **CT** = current transducer with a transformation ratio of: Iprim/Isec
- **Rb** = burden resistor in Ohm
- **Vf@Idn** = reaction voltage at armature rated current: 0.612 V
- **Vb@Idn** = reaction voltage on the burden resistor at the rated armature current in V

Valid formulas:

Vb@Idn = (Idn / (Iprim / Isec)) x Rb and **Gain_required** = Vf@Idn / Vb@Idn

Calculation example A

IdN = 2000 A, **CT** = 2400 A / 0.5 A; **Rb** = 5 Ohm

Vb@IdN = (IdN / (2400 / 0.5)) x Rb = (2000 / 4800) x 5 = 2.08333 V

Gain_required = Vf@IdN / Vb@IdN = 0.612 / 2.08333 = 0.29376

therefore

Binary_switch_setting = 51.2 / 0.29376 = 174.29 which is rounded off to 174 and converted into binary format as **000010101110**. i.e.:

SW3-1	SW3-2	SW3-3	SW3-4	SW4-1	SW4-2	SW4-3	SW4-4	SW4-5	SW4-6	SW4-7	SW4-8
OFF MSB	OFF	OFF	OFF	ON	OFF	ON	OFF	ON	ON	ON	OFF LSB

Calculation example B (extreme case)

Idn = 85 A, **CT** = 2000 A / 1 A; **Rb** = 2.5 Ohm

Vb@Idn = (Idn / (2000 / 1)) x Rb = (85 / 2000) x 2.5 = 0.10625 V

Gain_required = Vf@Idn / Vb@Idn = 0.612 / 0.10625 = 5.76

therefore

Binary_switch_setting = 51.2 / 5.76 = 8.88888 rounded off to 9 and converted into binary format as **000000001001**.

Calculation example C

Idn = 16000 A, **CT** = 20000 A / 5 A

Using an internal 2.50 Ohm RB, inserting a second CT2 with a ratio of 5 A / 1 A.
The new Iprim/Isec is the total of 20000 A / 1 A;

Vb@Idn = (Idn / (20000 / 1)) x Rb = (16000 / 20000) x 2.5 = 2 V

Gain_required = Vf@Idn / Vb@Idn = 0.612 / 2 = 0.306

therefore

Binary_switch_setting = 51.2 / 0.306 = 167.32 rounded off to 167 and converted into binary format as **000010100111**.

Calculation example D

Burden resistor connected to terminals XCT and CT with a 5 A secondary current. Applying the same criteria for the burden resistor, the ideal burden resistor value is 2.5 Ohm / 5 = 0.5 Ohm. The nearest value for the EIA E96 series is 0.499 Ohm ±1% but the more commonly used 47 Ohm ±1% can of course also be used.

Idn = 8000 A, **CT** = 10000 A / 5 A, **Rb** = 0.47 Ohm

Vb@Idn = (Idn / (10000 / 5)) x Rb = (8000 / 2000) x 0.47 = 1.88 V

Gain_required = Vf@Idn / Vb@Idn = 0.612 / 1.88 = 0.3255319149

therefore

Binary_switch_setting = 51.2 / 0.3255319149 = 157.281; rounded off to 157 and converted into binary format as

000010011101.

NOTE!

When choosing the external burden resistor, bear in mind the possibility of substantial power dissipation. In this example, the power at the rated current is already approx. $(1.88)^2 / 0.47 = 7.5$ W without taking into account any overload conditions or the advisability of not using resistors at more than half of their rated power.

Table 5-11: Calculation of the configuration of dip-switches SW3-1 to SW4-8 for standard TPD500 drives with external bridge

Rated armature current	CT transformer	Jumper J4 (on the FIRSXP-XX card)	Jumper J5 (on the FIRSXP-XX card)	Vb@IdN	Gain required	Binary switch setting	SW3-1, ..SW3-4, SW4-1, ..SW4-8 (on the FIRSXP-XX card)
[Adc]		[Rb=5Ω]	[Vdc]	[Vdc]			[MSB ... LSB]
1000	1600/0.4	OFF	ON	1.250000	0.489600	1101000	000001101000
1010	1600/0.4	OFF	ON	1.262500	0.484752	1101001	000001101001
1200	1600/0.4	OFF	ON	1.500000	0.408000	1111101	000001111101
1400	1600/0.4	OFF	ON	1.750000	0.349714	10010010	000010010010
1510	1600/0.4	OFF	ON	1.875000	0.326400	10011100	000010011100
1700	1600/0.4	OFF	ON	2.125000	0.288000	10110001	000010110001
1800	2400/0.5	OFF	ON	2.250000	0.272000	10111100	000010111100
2000	2400/0.5	OFF	ON	2.083333	0.293760	10101110	000010101110
2400	2400/0.5	OFF	ON	2.500000	0.244800	11010001	000011010001
2700	2400/0.5	OFF	ON	2.812500	0.217600	11101011	000011101011
2900	4000/0.5	OFF	ON	1.812500	0.337655	10010111	000010010111
3300	4000/0.5	OFF	ON	2.062500	0.296727	10101100	000010101100

6. OPERATION AND COMMISSIONING

6.1 Using the programming keypad

This chapter provides a detailed description of the **KB-TPD500** programming keypad (code **S5P12TW**) and its various operating modes, including parameter monitoring and programming.

6.1.1 Description

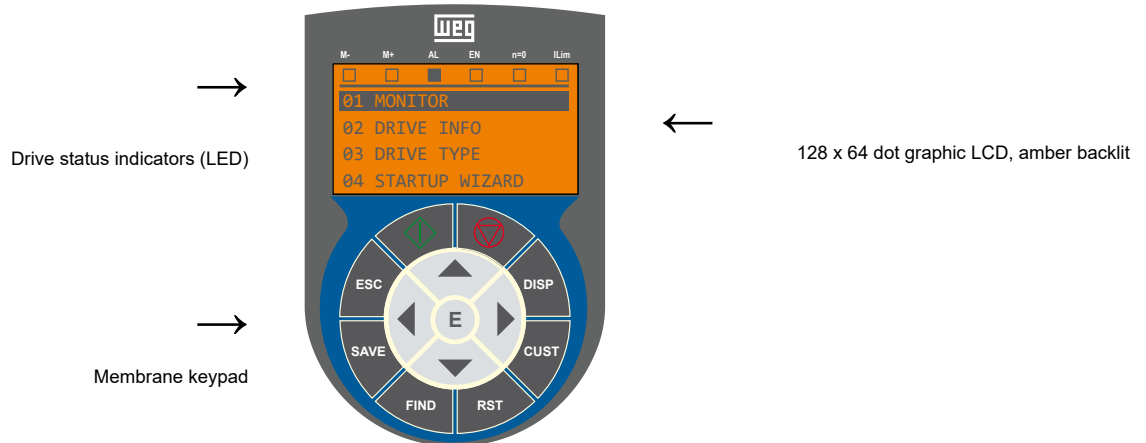


Figure 6-1: Front view of the programming keypad

6.1.1.1 Membrane keypad

Below are the descriptions of the keys on the membrane keypad and their functions.

Table 6-1: Description of the keypad commands

SYMBOL	REFERENCE	DESCRIPTION
	Start	Start command (valid only when IPA 500-Main commands is set to Digital mode).
	Stop	Stop command (valid only when IPA 500-Main commands is set to Digital mode; disables the drive with a double press).
ESC	Escape	Exits a parameter, a menu, or the SAVE, FIND, CUST and DISP functions, returning to the previous menu. Also allows clearing a message displayed on the keypad.
SAVE	Save	Saves the parameters by directly accessing parameter IPA 460-Save parameters. The save procedure is carried out by pressing the SAVE key and then, when prompted on the display, pressing the E key to execute the command. By scrolling down, it is also possible to directly access the IPA 472-Drive reset.
FIND	Find	Accesses the function that allows a parameter to be viewed by entering its IPA code.
RST	Reset	Resets alarms, only if the causes have been cleared.
CUST	Custom	Displays the last ten parameters modified via the keypad.
DISP	Display	Displays a list of drive status monitoring parameters.
E	Enter	Enters the selected submenu or parameter, or selects an operation. Used during parameter editing to confirm the new set value.
▲	Up	Scrolls up through a menu or a list of parameters. During parameter editing, increases the value of the digit under the cursor.
▼	Down	Moves the selection down in a menu or a list of parameters. During parameter editing, decreases the value of the digit under the cursor.
◀	Left	Returns to the previous menu. During parameter editing, moves the cursor to the left.
▶	Right	Enters the selected menu or submenu. During parameter editing, moves the cursor to the right.

6.1.1.2 Meaning of the status indicators (LED)

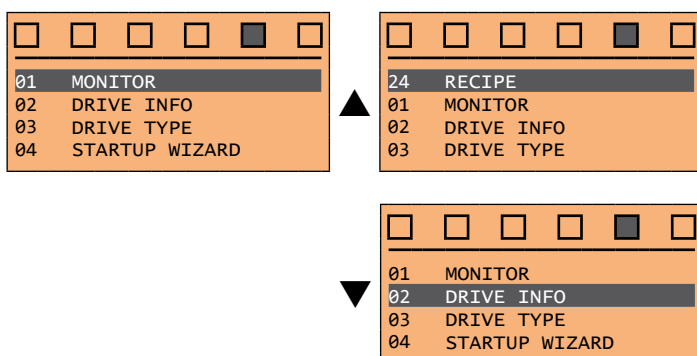
Table 6-2: Meaning of the status indicators

INDICATORS	MEANING
M-	Indicates activation of the negative bridge.
M+	Indicates activation of the positive bridge.
AL	Indicates alarm activation.
EN	Indicates whether the drive is enabled.
n=0	Indicates that the motor speed is 0 rpm (below the threshold set by IPA 810-Speed 0 level). Flashes when Fast Stop is active.
ILim	Indicates that the drive has reached the positive and/or negative current limits.

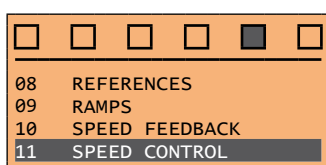
6.1.2 Navigation via keypad

6.1.2.1 Scanning first- and second-level menus

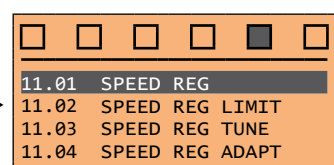
First level



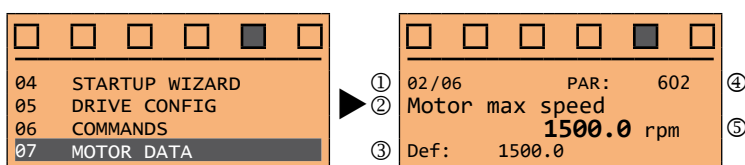
First level



Second level

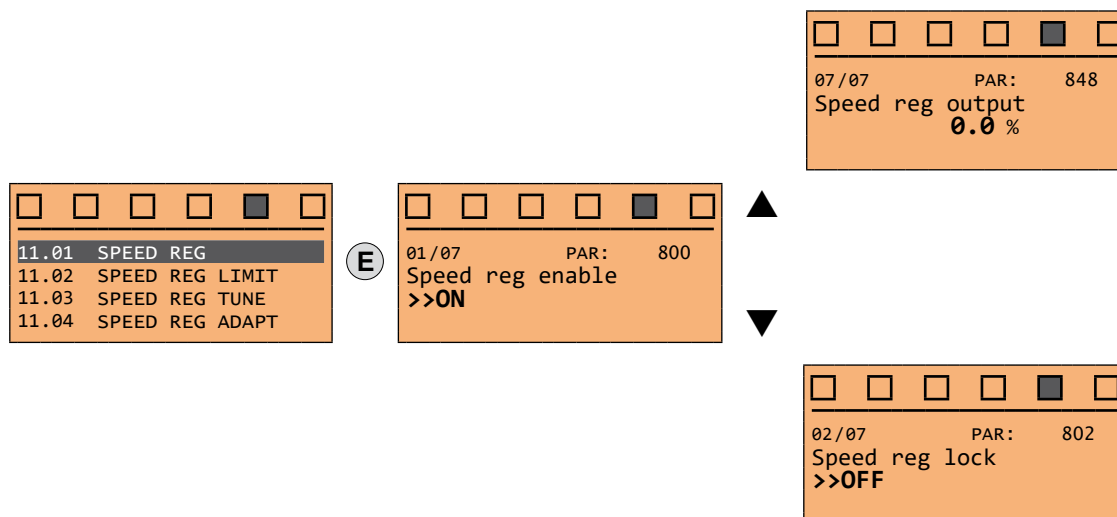


6.1.2.2 Viewing a single parameter



- ① Parameter position within the **MOTOR DATA** menu structure (02/06).
- ② Parameter name (**Motor max speed**).
- ③ Depends on the parameter type:
 - **Numeric parameter:** displays the numerical value of the parameter in the required format, along with the unit of measure.
 - **Binary selection:** the parameter can have only two states, shown as **OFF-ON**.
 - **ENUM-type parameter:** displays the description of the selected option.
 - **Command:** displays the prompt **Press E to Execute** to run the command.
- ④ IPA (Index Parameter Address) of the parameter.
- ⑤ In this position, the following can be displayed:
 - **Numeric parameter:** displays the default, minimum, and maximum values of the parameter. These values are shown in sequence by pressing the ► key.
 - **ENUM-type parameter:** displays the numeric value corresponding to the current selection.
 - **Possible warnings and error conditions:**
 - Par read only** attempt to modify a read-only parameter.
 - Drive enabled** attempt to modify a parameter that cannot be changed while the drive is enabled.
 - Out of range** attempt to enter a value outside the allowed minimum and maximum limits.

6.1.2.3 Parameter scanning



6.1.2.4 CUST function

By pressing the **CUST** key, a list is accessed containing the last ten parameters modified via the keypad. One parameter is displayed at a time, and the **▲** and **▼** keys can be used to scroll through the list. To exit the list, press the **ESC** key.

6.1.2.5 FIND function

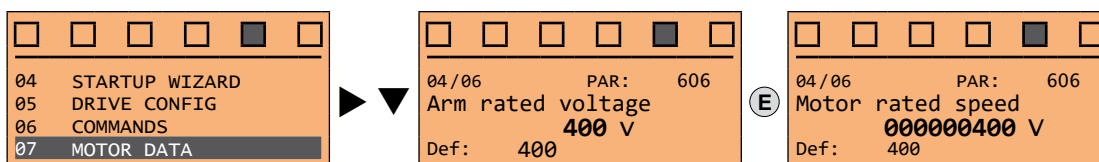
By pressing the **FIND** key, parameter IPA 474-**Goto parameter** is activated, allowing access to any parameter by entering its IPA code.

Once the target parameter is displayed, it is possible to navigate through all parameters within the same menu using the **▲** and **▼** keys. Pressing the **ESC** key returns to the **FIND** function.

6.1.2.6 Editing parameters

To enter parameter editing mode, press the **E** key when the parameter to be modified is displayed.

To confirm and store the new value, press the **E** key again after editing.



When the **E** key is pressed to enter editing mode, the cursor is activated on the digit corresponding to the units. Using the **◀** and **▶** keys, the cursor can be moved across all digits, including leading zeros that are normally not displayed.

The **▲** and **▼** keys are used to increment or decrement the digit under the cursor.

Press **E** to confirm the change or **ESC** to cancel.

To exit parameter editing mode without saving the value, press the **ESC** key.

NOTE!

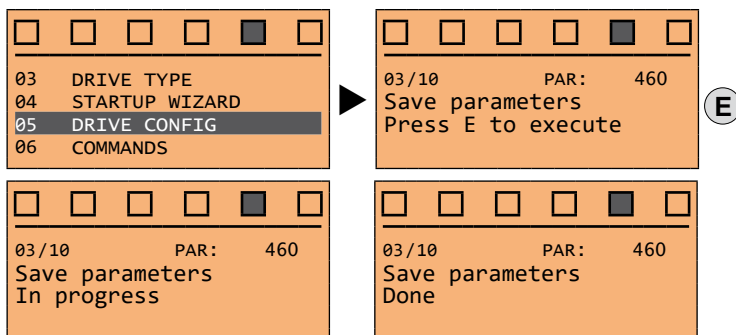
To permanently save the parameters, see [Chapter 6.1.2.7 – Saving parameters](#).

6.1.2.7 Saving parameters

To permanently save the parameters in the drive memory, two procedures are available:

- 1) Press the **SAVE** key on the keypad.
- 2) Access parameter IPA 460-**Save parameters** from the **DRIVE CONFIG** menu.

This allows the parameter setting changes to be retained even after power-off and subsequent restart.



To exit, press the **ESC** key.

6.1.2.8 Display startup

Through parameter IPA 484-**Display startup** in the **DRIVE CONFIG** menu, the parameter to be displayed automatically upon drive startup can be set.

Entering the value **-1** disables the function, and the main menu will be displayed at startup.

Entering the value **0** will display the **DISP** menu upon drive startup.

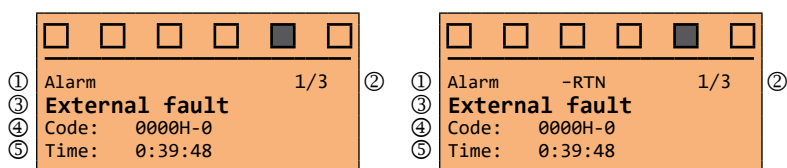
6.1.2.9 Display backlight

Through parameter IPA 482-**Display backlight** in the **DRIVE CONFIG** menu, the display backlight can be set to remain on at all times.

If set to **OFF**, the backlight will turn off three minutes after the last key press.

6.1.2.10 Alarms

The alarms page is displayed automatically when an alarm is triggered.



① **Alarm**: identifies the page of triggered alarms.

-RTN: indicates that the alarm has been cleared. If the alarm is still active, nothing is displayed.

② **x/y**: **x** indicates the position of this alarm in the alarm list, and **y** is the total number of triggered alarms (the alarm with the lower **x** is the most recent).

③ **Alarm description**.

④ **Alarm subcode**: provides additional information to the alarm description when available (further details are provided in **Chapter 6 – OPERATION AND COMMISSIONING**).

⑤ Time of alarm occurrence in hours and minutes since power-on (IPA 490-**Time drive power on**).

With the **▲** and **▼** keys, the alarm list can be scrolled.

NOTE!

For more information, see **Chapter 9 – FAULT INDICATIONS**.

6.1.2.10.1 Alarm reset

- **If the alarms page is displayed:**

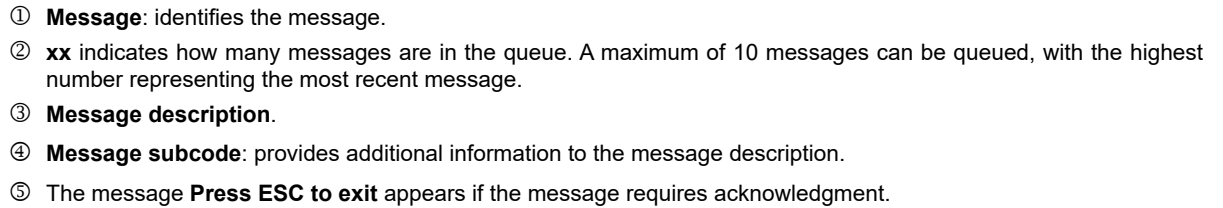
Pressing the **RST** key will reset the alarms and remove from the list all alarms that have been cleared. If the alarm list is empty after this operation, the alarms page will also close. If the list is not empty, press the **ESC** key to exit the alarms page.

- **If the alarms page is not displayed:**

Pressing the **RST** key will reset the alarms. If there are still active alarms after the reset, the alarms page will open.

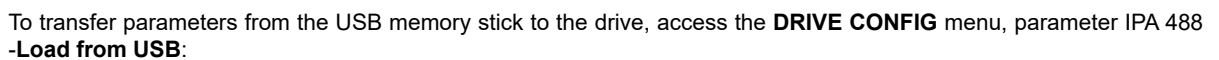
This page displays messages for the operator, divided into two categories:

- If multiple messages are generated simultaneously, they are queued and presented to the operator in sequence, from the most recent to the least recent.



6.1.2.12 Saving and retrieving new parameter settings via USB

Access the **DRIVE CONFIG** menu, parameter IPA 486-**Save to USB**, to save the parameters from the drive to the USB memory stick:



6.2 COMMISSIONING



Follow the instructions provided in [Chapter 1 – SAFETY INSTRUCTIONS](#) and [Chapter 2.2 – Technical data](#).

6.2.1 Jumper and dip-switch configuration

Before powering on the device in each specific application case, it is necessary to adjust and verify the hardware configuration of the jumpers and dip-switches on the **R-TPD500** control board (for more information, refer to [Chapter 4.4 – Control and regulation section](#)).

Table 6-3: Main hardware configurations

Analog inputs 1/2/3	
Voltage input 0... 10 V	Switch S9 / S10 / S11 = OFF
Current input 0...20 mA / 4...20 mA	Switch S9 / S10 / S11 = ON
Mixed configuration possible.	
Select the power supply for the digital encoders, respectively with switches S18 (+24VE1) and S19 (+24VE2)	
Voltage = 5 V	Switch +24VEx = OFF
Voltage = 15 ... 30 V	Switch +24VEx = ON
When the 24VEx voltage is activated, the green LED indicators light up.	
Configure dip-switch S4 for tachometer sensor scaling settings. For more information, see " Chapter 4.4 – Control and regulation section ".	
Configure dip-switch S14 for field current scaling settings. For more information, see " Chapter 4.4 – Control and regulation section ".	

6.2.2 Mounting and auxiliary voltages check

Before powering on the device, the following checks must be made:

- Correct wiring according to the typical diagram.
- Compliance with the design specifications.
- When the device's current limit is not set to the rated current of the connected motor, a thermal protection relay must be installed upstream of the drive, set to the motor's rated current multiplied by 0.86.



External voltage must not be connected to the drive output.

- Drive disabled (remove the connection from terminal 12).
- Check the following voltages:

Terminal 7	+10 V	Related to terminal 9
Terminal 8	-10 V	Related to terminal 9
Terminal 19	+24 ... 30 V	Related to terminal 18

6.2.3 Basic settings for the drive

NOTE!

It is assumed that the device has the factory settings configured and has been connected and tested according to the typical wiring diagram shown in [Chapter 4.2 – Device connection](#).

The factory default settings can be loaded using parameter IPA 470 - **Load Default** in the **DRIVE CONFIG** menu. Loading this parameter will overwrite all modifications made by the user so far.

The allowed values for each parameter can be found in [Chapter 6 – OPERATION AND COMMISSIONING](#) of the manual.

The following settings must be made with the drive in a locked (disabled) state: IPA 3084 - **Enable input mon** = 0 (no voltage applied to terminal 12).

For information on how to use the keypad, refer to [Chapter 6.1 – Using the programming keypad](#).

Selection of the operating mode

- When the drive must be controlled exclusively by the terminal block, set IPA 500-**Main commands** = *Terminals*.
- When using the keypad, the **WEG_DriveLabs** configurator, or a fieldbus, set IPA 500-**Main commands** = *Digital*.

Saving settings

- Use IPA 460-**Save parameters** in the **DRIVE CONFIG** menu (or dedicated key).
- To retain the configured parameters even after powering off and on the drive, the parameters must be saved.
- When using the keypad: press **E**.

In standard supply conditions, IPA 500-**Main commands** is set to *Digital*.

6.2.4 Commissioning procedure

6.2.4.1 Commissioning via keypad - STARTUP WIZARD

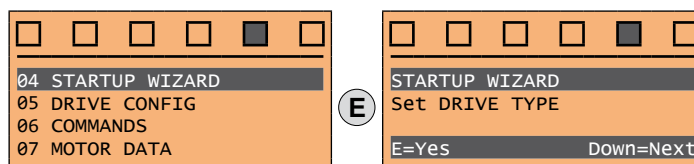
The **STARTUP WIZARD** is a guided procedure that simplifies the commissioning of the drive by assisting with the configuration of the main parameters required for basic operation.

It consists of a series of steps, each corresponding to a sequence for entering and calculating the parameters necessary for the correct operation of the drive and any application that may be loaded.

The steps are carried out in the following order:

- Step 1 - **Set DRIVE TYPE**
- Step 2 - **Set DRIVE CONFIG**
- Step 3 - **Set MOTOR DATA**
- Step 4 - **Set SPEED FEEDBACK**
- Step 5 - **Set ENCODER 1**
- Step 6 - **Set ENCODER 2**
- Step 7 - **Set TACHO**
- Step 8 - **Set LIMITS**
- Step 9 - **Set REFERENCES**
- Step 10 - **Exe CURR REG TUNE**
- Step 11 - **Set FIELD CONTROL**
- Step 12 - **Exe SAVE PARAMETERS**

The keypad screen format for function selection is as follows:



Pressing the **E** key accesses the selected function for programming.

Pressing the **▼** (Down) key skips the current function and moves to the next one.

Pressing the **▲** (Up) key returns to the previous function.

To exit the function sequence and return to the main menu, press the **ESC** key.

At the end of the sequence, after saving the parameters, if the commissioning has been completed successfully, the system returns to the main menu.

Step 1 - Set DRIVE TYPE

Setting the drive's basic parameters:

STARTUP WIZARD Set DRIVE TYPE E=Yes Down=Next	01/05 PAR: 300 Drive arm current 20 A	Read only.
▼	02/05 PAR: 302 Drive size set	Visible only in TPD500-CU-... configuration
▼	03/05 PAR: 304 Drive field current 6.25 A Def: 6.25	
▼	04/05 PAR: 312 Drive 2B inversion OFF	

IPA 300-**Drive arm current** is the drive's rated current (read only).

IPA 302-**Drive size set** allows setting the drive's rated size (only for TPD500-CU-... configuration).

IPA 304-**Drive field current** is the drive's rated field current. Set the field using dip-switch **S14** on the control board.

IPA 312-**Drive 2B inversion** enables field reversal via contactors (**Field contactors**) or **2B+E**.

At the end of the procedure, proceed to the next step.

Step 2 - Set DRIVE CONFIG

Drive configuration parameter settings:

STARTUP WIZARD Set DRIVE CONFIG E=Yes Down=Next	01/02 PAR: 400 Full scale speed 1500 rpm Def: 1500	
▼	02/02 PAR: 500 Main commands >>Terminals Value: 0	

IPA 400-**Full scale speed** defines the speed (in RPM) corresponding to the maximum signal applied to an analog input (e.g., 10 V or 20 mA).

IPA 500-**Main commands** defines the drive's control and command mode.

At the end of the procedure, proceed to the next step.

Step 3 - Set MOTOR DATA

Motor nameplate data settings:

The screenshot shows a sequence of five configuration screens for motor data. Each screen has a title bar with six checkboxes, the first of which is highlighted. The main content area displays the parameter name, its value, and the default value. The bottom of each screen has 'E=Yes' and 'Down=Next' buttons. Arrows indicate the flow from one screen to the next.

Step	Parameter	Value	Default
01/05	Motor rated speed	1500.0 rpm	1500.0
02/05	Motor max speed	1500.0 rpm	1500.0
03/05	Arm rated current	20.0 A	20.0
04/05	Arm rated voltage	400 A	400
05/05	Field rated current	2.06 A	2.06

IPA 600-**Motor rated speed** is the motor's rated speed (nameplate data).

IPA 602-**Motor max speed** is the motor's maximum speed (nameplate data).

IPA 604-**Arm rated current** is the motor's rated armature current (nameplate data). The default value is the drive's rated current. Current limit and overload settings are based on this value.

IPA 606-**Arm rated voltage** is the motor's rated armature voltage (nameplate data).

IPA 608-**Field rated current** is the motor's rated field current (nameplate data).

At the end of the procedure, proceed to the next step.

Step 4 - Set SPEED FEEDBACK

Speed feedback configuration parameter settings:

The screenshot shows the first screen of the speed feedback configuration wizard. It has a title bar with six checkboxes, the first of which is highlighted. The main content area displays the parameter name, its value, and the default value. The bottom of the screen has 'E=Yes' and 'Down=Next' buttons.

Step	Parameter	Value	Default
01/01	Speed fbk sel	Encoder 2	1

IPA 650-**Speed fbk sel** allows selection of the speed feedback source (Encoder 1, Encoder 2, Tachogenerator, or Armature).

At the end of the procedure, proceed to the next step.

Step 5 - Set ENCODER 1



CAUTION!

Incorrect encoder voltage settings may cause irreversible damage to the device. Always check the encoder nameplate voltage.

ENCODER 1 configuration parameter settings:

STARTUP WIZARD Set ENCODER 1 E=Yes Down=Next	01/04 PAR: 702 Enc 1 pulses 1024 ppr Def: 1024 ▼ 02/04 PAR: 704 Enc 1 supply enable OFF ▼ 03/04 PAR: 706 Enc 1 input config >>HTL Value: 1 ▼ 04/04 PAR: 708 Enc 1 Vdc supply >>5.2 V Value: 0
---	--

IPA 702-**Enc 1 pulses**, number of pulses per revolution of the digital encoder connected to connector XE1.

IPA 704-**Enc 1 supply enable**, enables the power supply for Encoder 1.

IPA 706-**Enc 1 input config**, selects the input signal type (HTL / TTL).

IPA 708-**Enc 1 Vdc supply**, power supply voltage for Encoder 1 (used when the +24VE1 switch is OFF).

At the end of the procedure, proceed to the next step.

Step 6 - Set ENCODER 2

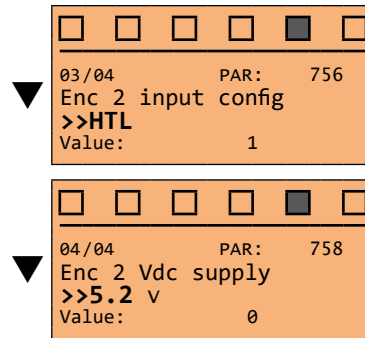


CAUTION!

Incorrect encoder voltage settings may cause irreversible damage to the device. Always check the encoder nameplate voltage.

ENCODER 2 configuration parameter settings:

STARTUP WIZARD Set ENCODER 2 E=Yes Down=Next	01/04 PAR: 752 Enc 2 pulses 1024 ppr Def: 1024 ▼ 02/04 PAR: 754 Enc 2 supply enable OFF
---	--

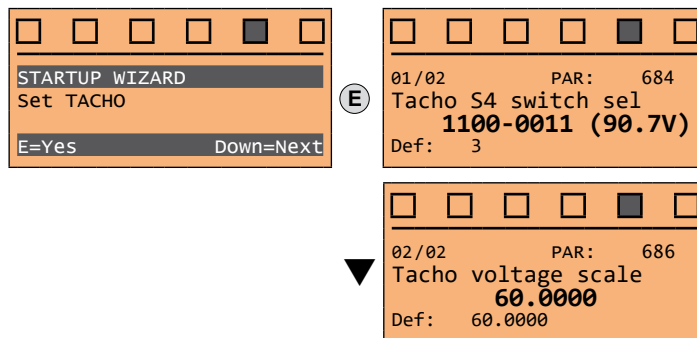


IPA 752-**Enc 2 pulses**, number of pulses per revolution of the digital encoder connected to connector XE2.
 IPA 754-**Enc 2 supply enable**, enables the power supply for Encoder 2.
 IPA 756-**Enc 2 input config**, selects the input signal type (HTL / TTL).
 IPA 758-**Enc 2 Vdc supply**, power supply voltage for Encoder 2 (used when the +24VE2 switch is OFF).

At the end of the procedure, proceed to the next step.

Step 7 - Set TACHO

Tachogenerator configurator parameter settings:

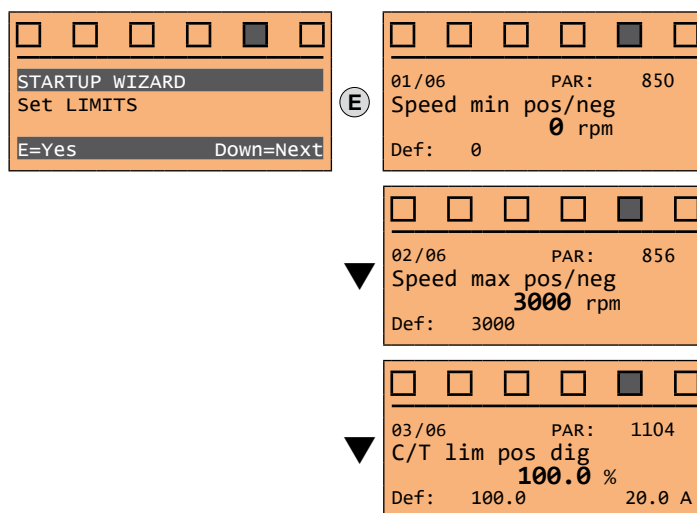


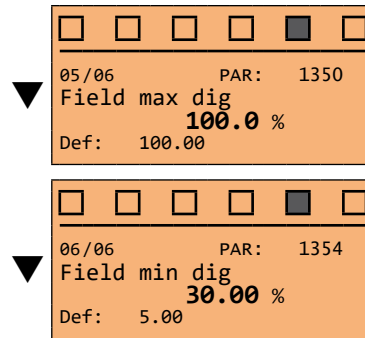
IPA 684-**Tacho DIP switch sel** corresponds to the setting of dip-switch **S4** for tachogenerator feedback.
 IPA 686-**Tacho voltage scale** is the tachogenerator feedback voltage scale.

At the end of the procedure, proceed to the next step.

Step 8 - Set LIMITS

Speed, torque current, and field current limit settings:





IPA 850-**Speed min pos/neg**, minimum speed reference limit.

IPA 856-**Speed max pos/neg**, maximum speed reference limit.

IPA 1104-**C/T lim pos dig** positive armature current limit, expressed as a percentage of IPA 604-**Arm rated current**.

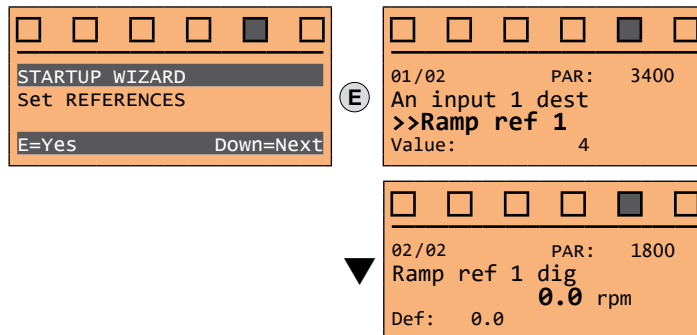
IPA 1350-**Field max dig**, maximum field current value.

IPA 1354-**Field min dig** minimum field current value. Corresponds to the field reference when the IPA 1314-**Field Weak Speed-0** function is active.

At the end of the procedure, proceed to the next step.

Step 9 - Set REFERENCES

Basic parameters to configure the speed reference:



IPA 3400-**An input 1 dest**, destination of analog input 1. Set to OFF to define the speed reference numerically via the next parameter.

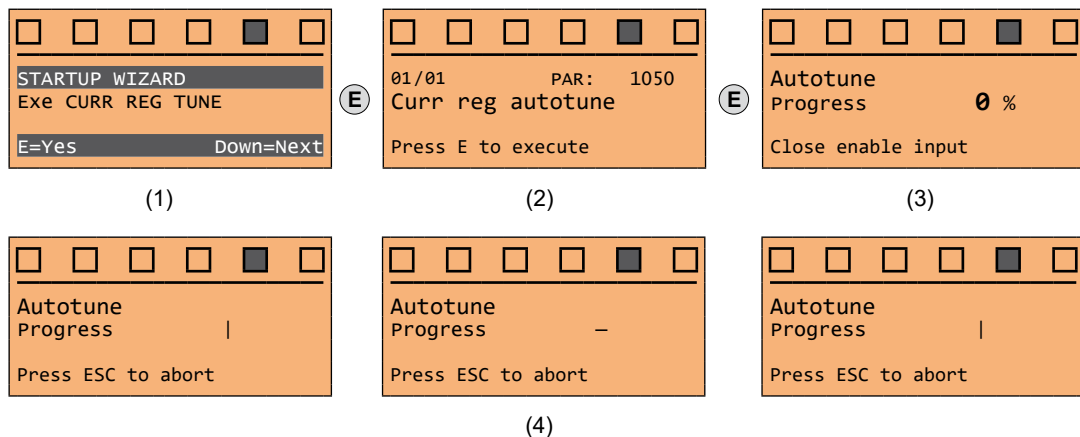
IPA 1800-**Ramp ref 1 dig**, speed reference input to the ramp function.

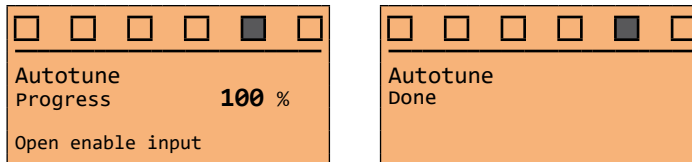
At the end of the procedure, proceed to the next step.

Step 10 - Exe CURR REG TUNE

The drive performs the auto-tuning procedure of the predictive current regulator (actual measurement of the motor's resistance and inductance parameters).

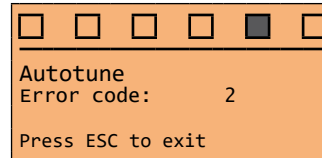
The procedure is fast and recommended in most cases.





(5)

- (1) Press the **E** key to start the auto-tuning procedure.
- (2) Press the **E** key to execute parameter IPA 1050-**Curr reg autotune**.
- (3) Enable the drive by closing the enable terminal within ten seconds; otherwise, an error message with code 2 will be displayed.



- (4) Once the drive is enabled, the auto-tuning procedure begins. Depending on the motor type, the process may take several minutes.
The procedure can be interrupted at any time by pressing the **ESC** key or disabling the drive. In this case, an error message will be displayed with code 4 or 3, respectively.
During the procedure, the progress status alternates between the symbols – and |.

- (5) At the end of the procedure, the indicated screen will appear.

After opening the enable terminal, the procedure moves to the next step.

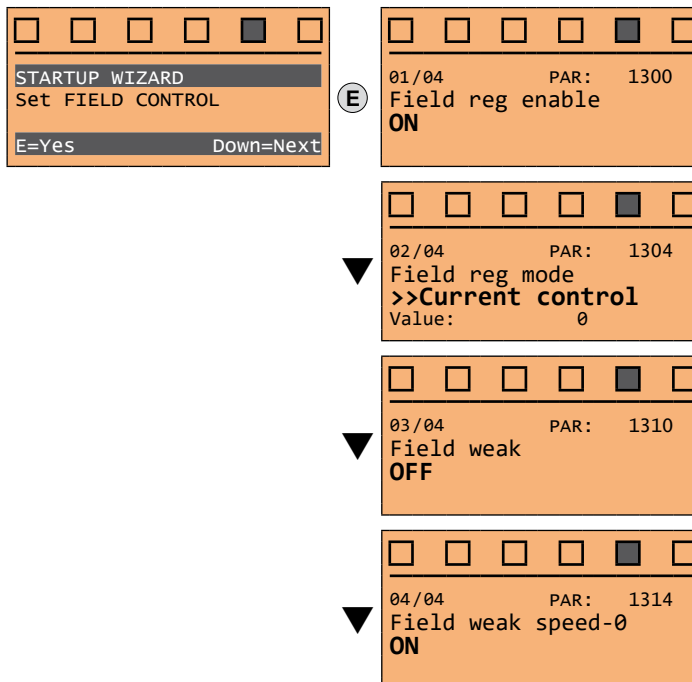
The procedure calculates parameters IPA 1052-**Arm resistance** and IPA 1054-**Arm inductance** in the **CURR REG TUNE** menu.

NOTE!

The calculated parameters are stored in volatile memory to allow the drive to perform the necessary calculations during operation.
If the device is powered off, this data will be lost. To save the motor data, follow the procedure described in **step 12**.

Step 11 - Set FIELD CONTROL

Basic field control configuration parameters:



IPA 1300-**Field reg enable**, enables the field current regulator.

IPA 1304-**Field reg mode**, selects the flux regulation mode (fixed field constant current, armature voltage control, or external control).

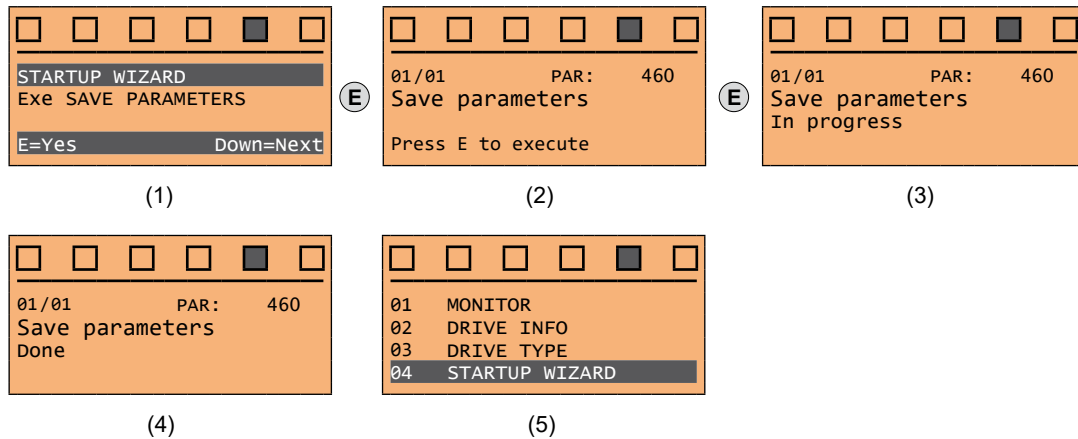
IPA 1310-**Field weak**, enables field weakening.

IPA 1314-**Field weak speed-0**, enables field weakening at zero speed.

At the end of the procedure, proceed to the next step.

Step 12 - Exe SAVE PARAMETERS

To save the new parameter settings so that they are retained even after the device is powered off, follow this procedure:



- (1) Press the **E** key to start the parameter saving procedure.
- (2) Confirm by pressing the **E** key again.
- (3) The procedure will begin and show progress.
- (4) The procedure completes.
- (5) At the end of the procedure, the indicated screen will appear.

6.2.4.2 Commissioning using the STARTUP WIZARD via WEG_DriveLabs configuration tool

WEG_DriveLabs is the configuration software for WEG Automation Europe products. It allows users to connect to one or more target devices to monitor their status, view information, and read/write parameters.

The **WEG_DriveLabs** configurator provides users with the ability to connect and configure WEG Automation Europe devices through dedicated interfaces, intuitive toolbars, and informative status bars.

Key features included:

- Device-to-PC communication via RJ45 Ethernet port using the ModbusTCP protocol;
- Creation and management of projects, both for individual drives and multiple devices simultaneously;
- Parameter reading and writing;
- Saving parameters to the device;
- Device status monitoring;
- Softscope - an integrated real-time oscilloscope.

The drive can be commissioned not only via the keypad but also directly through the configurator.

From the **STARTUP WIZARD** menu, the drive can be started by following a step-by-step guided procedure. This allows the user to configure the main parameters such as drive type, motor, feedback, speed references, and perform autotuning of the current regulator.

The user can directly set the values of the parameters displayed in each menu and proceed simply by clicking "Next". Parameters are automatically acquired when moving to the next step.

The sequence of steps corresponds to the order defined in the keypad procedure.

TPD500_1 **Startup Wizard**

Go through the following steps to complete drive commissioning

DRIVE TYPE (selected)

DRIVE CONFIG

MOTOR DATA

SPEED FEEDBACK

ENCODER 1

ENCODER 2

TACHO

LIMITS

REFERENCES

CURR REG AUTOTUNING

FIELD CONTROL

Ipa	Name	Value	Min	Max
300*	Drive arm current - [A]	20	---	---
304	Drive field current - [A]	1.00	0.5	150
312	Drive 2B+E enable	OFF ☐	---	---

Next

Reading parameters ...

10 / 35

Abort

6.2.5 Speed sensor connection check

Before proceeding, it is necessary to check that the speed sensor provides the information with the correct sign according to the following convention:

- **Positive speed:** clockwise rotation of the motor, observed from the output side of the motor shaft.
- **Negative speed:** counterclockwise motor rotation, observed from the output side of the motor shaft.
- **Positive torque:** torque producing a clockwise rotation of the motor, observed from the output side of the motor shaft motor.
- **Negative torque:** torque producing a counterclockwise rotation of the motor, observed from the output side of the motor shaft motor.

To check the speed signal, select parameter IPA 234-**Motor speed** in the **MONITOR** menu.

- With the drive disabled, turn the motor clockwise (viewed from the motor shaft side). The value displayed must be positive.
- If the value does not change or appears unintelligible, check the power supply, configuration and connection of the encoder or tachogenerator.
- If the value is negative, the encoder or tachogenerator connections must be reversed:
 - by swapping channel A+ with A- or B+ with B- of the encoder;
 - by reversing the tachogenerator signal connections.

6.2.6 Field regulator settings

All settings described in this chapter must be carried out with the drive disabled (no voltage applied to terminal 12).

6.2.6.1 Operating mode

This section provides a brief explanation on how to configure the field mode for the main applications.

For advanced modes and a more detailed explanation, refer to **Chapter 7 – FUNCTION PARAMETERS**.

Table 6-4: Main settings related to operating modes

Operating mode	Field regulator settings	Additional actions
Constant field	IPA 1304- Field reg mode = Current Control IPA 1300- Field reg enable = ON	Set IPA 1350- Field max dig Set IPA 1354- Field min dig
Field weakening managed by the drive	IPA 1304- Field reg mode = Voltage Control IPA 1300- Field reg enable = ON	Set Field max dig and Field min dig Tune the field regulator Set IPA 1306- Volt control ref dig Tune the voltage regulator
Field OFF	IPA 1304- Field reg mode = Current Control IPA 1300- Field reg enable = OFF	

6.2.6.2 Setting the rated field current

Based on the motor's rated field current, set the field converter current using dip-switch **S14**, following the instructions provided in **Chapter 2.3.3 – Field circuit calibration**.

This operation is always recommended to optimize performance, but it becomes necessary when the motor's rated field current is less than 10% of the field converter's rated current.

After setting dip-switch **S14**, update parameter IPA 304-**Drive field current** accordingly, as described in **Chapter 6.2.8 – Field current regulator tuning**.

These settings are not required if the motor field control is managed externally, outside of the TPD500's internal field converter.

6.2.6.3 Flux limits

The flux reference limits for the field regulator, available in the **FIELD CONTROL/FIELD REG LIM** menu, are set using parameters IPA 1350-**Field max dig** and IPA 1354-**Field min dig** as a percentage of the nominal flux.

The nominal flux corresponds to the flux generated when the rated field current - set via parameter IPA 608-**Field rated current** - is flowing through the field circuit.

6.2.7 Using the test generator

The **Test Generator** function allows system performance evaluation and, if necessary, manual tuning of the current and speed regulators.

This function generates square waveform signals with configurable frequency, amplitude, and offset.

Parameter IPA 4450-**Test Gen Dest** allows selection of the regulator input on which the generated signal will act.

For more details, refer to [Chapter 7.18.12 - Test generator](#).

6.2.8 Current regulator tuning

6.2.8.1 Current regulator auto-tuning

This procedure must be carried out before the initial enabling of the drive, as previously mentioned in the commissioning procedure ([Chapter 6.2.4 – Commissioning procedure](#)).

The current regulator auto-tuning can be started via parameter IPA 1050-**Curr reg autotune**, using either the keypad or the **AUTOTUNING WIZARD** menu in **WEG_DriveLabs**.

The measured armature resistance and inductance values are saved in parameters IPA 1052-**Arm resistance** and IPA 1054-**Arm inductance**, accessible in the **CURR REG TUNE** menu.

If needed, the user can manually adjust these parameters.

- The internal field controller is automatically disabled during the procedure.
- In some cases, when the field is supplied by a source other than the converter or residual magnetism is present, the motor may move. In such cases, disconnect the field circuit electrically or mechanically lock the motor.
- Power the drive's control section via terminals **U2** and **V2**.
- Make sure the drive is disabled (no voltage applied to terminal **12**).
- Set the desired armature current using parameters IPA 1104-**C/T lim pos dig** (positive torque) and IPA 1108-**C/T lim neg dig** (negative torque). The higher value will be used for the auto-tuning procedure.
- To ensure accurate results, the set current must be sufficient to guarantee continuous conduction mode. If necessary, disable the overload function during the procedure (IPA 4300-**Overload mode** = None).
- Start the procedure via IPA 1050-**Curr reg autotune** from the keypad or via the **AUTOTUNING WIZARD** menu in **WEG_DriveLabs**.
- Power the drive's power section via terminals **U**, **V**, **W**.
- Enable the drive (+24 V to terminal **12**) to start the auto-tuning.
- The procedure takes a few minutes and can be interrupted by:
 - turning off the unit;
 - disabling the drive or pressing **ESC** if started from the keypad;
 - executing the **Autotune Break** command from the **AUTOTUNING WIZARD** menu in **WEG_DriveLabs**.
- At the end of the auto-tuning, the drive will automatically disable itself.
- Disconnect the enable terminal (remove voltage from terminal **12**).
- Reactivate the overload control function, if used (IPA 4300-**Overload mode** set to one of the available options).
- Save the settings using the keypad or the save button  in **WEG_DriveLabs**.

NOTE!

If the procedure is interrupted by the user or due to an alarm, the parameters previously saved in the drive will be restored.

6.2.8.2 Fine (manual) tuning of the current regulator

During drive operation, the IPA 1060-**Compensation output** parameter can be monitored in the **CURRENT CONTROL\ CURR REG TUNE** menu. This parameter indicates the effectiveness of the current regulator tuning and is closely related to the load's inductance and resistance values.

The ideal value of IPA 1060-**Compensation output** should be close to zero, although dynamic variations between -40 V and +40 V are acceptable.

NOTE!

To ensure a reliable reading, the drive should operate under a load of at least 30% of its rated capacity.

If needed, small adjustments can be made to parameter IPA 1054-**Arm inductance** in order to bring the value of IPA 1060-**Compensation output** closer to zero:

- If IPA 1060-**Compensation output** is positive, increase the value of IPA 1054-**Arm inductance**;
- If IPA 1060-**Compensation output** is negative, decrease the value of IPA 1054-**Arm inductance**.

6.2.9 Manual tuning of the field current regulator

The field regulator comes with a default tuning that generally provides satisfactory performance when the field reference is constant.

However, if the field reference varies over time - for example, when controlled by the armature voltage regulator (IPA 1304-**Field reg mode** = Voltage control) - it is recommended to optimize the tuning as described below.

NOTE!

During the tuning of the field current regulator, the drive must not receive any **Start** command.

- Drive disabled (no voltage applied to terminal 12).
- Open the **FIELD CONTROL \ FIELD REG LIM** menu and set:
 - IPA 1350-**Field max dig** = 100.00% corresponding to the motor's rated field current;
 - IPA 1354-**Field min dig** = 0.00%
- Still in the **FIELD CONTROL\FIELD REG LIM** menu, set:
 - IPA 1320-**Field curr reg P** = 0.00%
 - IPA 1322-**Field curr reg I** = 0.00%
- Monitor the field reference and measured field current using **Softscope** or an analog output. To do this, assign the variable IPA 1342-**Field current [%]** to one output, and IPA 1340-**Field reference** to another (see [Chapter 6.17 – IOs](#)).

NOTE!

Access to **Softscope** is available via the dedicated icon in the **WEG_DriveLabs** menu.



- Open the **FIELD CONTROL\FIELD REG** menu and set:
 - IPA 1300-**Field reg Enable** = ON
 - IPA 1304-**Field reg mode** = Current control
- Open the **FUNCTIONS\TEST GENERATOR** menu and set:
 - IPA 4450-**Test gen dest** = Field ref
 - IPA 4454-**Test gen amplitude** to 70% of the motor's rated field current (this allows for system overshoot).
- Increase the value of parameter IPA 1320-**Field curr reg P** until a current response (IPA 1342-**Field current [%]**) with a maximum of 4% overshoot and no oscillations.
- Increase the value of parameter IPA 1322-**Field curr reg I** until the field current response shows a maximum overshoot of 4% and no oscillations.

NOTE!

Due to the high time constant, the rise time of the field current is limited. For this reason, increasing the gains may lead to a deterioration in current behaviour. In such cases, it is advisable to simply find the gain values that provide the best possible response without introducing oscillations

Complete the optimization procedure by setting:

- IPA 4450-**Test gen dest** = OFF
- IPA 1300-**Field reg enable** = OFF
- IPA 1354-**Field min dig** to the desired value.
- Configure the analog outputs according to your specific requirements.
- Finally, save the settings using the keypad or the save button  in **WEG_DriveLabs**.

Figures 6-2 to 6-7 show examples of field current regulator tuning.

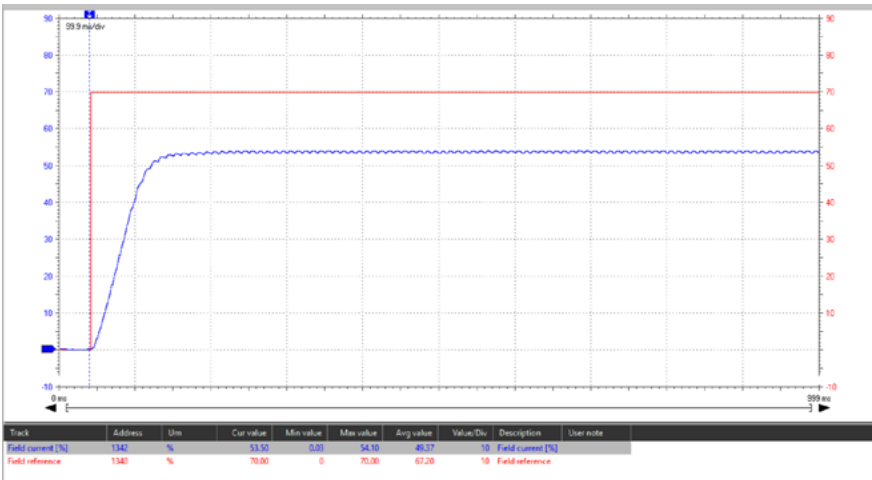


Figure 6-2: Field regulator Kp value too low

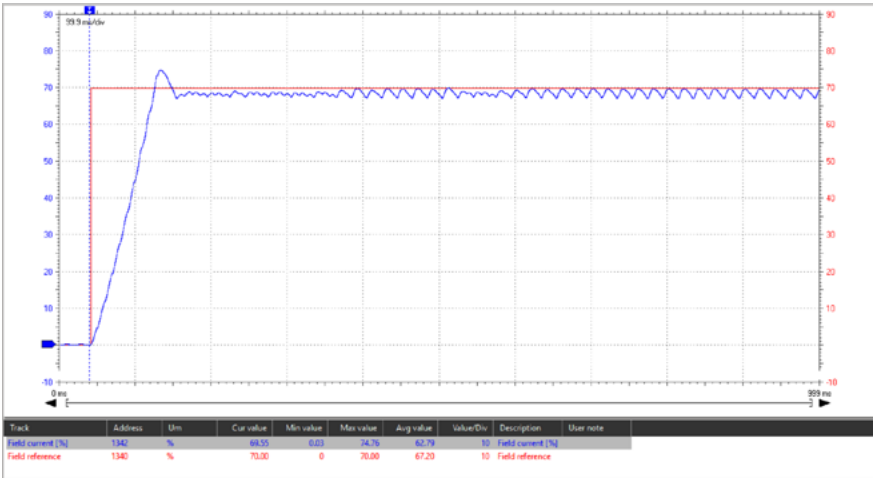


Figure 6-3: Field regulator Kp value too high. Presence of overshoot and field current oscillations

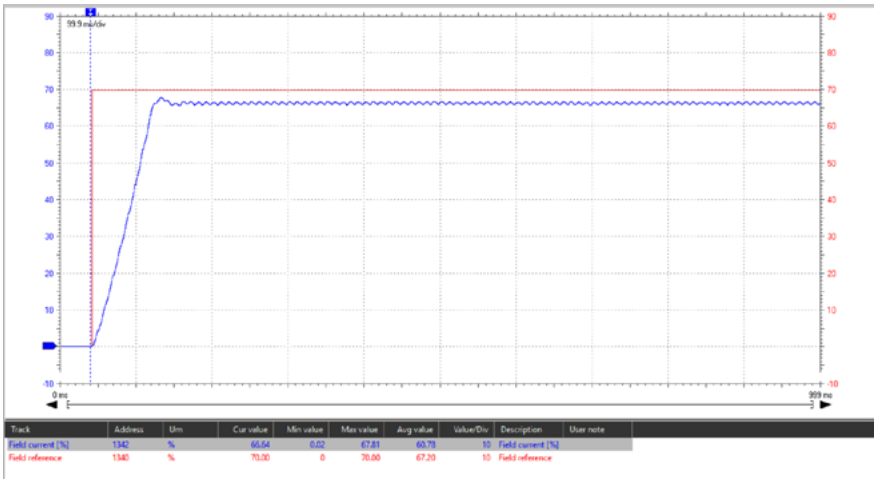


Figure 6-4: Correct Kp value

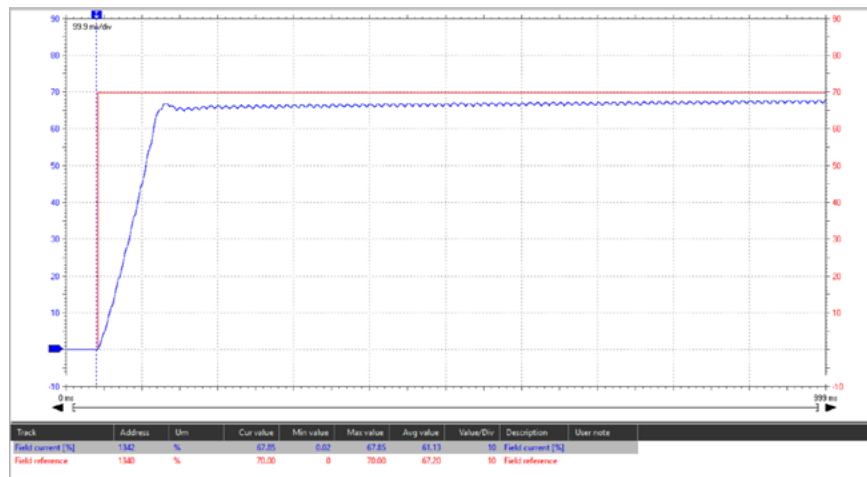


Figure 6-5: Ki value too low. The field current reaches the target value very slowly

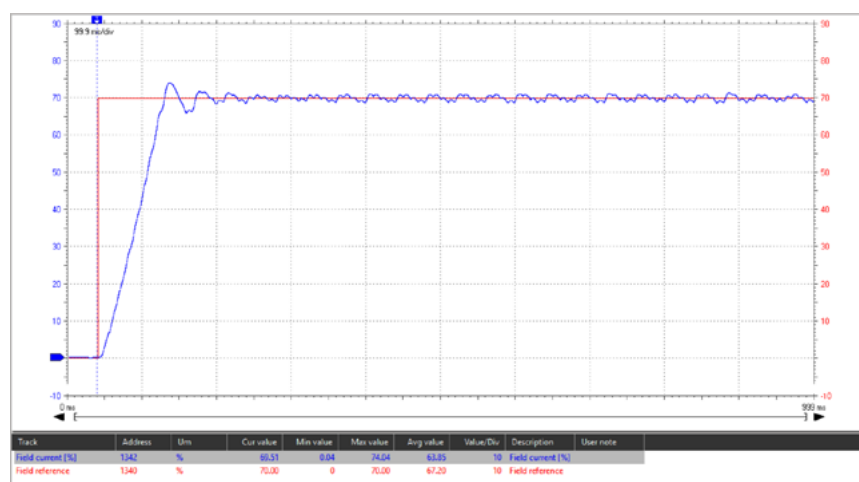


Figure 6-6: Ki value too high. Field current oscillations

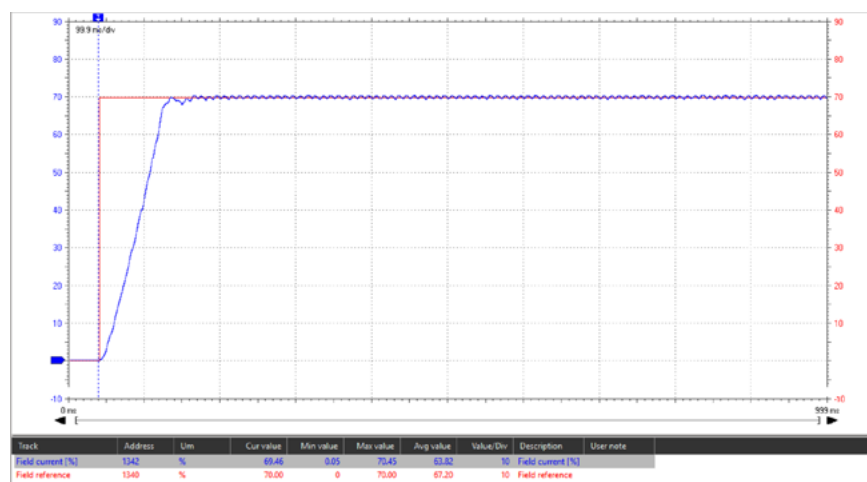


Figure 6-7: Regulator correctly tuned

6.2.10 Manual tuning of the speed regulator

The speed regulator of the **TPD500** drive is preset with default values that, under normal conditions, provide sufficient performance for initial operation in speed control mode.

The following procedure describes how to optimize the regulator's performance, if needed.

To generate a step signal, the internal test generator is used (**FUNCTIONTEST GENERATOR** menu), with the goal of achieving an optimal step response.

The analog output can be routed to the terminals with a sampling time of 1 ms.

- Drive disabled (no voltage applied to terminal 12).
- Open the **FUNCTIONTEST GENERATOR** menu and set:
 - IPA 4450-**Test gen dest** = *Speed ref*
 - IPA 4452-**Test gen frequency** = *0.2 Hz*
 - IPA 4454-**Test gen amplitude** = *10%*
 - IPA 4456-**Test gen offset** = *10%*
- Monitor the step response using Softscope or an analog output. To do this, assign variable IPA 234-**Motor speed** to one output and IPA 214-**Armature current [%]** to another (see [Chapter 7.17 – IOs](#)).
- Open the **SPEED CONTROL / SPEED REG TUNE** menu and set:
 - IPA 900-**Speed reg P** = *0.00%*
 - IPA 902-**Speed reg I** = *0.00%*
- Enable the drive (voltage on terminal 12) and issue a Start command (voltage on terminal 13).
- Increase IPA 900-**Speed reg P** until the speed response has no oscillations and shows an overshoot of less than 4% with the shortest possible response time. If the armature current shows rapid oscillations, reduce the value.
- Increase IPA 902-**Speed reg I** until the speed response has no oscillations and shows an overshoot of less than 4% with the shortest possible response time. If the armature current shows oscillations, reduce the value.
- Stop and disable the drive (remove voltage from terminals 12 and 13).
- Set IPA 4450-**Test gen dest** = *OFF*
- Save the settings using the keypad or the save button  in **WEG DriveLabs**.

NOTE!

When the **Bypass** function is enabled (IPA 656-**Speed fbk bypass** = ON) the drive automatically switches to armature feedback (estimated speed, not sensor-based) in the absence of the feedback signal.

In this scenario, with the feedback signal disconnected, it is necessary to repeat the speed regulator tuning as previously described. The proportional gain of the speed regulator is set using parameter IPA 930-**Speed reg P bypass**, while the integral gain is set using IPA 932-**Speed reg I bypass**.

In some cases, it is necessary to use different gain values depending on speed—for example, when field weakening is active or when the load behaviour changes significantly with speed.

For this reason, TPD500 series drives are equipped with an adaptive speed regulator.

For more details on this function, refer to [Chapter 7.13.4 – Adaptive speed regulator](#).

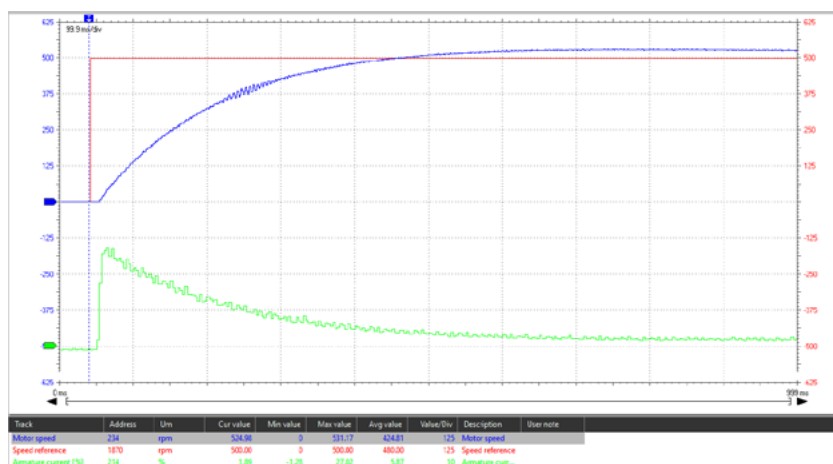


Figure 6-8: Speed reg P value too low

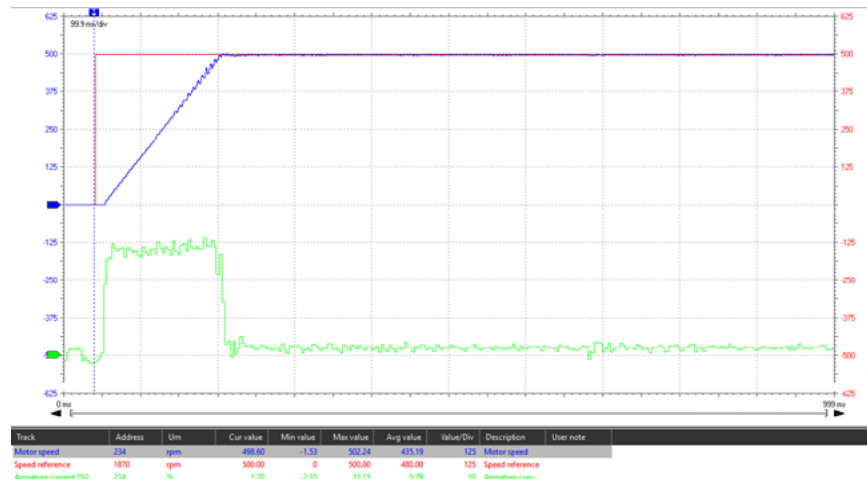


Figure 6-9: Speed reg P value too high, oscillations in armature current and speed

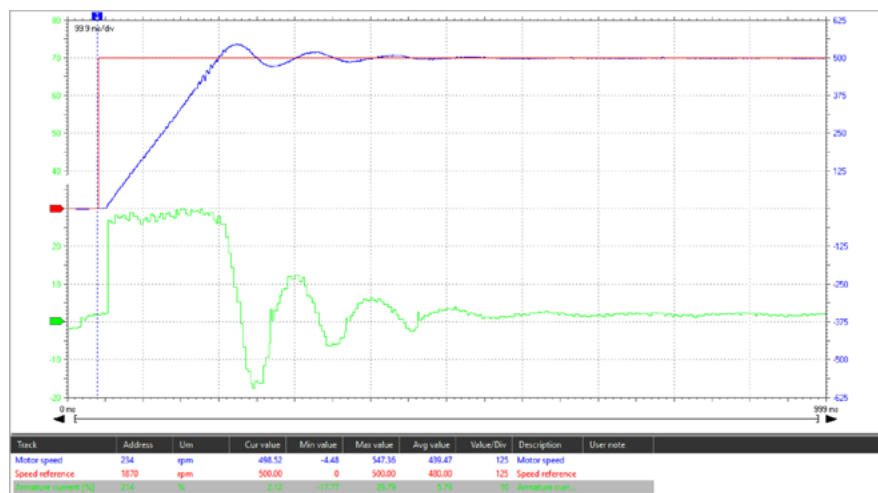


Figure 6-10: Speed reg I value too high, oscillations in armature current and speed

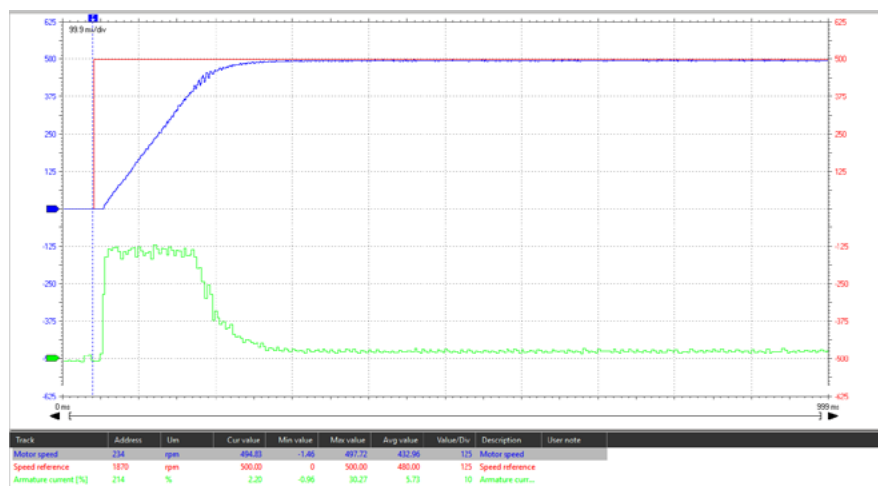


Figure 6-11: Speed reg P and Speed reg I values correctly set

6.2.11 Flux/If curve tuning

The magnetic flux in the motor may not be perfectly proportional to the field current.

If the drive operates with a constant field current equal to the nominal value (IPA 1350-Field max dig = 100%), this function does not need to be used.

However, in cases where the field current varies - such as during field weakening - tuning of the flux/current curve is necessary. This ensures that the field current is appropriately adjusted from its default value, in order to maintain correct behaviour of the following flux-related variables at every operating point:

- Motor flux
- Torque calculation
- Speed estimation when using armature feedback

The figure below illustrates the relationship between flux and field current, comparing the case where the Flux/If curve is enabled (Curve B) with the case where it is not (Curve A).

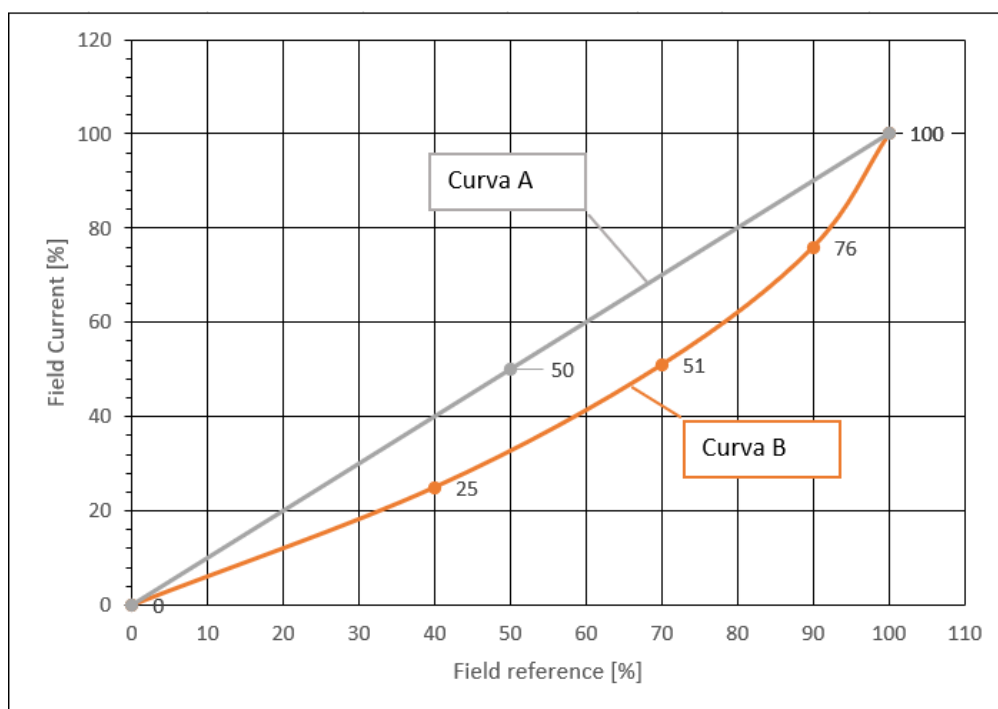


Figure 6-12: Example of field current tuning curve

Example:

Curve A – Keeping the tuning curve unchanged from the drive's standard factory settings will result in a linear behaviour of IPA 1344-Field current [A] as IPA 1340-Field reference varies.

Therefore:

Field current max / Field reference = 100% → **Field current / Field reference = Field rated current**

Field current max / Field reference = 50% → **Field current / Field reference = 50% of Field rated current**

Curve B – It represents the curve obtained by performing the flux curve tuning (see tuning procedure below).

The values of parameter IPA 1344-Field current [A] will follow a profile that corresponds to the percentage of actual flux (IPA 1340-Field reference) required to ensure the proper circulation of field current in the connected system.

Curve B is derived from the **Field curr const** parameters calculated during the manual tuning procedure described below.

Therefore:

Field current max / Field reference = 100% → **Field current / Field reference = Field rated current**

Field current max / Field reference = 50% → **Field current / Field reference = 33% of Field rated current**

Field current max / Field reference = 40% → **Field current / Field reference = 25% of Field rated current**

Values obtained by setting the following parameters:

- IPA 1450-Field curr const 40% = 25%
- IPA 1452-Field curr const 70% = 51%
- IPA 1454-Filed curr const 90% = 76%

6.2.11.1 Manual tuning procedure

- Open the **FIELD CONTROL\ FIELD REG TUNE** menu and reset the flux/current curve using command
- IPA 1458-**Field curve reset**.
- Open the **MOTOR DATA** menu and set the motor's rated field current, which corresponds to the current that produces the rated flux, using parameter IPA 608-**Field rated current**.
- Open the **VOLTAGE CONTROL/VOLT REG** menu and set the desired output voltage using parameter
- IPA 1306-**Volt control ref dig**, expressed as a percentage of the motor's rated voltage, represented by parameter IPA 606-**Arm rated voltage** (**MOTOR DATA** menu).
- In the same menu **FIELD CONTROL\ FIELD REG**, set the field regulator mode via IPA 1304-**Field reg mode** = Current control.
- Open the **FIELD CONTROL\ FIELD REG LIM** menu and set the flux percentage to 100% using parameter IPA 1350-**Field max dig**.
- Run the motor at a speed such that the variable IPA 210-**Armature voltage** (**MONITOR** menu) matches the previously set value of IPA 606-**Arm rated voltage**.
- Using parameter IPA 1350-**Field max dig**, reduce the voltage displayed in IPA 210-**Armature voltage**, until it reaches 90% of IPA 606-**Arm rated voltage**.
- Read the circulating current from IPA 1342-**Field current [%]** (in the **MONITOR** menu) and enter it in parameter IPA 1454-**Field curr const 90%** (in the **FIELD CONTROL\FIELD REG TUNE** menu).
- Reduce the voltage shown in IPA 210-**Armature voltage** to 70% of IPA 606-**Arm rated voltage** using IPA 1350-**Field max dig**.
- Read the circulating current from IPA 1342-**Field current [%]** and enter it into IPA 1452-**Field curr const 70%**.
- Then, reduce the voltage further to 40% of IPA 606-**Arm rated voltage** using IPA 1350-**Field max dig**.
- Read the circulating current from IPA 1342-**Field current [%]** and enter it into IPA 1450-**Field curr const 40%**.
- Disable the drive (remove voltage from terminal 12).
- Set the desired field control operating mode via IPA 1304-**Field reg mode**, and set IPA 1350-**Field max dig** back to 100%.
- Save the parameters using the keypad or the save button  in **WEG DriveLabs**.

NOTE!

Any change to parameter IPA 608-**Field rated current** requires a new tuning of the curve.

6.2.12 Armature voltage regulator (field regulator setpoint)

NOTE!

In most applications, separately excited DC motors operate with a constant field (IPA 1304-**Field reg mode** = Current control). In this case, there is no need to optimize the armature voltage regulator.

When voltage control is active, the regulator maintains a constant armature voltage by adjusting the field current within the defined limits (IPA 1350-**Field max dig** and IPA 1354-**Field min dig**).

The critical point for this regulator is when voltage control becomes active, as motor field saturation requires faster field current adjustments to compensate for flux variations.

It is therefore important to tune the regulator in a way that minimizes armature voltage fluctuations.

NOTE!

All other drive regulators must be properly configured before optimizing the voltage regulator.

- Drive disabled (no voltage applied to terminal 12).
- Open the **FUNCTION\TEST GENERATOR** menu and set:
 - IPA 4450-**Test gen dest** = *Ramp ref*
 - IPA 4452-**Test gen frequency** = *0.2 Hz*
 - IPA 4454-**Test gen amplitude** = *10%*
 - IPA 4456-**Test gen offset** based on the point of transition from armature adjustment to field adjustment.
- Example: if field weakening starts at 1500 rpm and IPA 602-**Motor max speed** = *2000 rpm*, set IPA 4456-**Test gen offset** = *75%*.
- Monitor the field current and armature voltage using Softscope or analog outputs.
- To do this, assign variables IPA 1342-**Field current [%]** and IPA 210-**Armature voltage** to two separate analog outputs (see [Chapter 6.17 – IOs](#)).
- Enable the drive (apply voltage to terminal 12) and issue a Start command (apply voltage to terminal 13).

- Check the armature voltage (IPA 210-**Armature voltage**). After a possible brief transient, the voltage should remain stable. See figures 5-13 to 5-15. You can adjust the proportional and integral gains in the **FIELD CONTROL \ FIELD REG TUNE** menu using parameters IPA 1400-Voltage reg **P** and IPA 1402-Voltage reg **I**, respectively.
- Stop and disable the drive (remove voltage from terminals 12 and 13).
- Set IPA 4450-**Test gen dest** = **OFF**
- Save the settings using the keypad or the save button  in **WEG DriveLabs**.

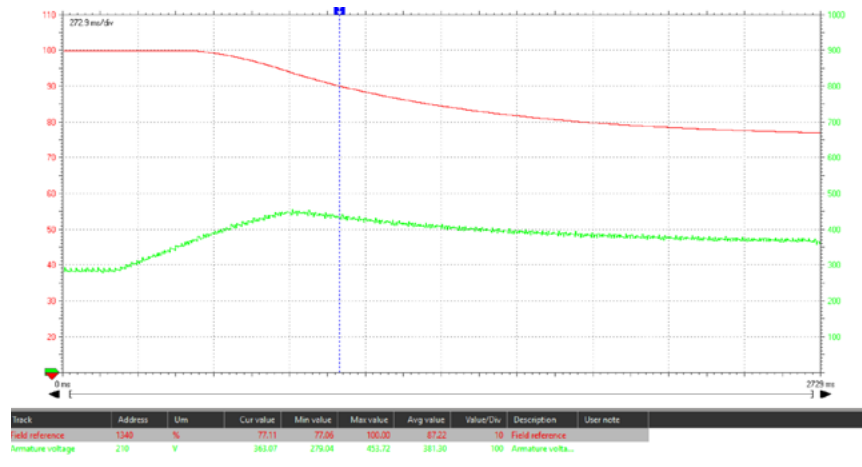


Figure 6-13: Regulator too slow, armature voltage rises above the maximum setpoint of 380 V

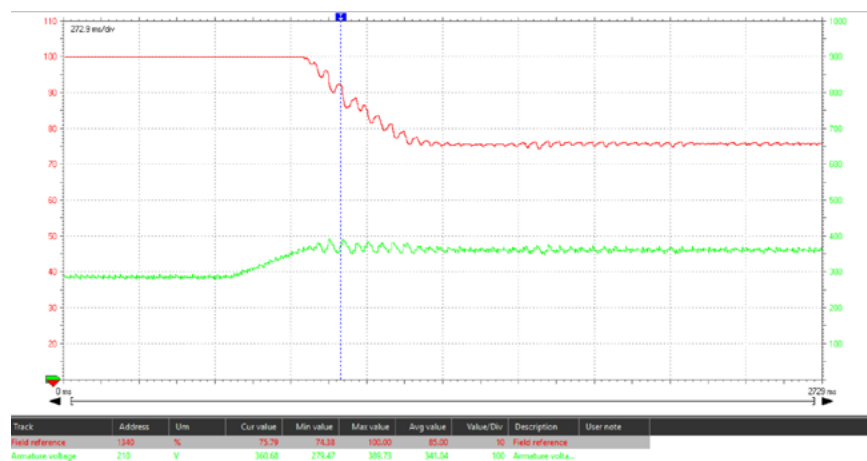


Figure 6-14: Regulator too reactive, armature voltage and flux reference show oscillations

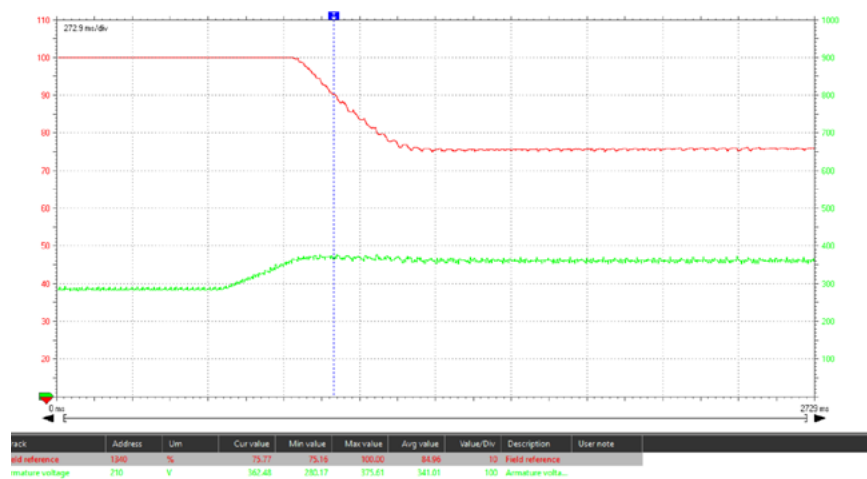


Figure 6-15: Regulator correctly set

In some cases, a separate converter may be required to regulate the motor excitation. The following diagram illustrates this configuration, where the drive managing the excitation (-FC) is controlled by the TPD500, which handles the motor armature control.

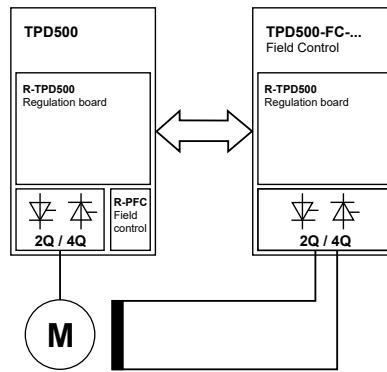


Figure 7-3: Motor control with an external drive for excitation regulation

For large motors and applications where fast direction changes are not required, the following **2B+E configuration** may be a suitable option.

In this setup, the **TPD500** operates in two-quadrant mode (**2Q**), while the direction reversal is achieved by switching the excitation polarity using the four-quadrant (**-FC**) converter, which regulates the excitation.

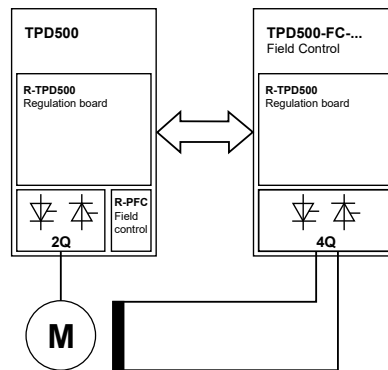


Figure 7-4: 2B+E configuration – two-quadrant converter combined with a four-quadrant -FC for direction reversal

NOTE!

The diagrams show the **TPD500-FC-...** as the field current controller (this version is currently unavailable), but a **TPD32-EV-FC** can also be used instead.

7.2 Main commands

The main commands of the drive are essential for its operation and can be a combination of digital inputs and commands received via keypad or fieldbus. The available commands are:

Table 7-1: Main control signals

Enable drive	Converter enable
Start	Regulation enable
Fast stop	The speed reference is immediately set to zero to stop the motor in a short (programmable) time
External fault	Triggers an alarm if an external fault is detected

A more detailed description of the commands and their logic is provided in the following paragraphs.

7.2.1 Commands via digital input

The following digital inputs must always be present to operate the drive, regardless of the selected operating mode. Wiring can be done as shown in the diagram; for detailed information on wiring and electrical data, refer to **Chapter 4 – ELECTRICAL CONNECTION**.

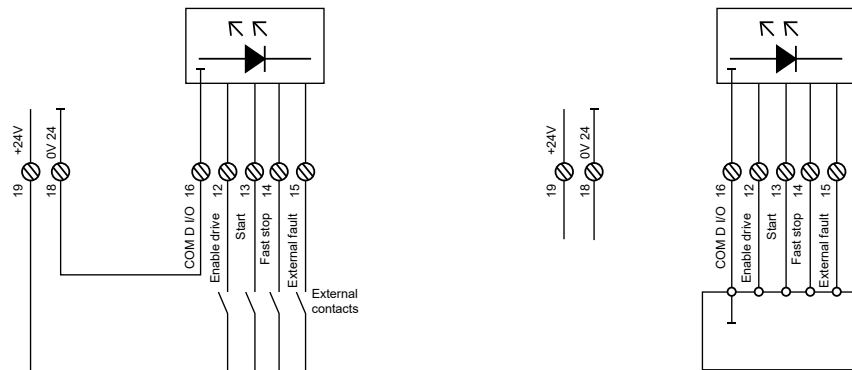


Figure 7-5: Example of digital input wiring

NOTE!

The **Enable drive** and **Start** signals use positive logic (active high), while the **Fast stop** and **External fault** signals use negative logic (active low). If the Fast stop and External fault signals are not used, they can be disabled by wiring them directly to the high potential (+24 V).

If parameter IPA 500-**Mains commands** is set to *Digital*, in addition to the signals described above, commands via keypad or fieldbus are also required.

If a fault is triggered by removing a signal from a terminal, to perform a new start, the signal must be restored at the corresponding terminal and the related command must also be sent via keypad or fieldbus.

7.2.2 Drive enable

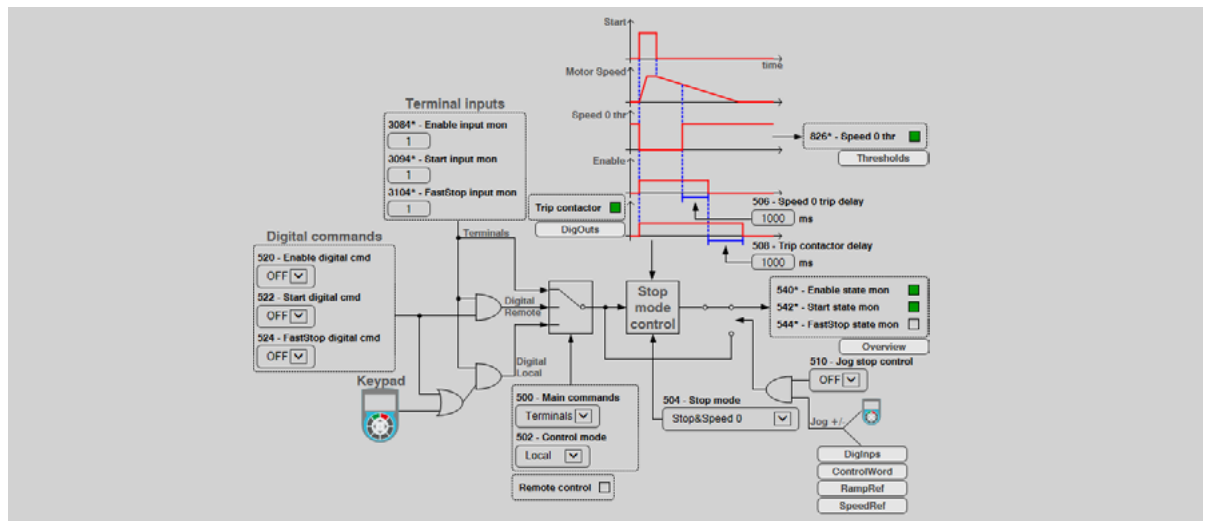


Figure 7-6: Drive control diagram (Commands diagram)

Drive enabling, as shown in the diagram, is achieved by applying a positive signal to the **Enable drive** terminal when parameter IPA 500-**Mains commands** is set to *Terminals*. If the parameter is set to *Digital*, enabling is determined by the logical AND between the digital input and parameter IPA 520-**Enable digital cmd** (available in the **COMMANDS** menu). The different configurations and states are summarized in the table below, which applies when parameter IPA 504-**Stop mode** is set to *OFF*.

Table 7-2: Drive command configurations

Main commands	Control mode	Enable HW (Digital in)	Enable parameter IPA 520 (keypad, WEG_DriveLabs)	Enable parameter IPA 520 (fieldbus)	Enable state
-	-	L	-	-	OFF
Terminals	-	H	-	-	ON
Digital	Local	H	L	-	OFF
Digital	Local	H	H	-	ON
Digital	Remote	H	-	L	OFF
Digital	Remote	H	-	H	ON

The user can check the drive enable status via parameter IPA 540-**Enable state mon**, available in the **MONITOR** menu.

NOTE!

When the drive is not enabled, no other commands are accepted (e.g. Jog +, Jog –, or Start).

NOTE!

If the **Enable drive** command is removed while the drive is operating, the motor will coast to a stop. Braking or controlled deceleration using the configured ramp time is therefore not possible.

7.2.3 Start/stop

When parameter IPA 500-**Main commands** is set to *Digital*, parameter IPA 522-**Start digital cmd** (ON-OFF) is used to start or stop the converter, similarly to the START and STOP keys on the keypad.

NOTE!

For the drive to operate, the **Start** command is only effective if the **Enable drive** signal is also present.

The behaviour of the drive in response to the **Start** command depends on the parameter settings:

- When using the ramp function (IPA 2000-**Ramp enable** to *ON* and IPA 800-**Speed reg enable** to *ON*). If the **Start** command is removed, the drive decelerates to a stop according to the deceleration time.
- When the ramp is disabled (IPA 2000-**Ramp enable** set to *OFF* and IPA 800-**Speed reg enable** set to *ON*) the speed reference set by IPA 1850-**Speed ref 1 dig** is sent directly to the speed controller. After the **Start** command is given, the drive immediately reaches the desired speed. If the command is removed, the speed is brought to zero. However, the **Start** command does not affect the correction value set by IPA 1860-**Speed ref 2 dig**.
- In current control mode (IPA 800-**Speed reg enable** set to *OFF*) the **Start** command enables the current references set by IPA 1900-**C/T ref 1 dig** and IPA 1910-**C/T ref 2 dig**.

The **Start** command is not required for jog operation.

If the **Start** and **Jog +/-** commands are issued simultaneously, the **Start** command has higher priority and can interrupt jog motion.

The **Start** status can be monitored in the **MONITOR** menu via parameter IPA 542-**Start state mon**.

7.2.4 Fast stop

For the converter to operate, the **Fast stop** signal must always be present, regardless of the selected operating mode (*Terminals* or *Digital*).

This signal can be used in emergency or hazardous situations to stop the machine quickly and in a controlled manner.

If this signal is removed while the drive is operating, a deceleration is triggered using the ramp configured by parameters IPA 2032-**FastStop speed** and IPA 2034-**FastStop time** in the **RAMPS** menu.

Once the motor has stopped, the drive remains enabled and torque is still applied. To disable it, the **Start** and/or **Enable drive** commands must be removed.

The behaviour after a **Fast stop** depends on the selected operating mode:

- Operation via terminal block. (IPA 500-**Main commands** set to *Terminals*).
The drive remains in braking condition as long as there is no voltage on terminal **14** (Fast stop).
Once voltage is restored on this terminal, the drive automatically restarts with the configured reference, provided all other enabling conditions are still valid.
- Operation via parameters. (IPA 500-**Main commands** set to *Digital*):
The drive remains in braking condition until it reaches zero speed.
When voltage is restored on terminal **14** (Fast stop), the drive does not restart automatically; it will only restart if a new **Start** command is issued via parameter IPA 522-**Start digital cmd**.
If the **Fast stop** is triggered via parameter IPA 524-**FastStop digital cmd** in the **COMMANDS** menu while terminal **14** (Fast stop) still has voltage, the drive is brought to zero speed.
To restart the drive, the state of IPA 524-**FastStop digital cmd** must be toggled, and a new **Start** command must be issued via IPA 522-**Start digital cmd**.

The **Fast stop** status can be monitored in the **MONITOR** menu via parameter IPA 544-**FastStop state mon**.

NOTE!

When **Fast stop** is active, the keypad displays the message Fast stop active, and once zero speed is reached, the **n=0** LED starts flashing.



7.2.5 External Fault

The **External fault** command allows the integration of an external fault signal into the converter's diagnostics and alarm system, using a dedicated digital input (active low on terminal **15**).

The converter's behaviour upon detection of an external fault depends on the parameter settings in the **ALARM CONFIG \ EXTERNAL FAULT** menu.

7.3 Monitor

The **MONITOR** menu displays the main variables used to check the system status: measured voltage, frequency, current, and speed values; applied references; overall digital I/O status; and system variables.

Some measurements are processed through a low-pass filter to provide more stable readings. In such cases, in addition to the actual measured value, a parameter representing the filter time constant is also available.

The parameters available in the **MONITOR** menu are described in the following list:

IPA		DESCRIPTION
200	Mains Voltage	Mains voltage in [V]
202	Mains Frequency	Mains frequency in [Hz]
210	Armature voltage	Armature voltage in [V]
214	Armature current [%]	Armature current as a percentage of the motor's rated armature current. This parameter can be displayed in dual units [%]-[A]
222	Armature current [A]	Armature current in [A]
216	Arm current filter	Time constant of the low-pass filter applied to the displayed armature current
1342	Field current [%]	Field current as a percentage of the motor's rated field current. This parameter can be displayed in dual units [%]-[A]
1344	Field current	Field current in [A]
220	Output power	Output power from the converter in [kW]
234	Motor speed	Motor speed in [rpm]
236	Motor speed filter	Time constant, in seconds, of the low-pass filter applied to the displayed motor speed
1020	Armature current ref	Armature current reference as a percentage of the motor's rated armature current. This parameter can be displayed in dual units [%]-[A]
1340	Field reference	Flux reference as a percentage of the motor's rated flux
1338	Field current ref	Field current reference as a percentage of the motor's rated field current
1820	Ramp reference	Ramp input reference in [rpm]
2048	Ramp output	Ramp output value in [rpm]
1870	Speed reference	Final speed reference in [rpm], input to the speed controller
3084	Enable input mon	Enable terminal (terminal 12) status monitor
3094	Start input mon	Start terminal (terminal 13) status monitor
3104	FastStop input mon	Fast stop terminal (terminal 14) status monitor
3114	Ext fault input mon	External fault terminal (terminal 15) status monitor
3196	Digital input mon	Overall digital input status display using the format I: 1 2 3 4 5 6 7 8 E S F X , where only active inputs (i.e., those with voltage applied) are shown by their number (1–8) or letter E = Enable, S = Start, F = Fast stop, X = External fault. For example, I: 4 7 S X means that only digital inputs 4 and 7, and the Start and External fault signals are active (high logic level).
3296	Digital output mon	Overall digital output status display using the format O: 1 2 3 4 5 6 7 8 R1 R2 , where only active outputs are shown by their number (1–8) or by letter R1 = Relay 1, R2 = Relay 2. For example, O: 2 3 5 6 R2 means that only digital outputs 2, 3, 5, 6, and R2 are active (high logic level).
540	Enable state mon	Drive Enable status monitor
542	Start state mon	Drive start status monitor
544	Start state mon	Drive Fast Stop status monitor

4770 First Alarm Code

Identification code of the first alarm that occurred. Refer to **chapter 9.1 - Alarm indications** for code interpretation, possible causes and solutions:

- 0 No alarm
- 1 Failure supply
- 2 Undervoltage
- 3 Overvoltage
- 4 Speed fbk loss
- 5 Heatsink
- 6 External fault
- 8 Overcurrent
- 9 Sustained curr
- 10 Power down
- 12 SCR open
- 13 Motor overtemp
- 14 Bus loss
- 16 Field loss
- 18 Enable seq err
- 19 Brake fault
- 20 Motor overload
- 21 Overspeed
- 22 Delta freq err
- 23 Drive overload
- 24 SCR short
- 33 PLC alarm 1 (alarm configurable with **WEG_DriveLogic** applications)
- 34 PLC alarm 2 (alarm configurable with **WEG_DriveLogic** applications)
- 35 PLC alarm 3 (alarm configurable with **WEG_DriveLogic** applications)
- 36 PLC alarm 4 (alarm configurable with **WEG_DriveLogic** applications)
- 37 PLC alarm 5 (alarm configurable with **WEG_DriveLogic** applications)
- 38 PLC alarm 6 (alarm configurable with **WEG_DriveLogic** applications)
- 39 PLC alarm 7 (alarm configurable with **WEG_DriveLogic** applications)
- 40 PLC alarm 8 (alarm configurable with **WEG_DriveLogic** applications)
- 41 PLC cfg error

NOTE!

In the **WEG_DriveLabs** configurator, in addition to the alarm code, the corresponding string is also displayed in the form of a numerical code [alarm description string], for example, in the case of an Undervoltage alarm, the parameter is displayed as **2 [Undervoltage]**.

NOTE!

If the alarm is reset, the parameter continues to display the alarm code until the alarm is reset after the alarm condition has been cleared (by pressing the **RST** button on the keypad, by a digital input configured as **Alarm reset** at logic high level, or by automatic restart of the alarm without user intervention, in which case the value returns to 0.

NOTE!

The **First Alarm code** parameter can be transmitted via the cyclic fieldbus channels (PDO) by assigning it to one of the parameters **IPA 6220-Fieldbus SM 1 ipa...IPA 6170-Fieldbus SM 16 ipa** in the **COMMUNICATION\FIELDBUS SM** menu.

In the standard delivery configuration, the devices are set up for speed control with cascaded current regulation, according to the following general **Overview** block diagram, where the above-mentioned monitor parameters are shown.

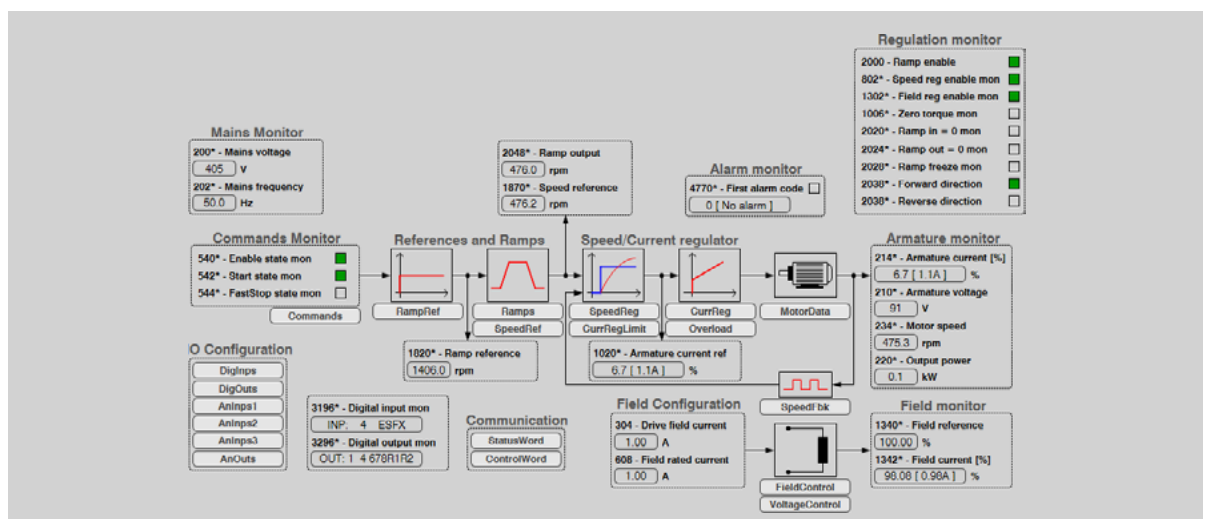


Figure 7-7: Overview diagram

7.4 Drive information

The **DRIVE INFO** menu displays product information useful for software-level identification. The parameters available in the **DRIVE INFO** menu are described in the following list:

IPA		DESCRIPTION
172	Drive series	Product series identification string
174	Firmware version	Product firmware version, in the format <i>x.y.z</i>
176	Firmware version DSP	Product control firmware version, in the format <i>x.y.z</i>
182	Boot version	Product boot firmware version, in the format <i>x.y.z</i>
180	Boot version DSP	Product control boot firmware version, in the format <i>x.y.z</i>
184	Application name	String containing the name of the loaded application, if any (e.g., <i>PID</i> or <i>TW</i> for Torque Winder)
194	Application type	Application ID code developed with WEG_DriveLogic
192	Application version	Application version developed with WEG_DriveLogic , in the format <i>x.y.z</i>
490	Time drive power on	Converter power-on time, in <i>h.min</i> format
492	Time drive enable	Converter enable time, in <i>h.min</i> format
494	Number power up	Number of converter power-on cycles
440	Product S/N	Product serial number
444	Regulation S/N	Control board serial number
9600	MAC address	MAC address of the network interface associated with the R-TPD500 control board for EtherNet communication

NOTE!

The parameters **Time drive power on**, **Time drive enable** and **Number power up** retain their values even after the drive is powered off and restarted, without requiring manual parameter saving.

7.5 Drive type

The **DRIVE TYPE** menu includes parameters related to the configuration of the product's size and operating mode. The parameters available in the **DRIVE TYPE** menu are described in the following list:

IPA		DESCRIPTION
300	Drive arm current	Displays the converter's rated armature current, expressed in [A], based on the predefined setting of switch S15 on the R-TPD500 control board
302	Drive size set	Allows setting the drive's rated armature current (only in the case of a Control Unit) in the range 4-20000 A. After setting, parameter IPA 300- Drive arm current will match IPA 302- Drive size set
304	Drive field current	Allows setting the drive's rated field current, expressed in [A], and also defines the maximum allowed value for parameter IPA 608- Field rated current , corresponding to the motor's rated field current.
306	Drive mains	Displays the converter's rated armature voltage. Two values are available depending on the drive model: 1 500V 2 690V
308	Drive 2/4 quadrant	Displays the converter model. Two options are available depending on the drive: 0 4B: four-quadrant drive, which accepts both positive and negative speed references 1 2B: two-quadrant drive, which accepts only positive speed references

Allows field reversal to be activated in one of the following modes, only for type 2B drives. If one of these three modes is activated, the ramp, speed and current references function in the same way as a 4B converter.

0 OFF: field reversal not active

1 FC (2B+E): field reversal with 2B configuration + external TPD500-FC exciter.

The drive can be connected to the external exciter via a wired connection or via fiber optics. Depending on the connection method, the drive must be configured as follows:

- Fiber-optic connection

Set IPA 1304-**Field reg mode** to Optic FC volt or Optic FC curr, depending on whether automatic current control is required.

Configure the Optic communication module by setting IPA 5300-Optic mode to Master and selecting FC in 5302/5304/5306/5308 Optic device x to match the drive's -FC setting.

- Wired connection

Set IPA 1304-**Field reg mode** to Ext **wired FC** volt or **Ext wired FC** curr, depending on whether automatic field weakening is required.

Configure a digital input destination to **Wired FC enable**, indicating the enable status of the external **TPD500-FC** unit.

Set digital input destination to **Wired FC inv seq**, indicating the bridge inversion status of the external **TPD500-FC** unit.

Configure a digital input destination to **Wired FC active brg**, indicating which bridge (positive or negative) is currently active in the external **TPD500-FC** unit.

Set an analog output selection to **Wired FC ref**, representing the field current reference for the external **TPD500-FC** unit.

The external TPD500-FC unit must be parameterized with an I/O signal configuration that mirrors this one.

Table 7-3: TPD500-FC signal management connections

TPD500 (master)			
IPA 3500 An output 1 sel	IPA 3020 Digital input 3 dest	IPA 3010 Digital input 2 dest	IPA 3000 Digital input 1 dest
Wired FC ref	Wired FC act Brg	Wired FC Inv Seq	Wired FC EN
21	33	32	31
1	28	27	26
T current ref 1	Wired FC act Brg	Wired FC Inv Seq	Wired FC EN
IPA 3400 An input 1 sel	IPA 3204 Digital output 3 sel	IPA 3202 Digital output 2 sel	IPA 3200 Digital output 1 sel
TPD500-FC			

NOTE!

NOTE!

The wired connection is compatible with the TPD32-EV drive series, whereas the fiber-optic connection is only compatible between products of the TPD500 series.

2 Field contactors

This feature allows to reverse the direction of rotation or brake a motor with a 2B drive using suitably wired contactors capable of reversing the field polarity, without having to use an external exciter.

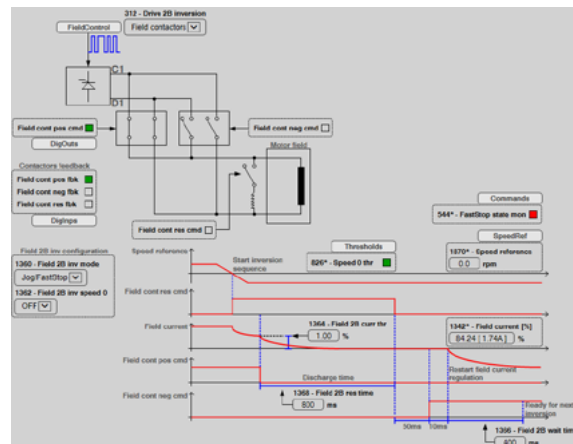


Figure 7-8: Field Regulation Inversion

Since an electromechanical system is used, the dynamic response obtainable with this system is limited, making it suitable for sporadic manual manoeuvres or for controlling systems with slow dynamics.

The reference diagram for using this function is shown in **Figure 7-8: Field Regulation Inversion**, where you can see the use of two interlocked contactors to exchange the field contacts (C1 and D1) and another that activates the discharge resistor.

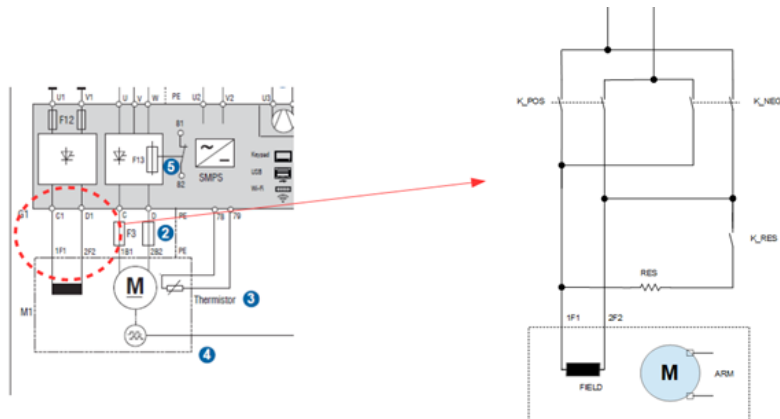


Figure 7-9: Variation of the typical connection diagram for field reversal management via external contactors

Logical diagram for managing field reversal via external contactor

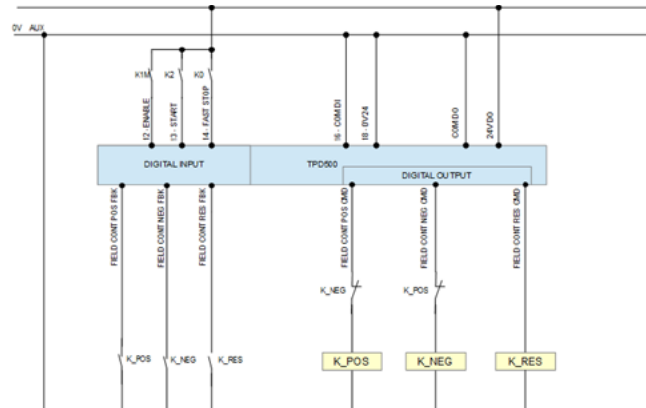


Figure 7-10: I/O logic diagram for field reversal management via external contactors

NOTE!

- POS-NEG interlock
- This is a logical diagram; use the appropriate components and connections in accordance with the electrical data and state-of-the-art rules for the implementation of plant automation.

The timing diagram illustrates the sequence and some of the parameters that can be set:

- The speed regulator requires a current of opposite polarity to the current one, triggering the reversal sequence.
- Insertion of the discharge resistor (which is currently bypassed by the recirculation diode of the semi-controlled bridge). Once the IPA 1364-**Field 2B curr thr** threshold is reached, the system moves on to the next state.
- The contactor is opened, allowing any current still circulating in the discharge resistor to flow until the IPA 1368-**Field 2B res time** expires.
- The discharge resistor contactor is opened and a preset time of 50 ms is waited for.
- Closing of the contactor in the opposite direction and waiting for a preset time of 10 ms.
- Activation of the field current regulation and waiting for a 'wait' time that can be set with the IPA 1366 - **Field 2B wait time** parameter, within which it is not possible to start a new reversal.
- Drive ready for another polarity change.

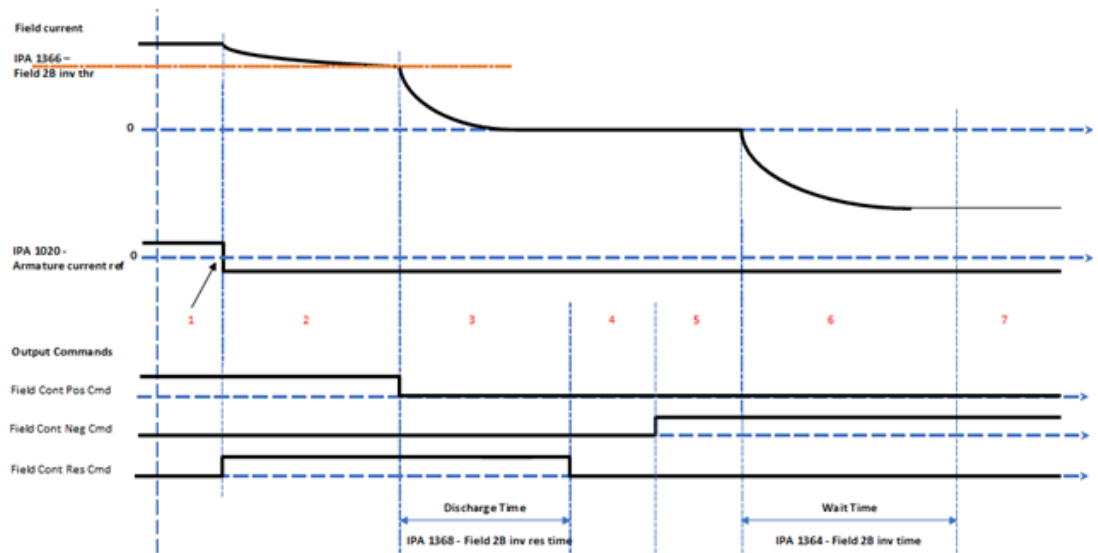


Figure 7-11: Timeline diagram of the field reversal

To avoid short circuits, the contactors must be interlocked as shown in **Figure 7-9**. It is also recommended to provide contactor feedback to prevent a fault or sticking of the contactor contacts from causing faults that could damage the system or machine. The TPD500 is able to monitor this feedback, interrupting the reversal procedure in the event of inconsistencies and generating a Field Loss fault.

To activate contactor feedback control, simply set the destination of the digital input to which the feedback is connected:

- Field cont pos cmd** for the contactor that allows a positive field current.
- Field cont neg cmd** for the contactor that allows a negative field current.
- Field cont res cmd** to monitor the status of the contactor that engages and disengages the discharge resistor.

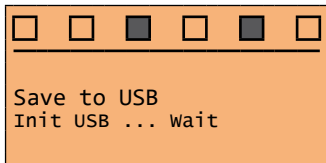
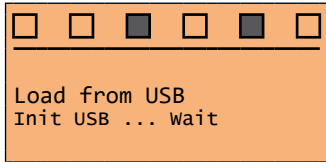
7.6 Startup Wizard

The **STARTUP WIZARD** menu provides access to the guided commissioning procedure of the drive. For more details, refer to [Chapter 6.2 – Commissioning](#).

7.7 Drive configuration

The **DRIVE CONFIG** menu contains a set of general-purpose parameters used for system-level drive management and configuration.

The parameters available in the **DRIVE CONFIG** menu are described in the following list:

IPA		DESCRIPTION
400	Full scale speed	Speed full scale, expressed in [rpm]
470	Load default	Command to restore parameters to factory default values. This operation is only possible when the converter is disabled. After executing the command, a parameter save must be performed before restarting; otherwise, the default values will be lost
460	Save parameters	Command to save parameters to permanent memory. Any changes made to parameter values take effect immediately on the converter's behaviour and operation, but are not automatically stored in permanent memory. Therefore, this command must be executed if the modified parameter values are to be retained after power-off and restart
472	Drive reset	Software restart command, available only when the converter is disabled.
466	Application enable	Enables the application eventually loaded on board the drive (e.g., PID or Torque Winder).
462	Access level	Parameter to enable the SERVICE menu, access to which is password-protected and reserved for WEG technical support personnel. When the password is enabled, the access level is shown as "Service"; otherwise, it is shown as "Expert".
482	Display backlight	Enables the keypad display backlight to remain on for the entire time the drive is powered. If set to <i>OFF</i> , the display still lights up when the keypad is used and turns off after approximately three minutes of inactivity.
484	Display startup	Allows configuring what is automatically shown on the keypad display when the drive is powered on. The following values are supported: Any existing IPA: the corresponding parameter will be displayed, as if directly navigated from its respective menu 0: displays the DISPLAY menu (equivalent to pressing the DISP key on the keypad) -1: displays the main menu (default setting)
486	Save to USB	Command to transfer the drive parameters to the memory device connected to the USB port
		
488	Load from USB	Command to transfer into the drive the parameters previously stored on the memory device connected to the USB port
		

NOTE!

The parameter IPA 400-**Full scale speed** defines the minimum and maximum allowable values for the following drive parameters, which are set to twice its value:

- **Ramp references:** IPA 1800-**Ramp ref 1 dig** and IPA 1810-**Ramp ref 2 dig**
- **Speed references:** IPA 1850-**Speed ref 1 dig** and IPA 1860-**Speed ref 2 dig**
- **Speed limits:** IPA 850-**Speed min pos/neg**, IPA 852-**Speed min pos**, IPA 854 - **Speed min neg**, IPA 856-**Speed max pos/neg**, IPA 858-**Speed max pos**, and IPA 860-**Speed max neg**
- **Multi-speed settings:** IPA 4152-**Multi speed 1**, IPA 4154-**Multi speed 2**, IPA 4156-**Multi speed 3**, IPA 4158 - **Multi speed 4**, IPA 4160-**Multi speed 5**, IPA 4162-**Multi speed 6**, and IPA 4164-**Multi speed 7**
- **Auxiliary functions:** IPA 954-**Adaptive ref dig**, IPA 4052-**Jog ref dig**, IPA 4008-**Motorpot bottom lim**, IPA 4010-**Motorpot top lim**, IPA 4408-**Droop limit**
- **Brake open/close references and thresholds:** IPA 4104-**Fwd open speed thr**, IPA 4106-**Fwd open speed ref**, IPA 4108-**Fwd close speed ref**, IPA 4112-**Rev open speed thr**, IPA 4114-**Rev open speed ref**, and IPA 4116-**Rev close speed ref**
- **Speed thresholds:** IPA 812-**Speed 0 level**, IPA 816-**Speed thr pos**, IPA 818-**Speed thr neg**, IPA 822-**Speed set error**, and IPA 920-**Speed ref 0 level**

NOTE!

The parameter IPA 400-**Full scale speed** also defines the full scale of the analog inputs, when they are configured to assign a speed.

NOTE!

The parameter IPA 400-**Full scale speed** also defines the full scale of the analog outputs, when they are configured to be assigned by a speed.

NOTE!

The parameter IPA 400-**Full scale speed** also defines the reference level for the amplitude and offset of the Test generator function, when it is configured to act on ramp or speed references.

NOTE!

The parameters IPA 486-**Save to USB** and IPA 488-**Load from USB** are not available in the **WEG_DriveLabs**

7.8 Commands

The **COMMANDS** menu contains parameters used to manage the drive command signals in various modes. The parameters available in the **COMMANDS** menu are described in the following list:

IPA	DESCRIPTION
500 Main commands	Allows you to choose the origin of the drive command signals. Two selections are possible: 0 Terminals: command signals come exclusively from terminal block 1 Digital: command signals come from a digital channel (but commands from terminal block are still required)
502 Control mode	Allows the selection of the digital channel from which the control signals originate in Digital mode. Two selections are possible: 0 Local: control signals come from keypad and/or WEG_DriveLabs configurator 1 Remote: control signals come from fieldbus

The parameter IPA 504-**Stop mode**, if set to a value other than *OFF*, allows the line contactor to be coordinated with the converter's enable status.

In this case, after a stop command is issued, the motor speed decreases to 0 rpm, triggering the **Speed 0 thr** output (in the **THRESHOLDS** menu). This causes the converter to be disabled after the **Speed 0 trip delay** time. From that moment, after the Trip contactor delay time, the digital output Trip contactor is deactivated.

The parameter IPA 3218-**Relay 2 sel**, which controls the relay on terminals 75-76 (in the **DIGITAL OUTPUTS** menu), is set by default to **Trip contactor**. As a result, this relay output can be used to control the line contactor in sync with the converter's enable/disable state.

It is therefore possible to define the following operating modes, assuming that the **Enable drive** command is always present:

- **Stop mode = Stop&Speed 0**: the Start command controls operation. If the **Start** command is not active and the drive is stopped, the converter is disabled and the **Trip contactor output** is open (0 V, logic low). When the **Start** command is issued, the converter is enabled and the contact closes (24 V, logic high). If the **Start** command is removed again, once the speed reaches 0 rpm (Speed 0 thr), the converter is disabled after the **Speed 0 trip delay** time. The **Trip contactor output** then opens again after the **Trip contactor delay**, causing the line contactor to open.

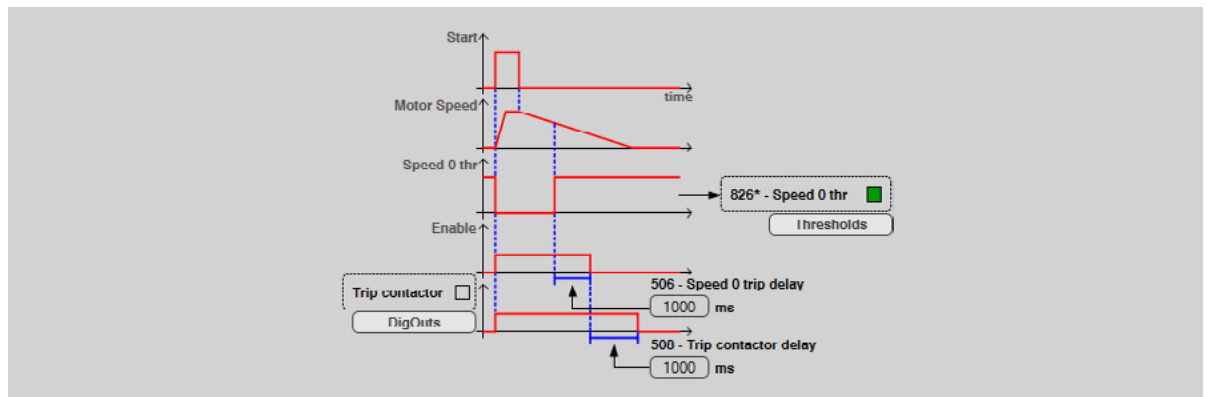


Figure 7-13: Operation when Stop mode = Stop&Speed 0

- **Stop mode = Fstop&Speed 0**: the **Fast stop** command controls operation. If the **Fast stop** command is active (active low, 0 V on terminal 14) and the drive is stopped, the converter is disabled and the Trip contactor output is open (0 V, logic low). When the **Fast stop** command is deactivated (24 V on terminal 14), the converter is enabled and the contact closes (24 V, logic high). If the **Fast stop** command is activated again, once the speed reaches 0 rpm (Speed 0 thr), the converter is disabled after the Speed 0 trip delay time. The **Trip contactor output** then opens again after the **Trip contactor delay**, causing the line contactor to open.

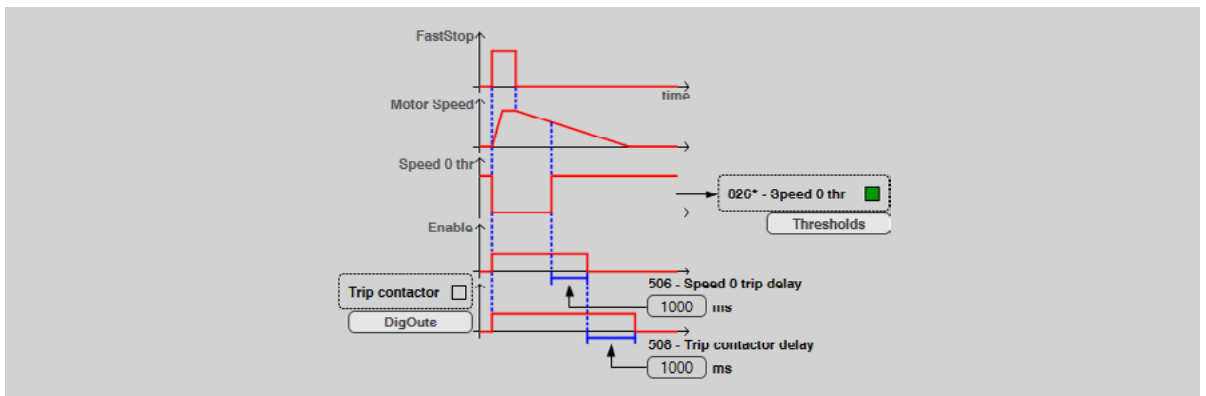


Figure 7-14: Operation when Stop mode = Fstop&Speed 0

- **Stop mode = Stop/Fstop&Speed 0**: the **Start** or **Fast stop** commands control operation. If the **Start** command is not active or the **Fast stop** command is active (active low, 0 V on terminal 14) and the drive is stopped, the converter is disabled and the Trip contactor output is open (0 V, logic low). When the **Start** command is issued or the **Fast stop** command is deactivated (24 V on terminal 14), the converter is enabled and the contact closes (24 V, logic high). If the **Start** command is removed again or the **Fast stop** command is activated, once the speed reaches 0 rpm (**Speed 0 thr**), the converter is disabled after the **Speed 0 trip delay** time. The **Trip contactor output** then opens again after the **Trip contactor delay**, causing the line contactor to open.

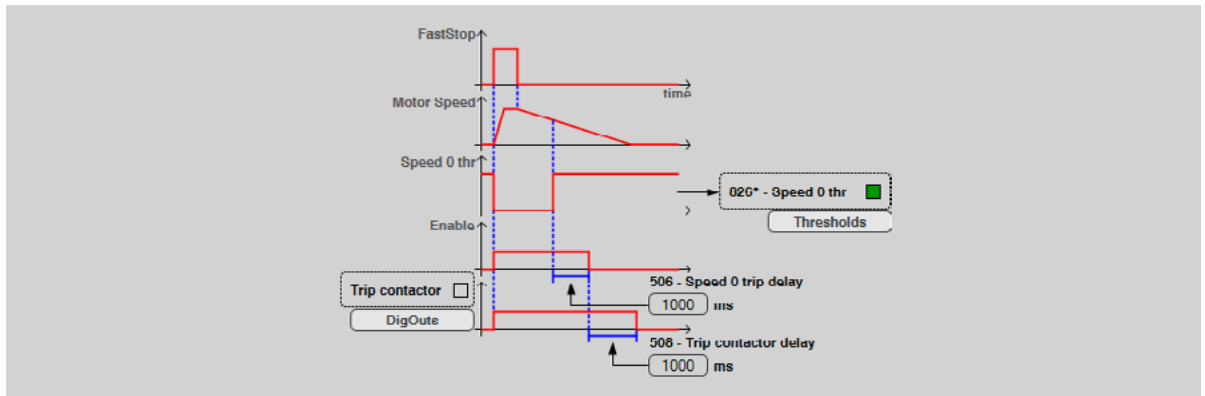


Figure 7-15: Operation when Stop mode = Stop/Fstop&Speed 0

NOTE!

The IPA 500-**Main commands** parameter can only be changed from *Digital* to *Terminals* if the **Enable drive** terminal (12) is not powered.

If the IPA 500-**Main commands** parameter is set to *Digital*, a **disable** command caused, for example, by removing the signal from the **Enable drive** terminal (12) means that, in order to obtain a new enable, it is necessary not only to restore the voltage on the relevant terminal but also to make a new transition from *OFF* to *ON* of the relevant digital command IPA 520 - **Enable digital cmd**.

If the IPA 500-**Main commands** parameter is set to *Digital*, a **Stop** command caused, for example, by removing the signal from the **Start** terminal (13) means that in order to obtain a new **Start**, it is necessary not only to restore the voltage on the relevant terminal but also to make a new transition from *OFF* to *ON* of the relevant digital command IPA 520-**Start digital cmd**.

NOTE!

If the IPA 500-**Main commands** parameter is set to **Digital** mode, the IPA 502-**Control mode** parameter can only be changed from **Local** to **Remote** if the **Enable drive** terminal (12) is not powered.

The **WEG_DriveLabs** configurator allows the drive to be controlled in *Digital + Local* mode through an intuitive graphical interface, which can be opened by selecting the Keypad command from the Toolbar.

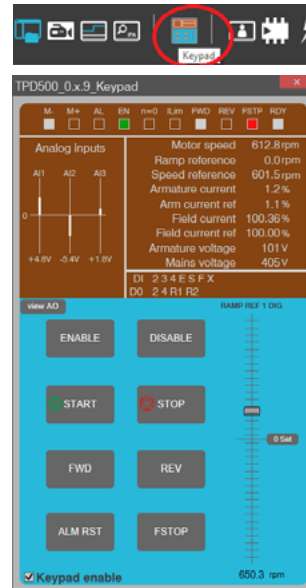


Figure 7-16: Keypad interface on PC

NOTE!

A virtual panel is opened, providing access to all drive commands and monitoring information. By enabling the Keypad enable checkbox, the panel becomes active. In this case, the parameters IPA 500-**Main commands** and IPA 502-**Control mode** are automatically set to *Digital* and *Local*, respectively, allowing the following commands to be managed:

- **ENABLE**: drive enable command
- **DISABLE**: drive disable command
- **START**: drive start command
- **STOP**: drive stop command
- **FWD**: forward direction selection
- **REV**: reverse direction selection
- **ALM RST**: alarm reset
- **FSTOP**: fast stop command

The panel display shows status LEDs and all monitoring data related to:

- Digital I/O (sections **DI** and **DO**)
- Analog I/O (sections **view AI** and **view AO**, which are mutually exclusive and selectable via the corresponding button)
- Main control variables, including:
 - **Motor speed**: filtered motor speed in [rpm]
 - **Ramp reference**: ramp reference in [rpm]
 - **Speed reference**: speed reference in [rpm]
 - **Armature current**: filtered armature current in [%]
 - **Armature current ref**: armature current reference in [%]
 - **Field current**: field current in [%]
 - **Field current ref**: field current reference in [%]
 - **Armature voltage**: armature voltage in [V]
 - **Mains voltage**: mains voltage in [V]

A scroll bar also allows control of the motor speed by adjusting the value of **Ramp ref 1 dig**.

This reference can be modified manually or instantly reset to 0 rpm using the **0 Set** command. For this control to be effective, the reference must not be assigned via an analog input.

NOTE!

When the panel is closed or disabled, the IPA 500-**Main commands** and IPA 502-**Control mode** parameters are automatically reset to their initial values.

NOTE!

When the panel is enabled, it is recommended not to change the IPA 500-**Main commands** and IPA 502-**Control mode** parameters from the keypad or the configurator: if this happens, the keypad will be automatically disabled.

NOTE!

If no direction is assigned, both the **FWD** and **REV** LEDs flash red.

7.9 Motor data

In the **MOTOR DATA** menu, you can find the parameters used to set the motor nameplate data, which are required for the correct operation of the drive and must be configured during the initial commissioning phase.

The parameters available in the **MOTOR DATA** menu are described in the following list:

IPA		DESCRIPTION
600	Motor rated speed	Motor rated speed, expressed in [rpm]
602	Motor max speed	Motor maximum speed, expressed in [rpm]
604	Arm rated current	Motor rated armature current, expressed in [A]
606	Arm rated voltage	Motor rated armature voltage, expressed in [V]
608	Field rated current	Motor rated field current, expressed in [A]
612	Motor EMF constant	Motor back EMF constant, expressed in [V/rpm]

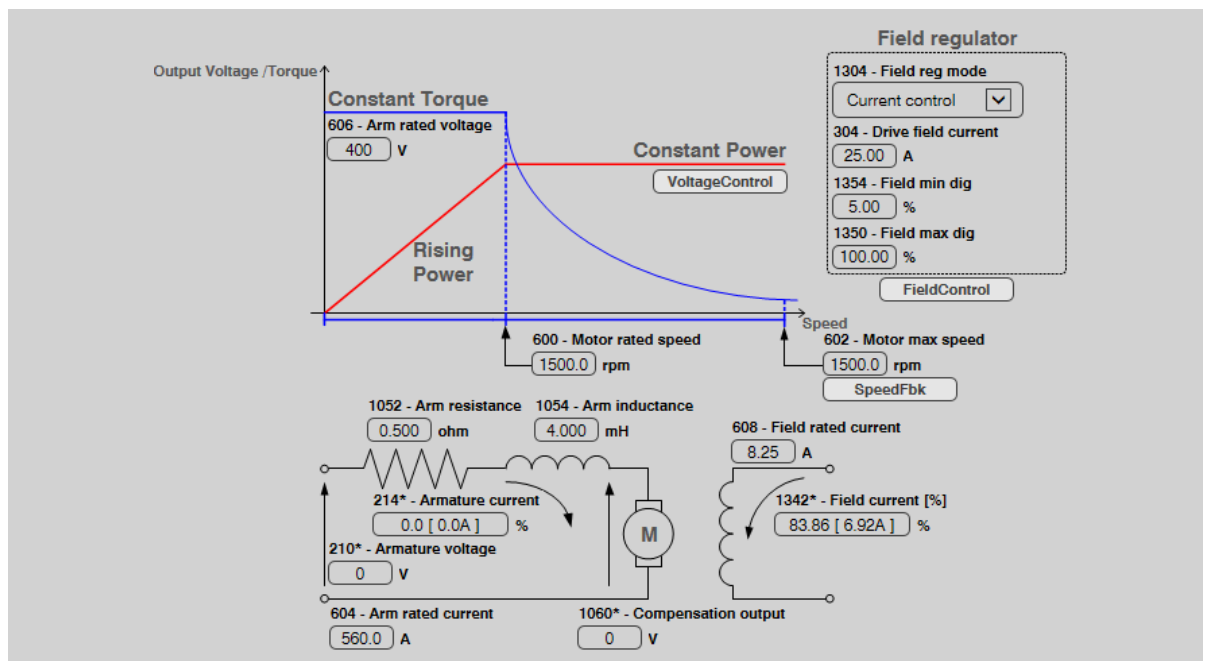


Figure 7-17: Motor Data diagram

7.10 References management

The **REFERENCES** menu provides parameters for managing the programmable ramp, speed, and current/torque references used to set the reference values for speed and/or current control of the converter.

Each of the three reference types is managed through a dedicated submenu, as detailed below.

7.10.1 Ramp reference

The ramp reference sets the target speed the drive must reach at the end of the acceleration phase. Changes to the ramp reference are followed according to the configured ramp times. The ramp reference value determines the motor speed. For four-quadrant drives (**4B**), the direction of rotation is determined by the sign of the reference. In contrast, two-quadrant drives (**2B**) accept only positive references; negative values are interpreted as zero, as indicated by parameter IPA 308 - **Drive 2/4** quadrant in the following diagram.

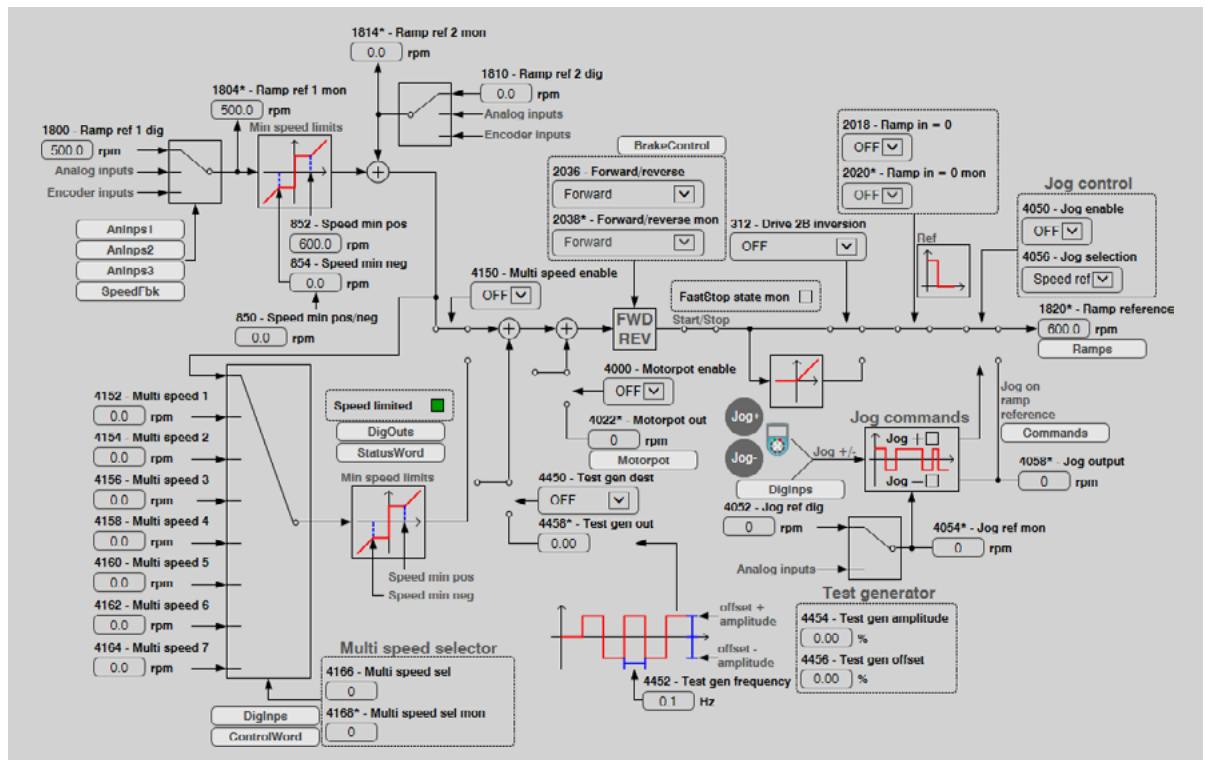


Figure 7-18: Ramp reference diagram

In the **REFERENCES\RAMP REF** menu, parameters are available for configuring the two programmable ramp references used to set the converter's ramp reference.

IPA		DESCRIPTION
1800	Ramp ref 1 dig	Ramp reference 1, expressed in [rpm]
1804	Ramp ref 1 mon	Monitor of ramp reference 1, which can also be assigned via: - Analog inputs 1, 2, or 3 - Encoder 1 or 2 - Fieldbus
1810	Ramp ref 2 dig	Ramp reference 2, expressed in [rpm]
1814	Ramp ref 2 mon	Monitor of ramp reference 2, which can also be assigned via: - Analog inputs 1, 2, or 3 - Encoder 1 or 2 - Fieldbus

To assign references via analog inputs, voltage and/or current signals can be used: ± 10 V, 0–20 mA / 0–10 V, or 4–20 mA. References set via current signals are unipolar and are used only with two-quadrant drives (**2B**).

The parameter IPA 1820 - **Ramp reference** (in the **MONITOR** menu) represents the total ramp reference input to the ramp function (in the **RAMPS** menu).

Under standard factory settings, it corresponds to the sum of the two ramp references (**Ramp ref 1 mon** + **Ramp ref 2 mon**), after the drive is enabled and the **Start** command is issued.

However, other parameters applied in cascade may influence the magnitude and sign of the reference, as shown in the diagram (see Figure 6-14), including:

IPA	DESCRIPTION
2036 Forward/reverse	Allows you to change the sign of the ramp reference (RAMPS menu). Four selections are possible: 0 No (Fwd L-Rev L): the reference is reset, the direction is not assigned 1 Forward: the reference is not altered 2 Reverse: the reference is inverted (multiplied by -1) 3 No (Fwd H-Rev H): the reference is reset to zero, the direction is not assigned Selections 0 and 3 are equivalent, however, in the case of direction assignment via dedicated bits of the Control word (see section 6.19.6) if the Forward and Reverse bits are both set to 0 or both to 1, a conflict arises in the direction, which is therefore not assigned, for example in the case where: IPA 6454 - Control word 0 dest = <i>Forward</i> IPA 6456 - Control word 1 dest = <i>Reverse</i> • If Control word bit 0 = 0 (L) and Control word bit 1 = 0 (L) you get IPA 2038 - Forward/reverse mon = IPA 2036 - Forward/reverse = <i>No (Fwd L-Rev L)</i> • If Control word bit 0 = 1 (H) and Control word bit 1 = 0 (L) you get IPA 2038 - Forward/reverse mon = IPA 2036 - Forward/reverse = <i>Forward</i> • If Control word bit 0 = 0 (L) and Control word bit 1 = 1 (H) you get IPA 2038 - Forward/reverse mon = IPA 2036 - Forward/reverse = <i>Reverse</i> • If Control word bit 0 = 1 (H) and Control word bit 1 = 1 (H) you get IPA 2038 - Forward/reverse mon = IPA 2036 - Forward/reverse = <i>No (Fwd H-Rev H)</i>
2038 Forward/reverse mon	Monitor of the IPA 2036-Forward/reverse command, which can also be assigned by programmable digital inputs (RAMPS menu). Even if the direction is assigned via programmable digital inputs (see chapter 7.17.1), the Forward and Reverse signals, both at low or high logic level, generate a conflict in the direction, which is therefore not assigned, for example in the following case: IPA 3000-Digital input 1 dest = <i>Forward</i> IPA 3010-Digital input 2 dest = <i>Reverse</i> • If Digital input 1 mon = 0 (L) and Digital input 2 mon = 0 (L) you get IPA 2038-Forward/reverse mon = <i>No (Fwd L-Rev L)</i> • If Digital input 1 mon = 1 (H) and Digital input 2 mon = 0 (L) you get IPA 2038-Forward/reverse mon = <i>Forward</i> • If Digital input 1 mon = 0 (L) and Digital input 2 mon = 1 (H) you get IPA 2038-Forward/reverse mon = <i>Reverse</i> • If Digital input 1 mon = 1 (H) and Digital input 2 mon = 1 (H) you get IPA 2038-Forward/reverse mon = <i>No (Fwd H-Rev H)</i>
2018 Ramp in = 0	Monitor for immediate reset of the ramp reference, which can also be assigned by programmable digital inputs (RAMPS menu)
1814 Ramp ref 2 mon	Ramp reference monitor 2, also assignable from: • Analogue inputs 1, 2 or 3 • Encoder 1 or 2 • Fieldbus

The ramp reference can also be set through specialized functions in the **FUNCTIONS** menu:

- **Multispeed** function (**FUNCTIONS\MULTI SPEED**)
- **Motorpotentiometer** function (**FUNCTIONS\MOTORPOT**)
- **Jog** function (**FUNCTIONS\JOG**)
- **Test generator** function (**FUNCTIONS\TEST GENERATOR**)

Finally, the ramp reference is also influenced by the positive and negative minimum speed limits (in the **SPEED CONTROL\SPEED REG LIMIT** menu), which are applied only to **Ramp ref 1 mon** and **Multispeed** references.

7.10.2 Speed reference

The speed reference is processed by a PI controller, which calculates the current required to make the motor rotate at the requested speed. This is only possible if the required current is within the available current limits; otherwise, the drive operates in current limit mode.

For four-quadrant drives (**4B**), the direction of rotation is determined by the sign of the reference. Two-quadrant drives (**2B**), on the other hand, only accept positive references; negative values are interpreted as zero, as indicated by parameter IPA 308 - **Drive 2/4 quadrant** in the following diagram.

7.10.3 Armature current reference

The armature current reference is the input to a current controller, which can be either predictive or PI type. The current reference value is expressed as a percentage of the motor's rated armature current and determines the amount of torque required, while the sign defines the direction.

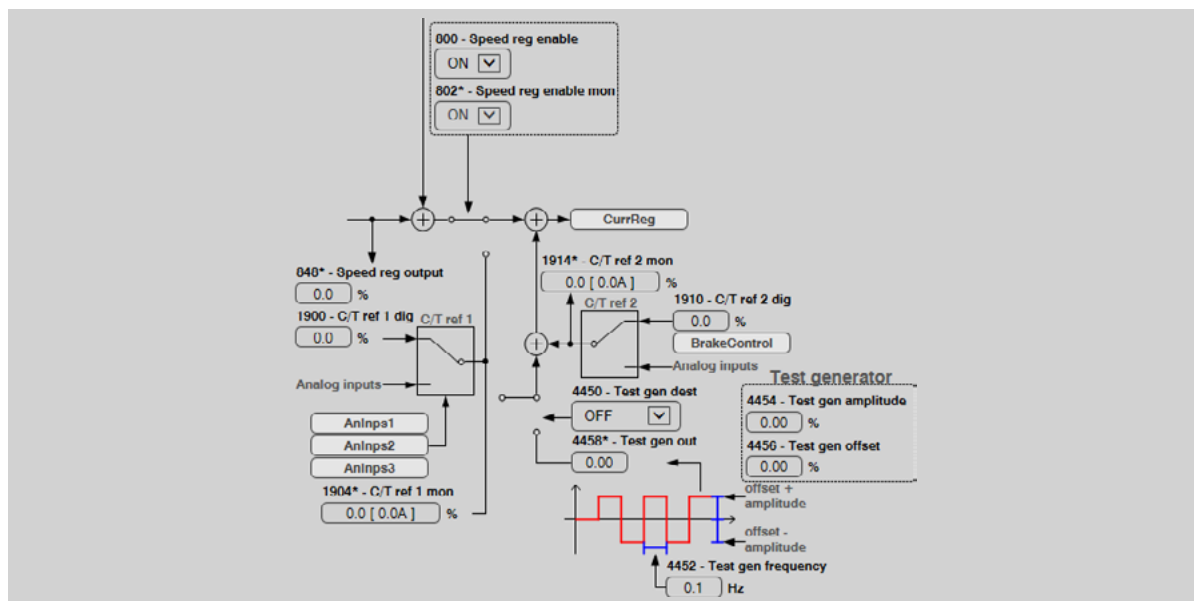


Figure 7-20: Torque reference diagram

In the **REFERENCES\TORQUE REF** menu, parameters are available for configuring the two programmable current/torque references used to set the converter's current reference.

IPA		DESCRIPTION
1900	C/T ref 1 dig	Current reference 1 expressed as a percentage of the motor's rated armature current
1904	C/T ref 1 mon	Current reference monitor 1, also assignable from: - Analogue inputs 1, 2 or 3 - Fieldbus For this parameter, dual unit display is available [%]-[A]
1910	C/T ref 2 dig	Current reference 2 expressed as a percentage of the motor's rated armature current
1914	C/T ref 2 mon	Current reference monitor 2, also assignable from: - Analogue inputs 1, 2 or 3 - Fieldbus For this parameter, dual unit display is available [%]-[A]

To assign references via analog inputs, voltage and/or current signals can be used: ± 10 V, 0–20 mA / 0–10 V, or 4–20 mA. References assigned via current signals are unipolar and are used only with two-quadrant drives (2B).

The parameter IPA 1020 - **Armature current ref** (in the **MONITOR** menu) represents the total armature current reference input to the current controller (in the **CURRENT CONTROL** menu).

Only when speed control is disabled (IPA 800 - **Speed reg enable** = OFF) does it correspond to the sum of the two current references (**C/T ref 1 mon** + **C/T ref 2 mon**), after the drive is enabled and the **Start** command is issued.

However, other parameters applied in cascade may affect the magnitude and sign of the reference, as shown in the diagram (figure 6-16), including:

IPA		DESCRIPTION
800	Speed reg enable	Enables/disables speed control (SPEED CONTROL\SPEED REG menu). If ON is selected, the current reference 1 C/T ref 1 mon is disabled by the chain and is ineffective.
1004	Zero torque	Immediate reset command for the armature current reference, downstream of the two references (CURRENT CONTROL\CURR REG menu)

The armature current reference can also be set through specialized functions in the **FUNCTIONS** menu:

- **Test generator** function (**FUNCTIONS\TEST GENERATOR**)
- **Brake control** function (**FUNCTIONS\BRAKE CONTROL**)

Finally, the armature current reference is also influenced by the current limits (in the **CURRENT CONTROL\CURR REG LIMIT** menu), which are applied downstream in the chain.

For both current references **C/T ref 1 dig** and **C/T ref 2 dig**, the maximum allowable value depends on the overload control setting defined by parameter IPA 4300-**Overload mode** (in the **FUNCTIONS\OVERLOAD** menu):

- If **Overload mode = None**, the maximum value is 100%
- If **Overload mode = I2t Drive, I2t Drive and Motor, or Current limited**, the maximum value is 150%

7.11 Ramp management

The ramp function defines the drive's acceleration and deceleration times, which can be set independently.

For rapid stopping, a **Fast stop** ramp is available, which can be activated via a digital input or a dedicated parameter. The ramp profile can be either linear or S-shaped.

The ramp is managed using the following parameters in the **RAMPS** menu.

IPA	DESCRIPTION
2000 Ramp enable	Enables/disables ramp control of the speed reference. When set to ON , speed reference 1 IPA 1854- Speed ref 1 mon is disabled by the speed reference chain and is ineffective, while when set to OFF , the ramp output IPA 2048- Ramp output in favour of speed reference 1 IPA 1854 - Speed ref 1 mon (see figure 7-17), however, the ramp generator continues to operate and can be used in stand-alone configuration regardless of the Enable , Start and/or Fast stop commands.

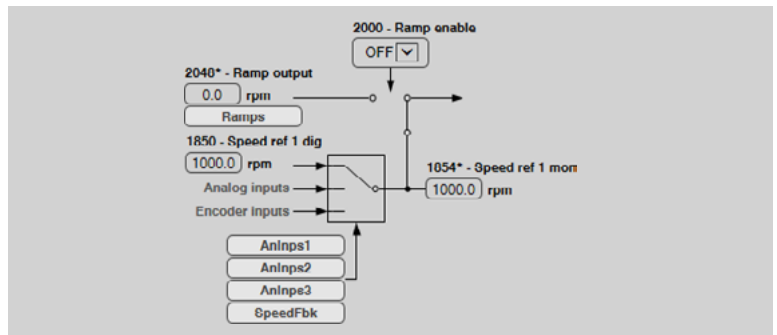


Figura 7-21: Operation of Ramp Enable

2002 Acc speed	Standard ramp acceleration speed expressed in [rpm]
2004 Acc time	Standard ramp acceleration time expressed in [s], representing the time to reach the IPA 2002- Acc speed starting from zero speed with constant increments
2006 Dec speed	Standard ramp deceleration speed expressed in [rpm]
2008 Dec time	Standard ramp deceleration time expressed in [s], representing the time to reach zero speed from the IPA 2006- Dec speed with constant decrements

0 Linear: linear ramp, with constant acceleration defined by the **Acc speed / Acc time ratio** and constant deceleration defined by the **Dec speed / Dec time ratio** (see figure 7-18)

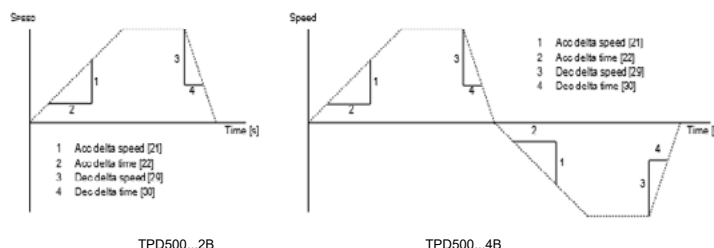


Figure 7-22: Acceleration and deceleration ramps

1 S-shape: S-shaped ramp, with acceleration and deceleration varying linearly over time. Jerk can be used to avoid sudden mechanical changes in the system at the start/end of the acceleration and deceleration phases.

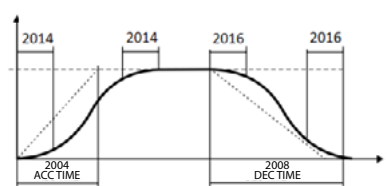


Figure 7-23: Indication of available Jerk parameters

2014	Acc time jerk	Jerk time during acceleration of the S ramp expressed in [ms]
2016	Dec time jerk	Jerk time during deceleration of the S ramp expressed in [ms]
2018	Ramp in = 0	Immediate reset command for the ramp reference
2020	Ramp in = 0 mon	Monitor for the immediate reset command for the ramp reference, which can also be assigned by programmable digital inputs or fieldbus
2022	Ramp out = 0	Immediate reset command for the ramp output
2024	Ramp out = 0 mon	Monitor for immediate reset command of ramp output, which can also be assigned by programmable digital inputs or fieldbus
2026	Ramp freeze	Command to freeze the output value at the ramp, regardless of changes in the input reference
2028	Ramp freeze mon	Monitor for command to freeze the output value at the ramp, which can also be assigned by programmable digital inputs or fieldbus
2030	Ramp +/- delay	Delay time in [ms] on Ramp + and Ramp - signals

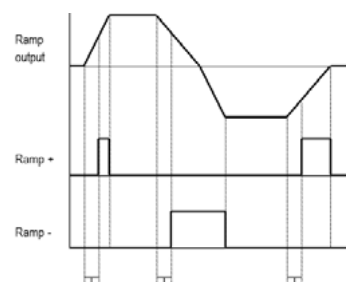


Figure 7-24: Operation of signals dependent on the Ramp delay parameter

2032	FastStop speed	Fast stop ramp deceleration speed expressed in [rpm]
2034	FastStop time	Fast stop ramp deceleration time expressed in [s], representing the time to reach zero speed from the IPA 2032- FastStop speed with constant decrements
2036	Forward/reverse	Command to change the sign of the ramp reference
2038	Forward/reverse mon	Monitor of the IPA 2036- Forward/reverse command, which can also be assigned by programmable digital inputs or fieldbus

The parameter IPA 1820-**Ramp reference** (in the **MONITOR** menu) represents the total ramp reference input to the ramp function.

Its purpose is to ensure that the drive reaches the desired speed within the configured acceleration time after the **Start** command is issued, and decelerates to a stop within the configured deceleration time after the command is removed.

The generation of the IPA 1820-**Ramp reference input** is described in the **REFERENCES\RAMP REF** menu.

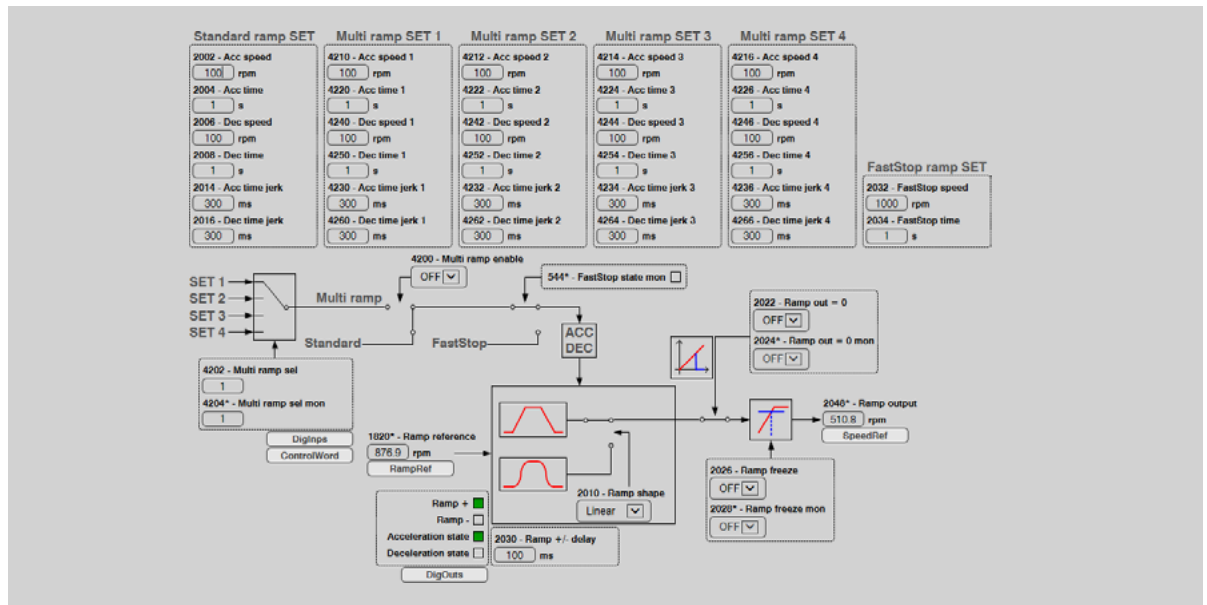


Figure 7-25: Ramps diagram

NOTE!

Setting the **Acc time**, **Dec time**, and/or **FastStop time** to 0 causes the corresponding acceleration, deceleration, and/or Fast stop ramp to follow the reference immediately.

7.12 Speed feedback

The **SPEED FEEDBACK** menu provides parameters for configuring the motor speed feedback. Each of the three feedback types is managed through a dedicated submenu (**ENCODER 1**, **ENCODER 2**, **TACHO**), and a general configuration menu (**CONFIG**) is also available.

NOTE!

There is no dedicated menu for armature feedback, but further details are provided below.

7.12.1 Configuration

The **SPEED FEEDBACK\CONFIG** menu provides parameters for configuring the type of speed feedback and managing any feedback faults.

IPA		DESCRIPTION
650	Speed fbk sel	Selection of the type of feedback to be used for measuring or estimating the motor speed for speed control via a PI controller. Four selections are available: 0 Encoder 1: the digital encoder connected to connector XE1 is used 1 Encoder 2: the digital encoder connected to connector XE2 is used 2 Tacho: the tachometer dynamo connected to the dedicated +/- terminals of the MOT connector is used 3 Armature: the internal speed estimate derived from the armature voltage measurement is used, therefore no external connection is required
654	Speed fbk error	Armature voltage threshold, as a percentage of the motor rated value IPA 606- Arm rated voltage , above which the speed sensor is checked, if activated by parameter IPA 658- Speed fbk control
656	Speed fbk bypass	Enables automatic switching to armature feedback in the event of a fault or failure of the encoder or tachometer feedback, without losing control of the motor or stopping the drive following the Speed fbk loss alarm
658	Speed fbk control	Enables consistency control between the speed measured by the feedback sensor and the armature voltage, generating the Speed fbk loss alarm

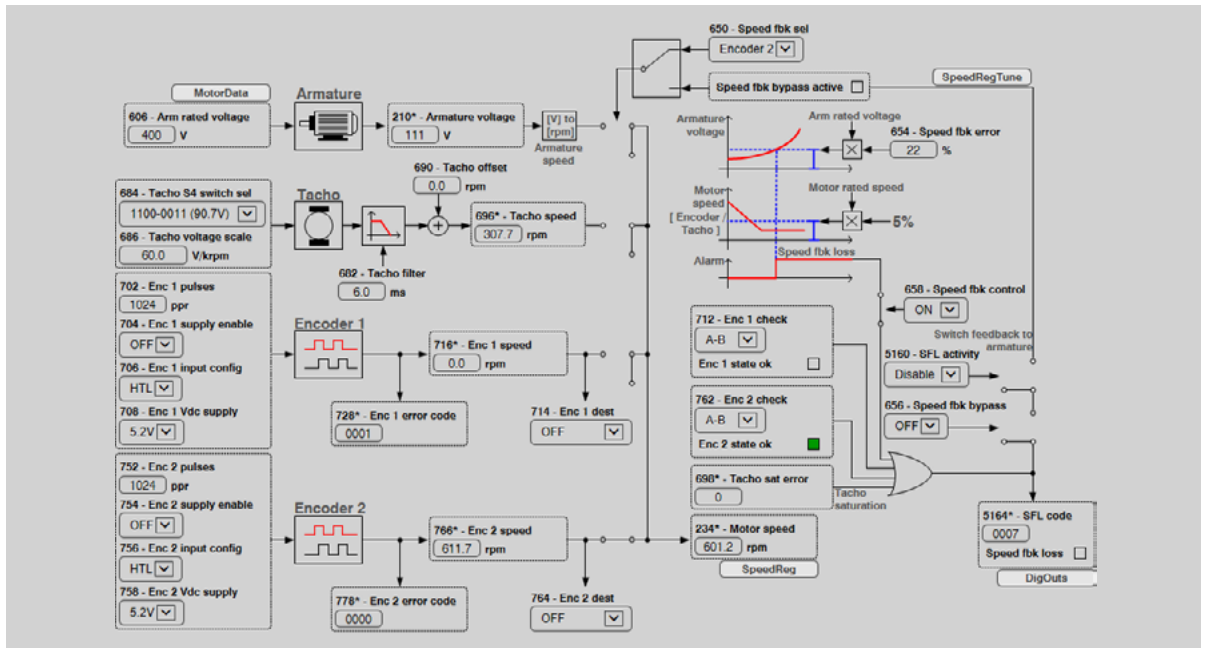


Figure 7-26: Speed feedback diagram

The motor speed, shown in parameter IPA 234-**Motor speed**, is assigned based on the type of speed feedback selected via parameter IPA 650-**Speed fbk sel**, which can be set to either of the two encoders, the tacho, or the speed estimate calculated from system variables.

Parameters for configuring the connected sensors are available in the **SPEED FEEDBACK\ENCODER 1**, **SPEED FEEDBACK\ENCODER 2**, and **SPEED FEEDBACK\TACHO** menus.

The drive has self-diagnostic functions to identify if a sensor is faulty, with parameters that can be configured in the respective menus. In addition to these functions, it is possible to activate the following via parameter IPA 658-**Speed fbk control**, which consists of determining whether the sensor is disconnected or malfunctioning by checking whether the speed read is less than 5% of IPA 600 - **Motor rated speed** and the armature voltage is greater than IPA 654-**Speed fbk error** multiplied by the nominal motor voltage IPA 606-**Arm rated voltage**. The sensor identified as faulty/disconnected is signalled via parameter IPA 5164-SFL code in the **ALARM CONFIG\SPEED FBK LOSS** menu, generating a **Speed fbk loss** alarm.

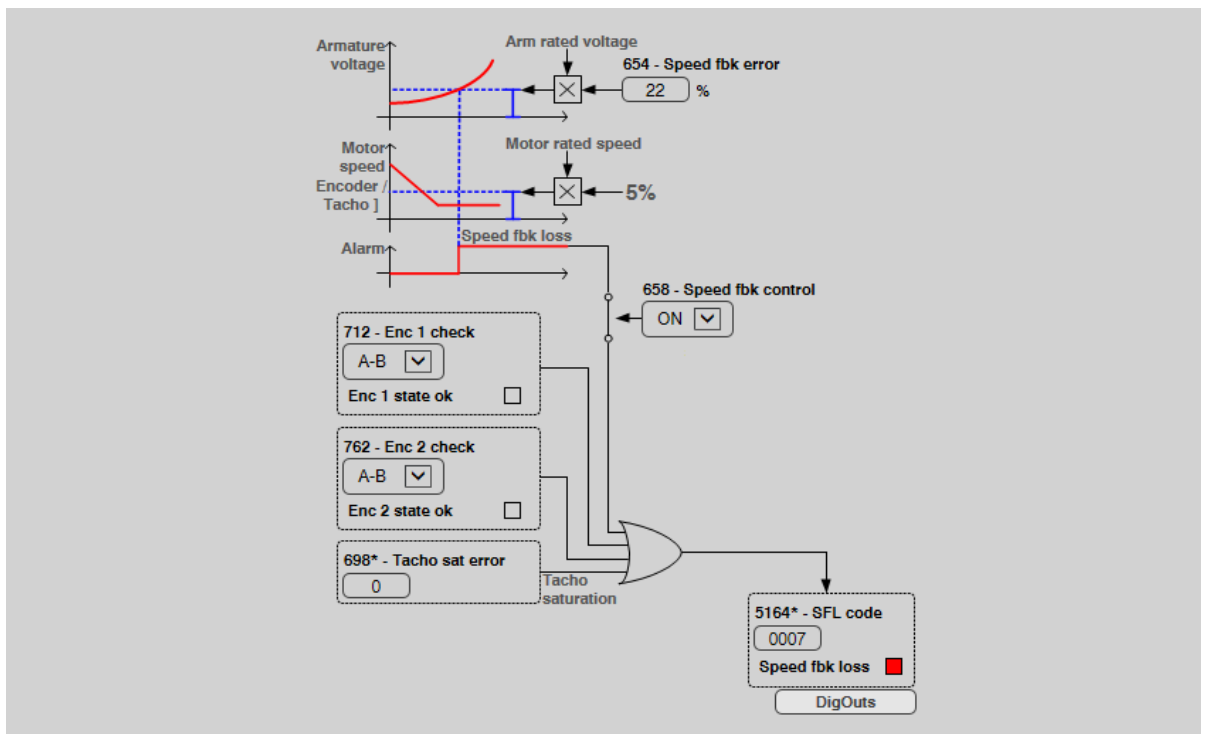
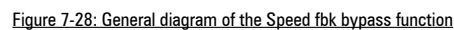


Figure 7-27: General diagram of the Speed fbk control function

By enabling parameter IPA 656-**Speed fbk bypass**, the system allows automatic switching of the speed feedback from the faulty sensor to the speed estimate.

This prevents motor control loss or drive shutdown due to a **Speed fbk loss** alarm.

This gain switching also occurs automatically (see **Figure 7-23**).



To use the feedback bypass function, parameter **IPA 5160-SFL activity** must be set to Ignore or Warning, in order to prevent the drive from being disabled when a fault condition is detected.

The **SPEED FEEDBACK/ENCODER 1** menu provides parameters for configuring the digital encoder connected to connector **XE1** on the **R-TPD500** control board, used for measuring motor speed.

149

706	Enc 1 input config	Encoder signal type selection 1. Two selections are possible: 0 TTL: TTL signal type 1 HTL: HTL signal type
708	Enc 1 Vdc supply	Allows you to adjust the power supply level of encoder 1 if the Enc 1 supply enable parameter is set to ON . Four selections are possible: 0 5.2 V 1 5.6 V 2 6.0 V 3 6.4 V
712	Enc 1 check	Enables hardware-level control of encoder 1 channels for generating the Speed fbk loss alarm. Three selections are possible: 0 None : no control is performed 1 A-B : only channels A-B are checked, not Z 2 A-B-Z : channels A-B and Z are checked
714	Enc 1 dest	Allows you to set the destination of encoder 1. There are five options: 0 OFF 2 Speed ref 1 : Encoder 1 is used as speed reference 1

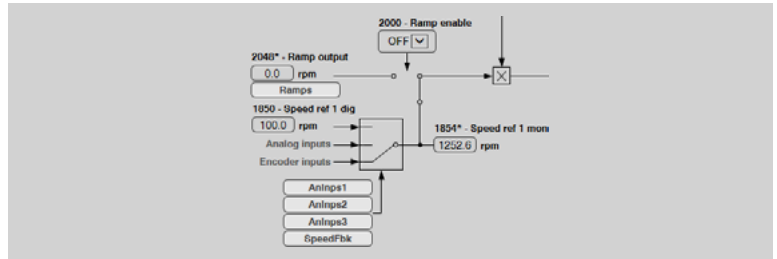


Figure 7-30: Logic diagram in the case where Encoder 1 dest = Speed Ref 1

3 Speed ref 2: Encoder 1 is used as speed reference 2

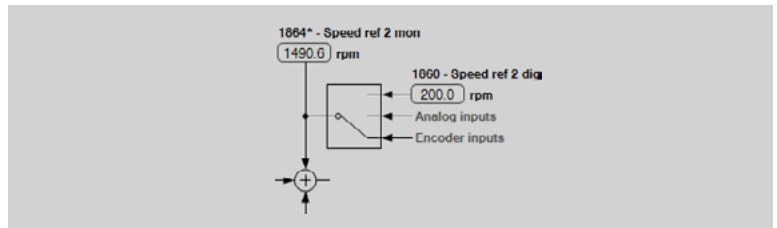


Figure 7-31: Logic diagram in the case where Encoder 1 dest = Speed Ref 2

4 Ramp ref 1: Encoder 1 is used as ramp reference 1

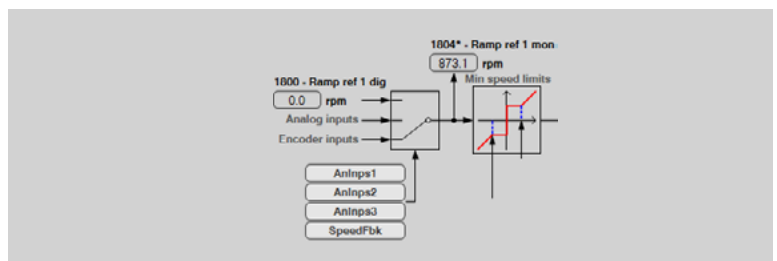


Figure 7-32: Logic diagram in the case where Encoder 1 dest = Ramp Ref 1

5 Ramp ref 2: Encoder 1 is used as ramp reference 2

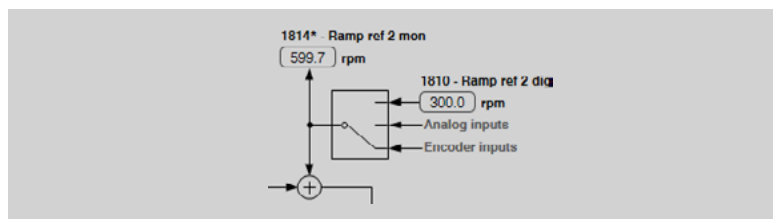


Figure 7-33: Logic diagram in the case where Encoder 1 dest = Ramp Ref 2

716	Enc 1 speed	Speed measurement provided by encoder 1, expressed in [rpm]
728	Enc 1 error code	Code indicating the type of error detected on encoder 1 Enc 1 error code = 0 : no error Enc 1 error code = 1 : error on channels A-B Enc 1 error code = 2 : error on channel Z Enc 1 error code = 3 : error on channels A-B and Z

Digital encoder 1 can be used as a speed feedback source by setting parameter IPA 650 - **Speed fbk sel** to **Encoder 1**, or as a ramp (1/2) or speed (1/2) reference by configuring parameter IPA 714-**Enc 1 dest**.

Before connecting encoder 1, the user must ensure that the **+24VE1 switch** on the **R-TPD500** control board is properly set.

When an encoder requiring 24 V power supply is connected, power generation must be enabled by setting the **+24VE1 switch** to **ON** (the corresponding LED on the control board will turn on).

When an encoder requiring 5 V power supply is connected, power generation for encoder 1 must be enabled via parameter IPA 704-**Enc 1 supply enable**, and the voltage can be adjusted between 5.2 V and 6.4 V using parameter IPA 708-**Enc 1 Vdc supply**.

This voltage adjustment is used to compensate for any voltage drop along the cable between the sensor and the drive.

To select the correct value, measure the voltage at the encoder's power supply terminals directly.

The drive includes a self-diagnostic feature to detect possible connection issues or encoder 1 faults.

This check can be disabled (None), enabled on channels **A-B** only, or on **A-B-Z** (index), via parameter IPA 712 - **Enc 1 check**.

Any detected fault is reported through parameter IPA 728-**Enc 1 error code** and may result in feedback bypass activation or trigger a **Speed fbk loss** alarm, which can be managed via parameters in the **ALARM CONFIG\SPEED FBK LOSS** menu.

7.12.3 Encoder 2

The **SPEED FEEDBACK\ENCODER 2** menu provides parameters for configuring the digital encoder connected to connector **XE2** on the **R-TPD500** control board, used for measuring motor speed.

Encoder 2 is the default feedback source for speed regulation.

IPA		DESCRIPTION
752	Enc 2 pulses	Number of pulses per revolution of the digital encoder connected to the XE2 connector. A high resolution corresponds to better motor speed control.
754	Enc 2 supply enable	Enables the generation of power supply for encoder 2 at 5 V
756	Enc 2 input config	Encoder signal type selection 2. Two selections are possible: 0 TTL: TTL signal type 1 HTL: HTL signal type
758	Enc 2 Vdc supply	Allows you to adjust the power supply level of encoder 1 if the Enc 1 supply enable parameter is set to ON . Four selections are possible: 0 5.2V 1 5.6V 2 6.0V 3 6.4V
762	Enc 2 check	Enables hardware-level control of encoder 2 channels for generating the Speed fbk loss alarm. Three selections are possible: 0 None: no control is performed 1 A-B: only channels A-B are checked, not Z 2 A-B-Z: channels A-B and Z are checked
764	Enc 2 dest	Allows you to set the destination of encoder 2. Five selections are possible:

0 OFF

2 **Speed ref 1:** Encoder 2 is used as speed reference 1

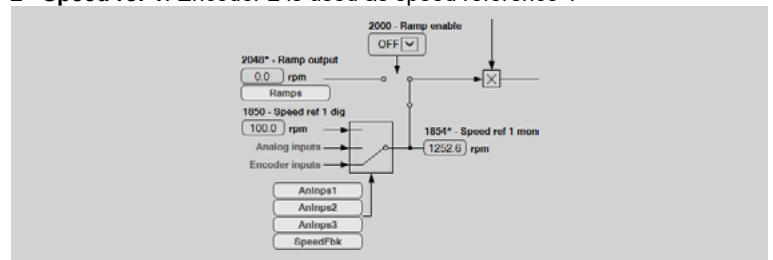


Figure 7-34: Logic diagram when Encoder 2 dest = Speed Ref 1

3 **Speed ref 2:** Encoder 2 is used as speed reference 2

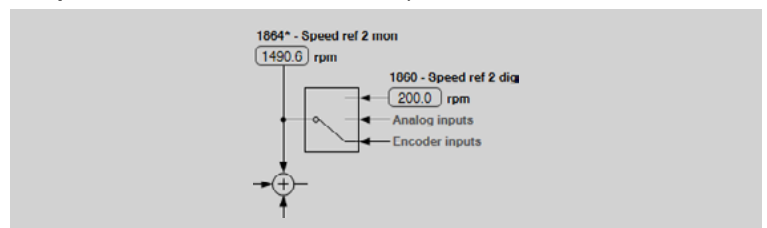


Figure 7-35: Logic diagram when Encoder 2 dest = Speed Ref 2

4 Ramp ref 1: Encoder 2 is used as ramp reference 1

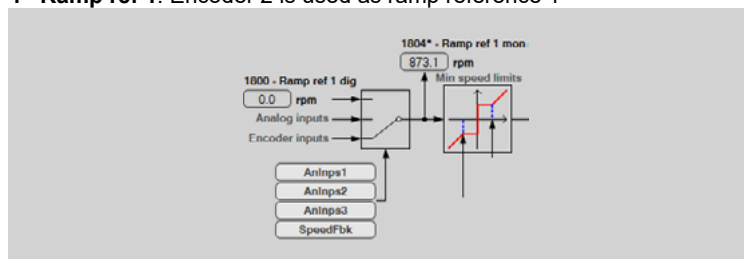


Figure 7-36: Logic diagram when Encoder 2 dest = Ramp Ref 1

5 Ramp ref 2: Encoder 2 is used as ramp reference 2

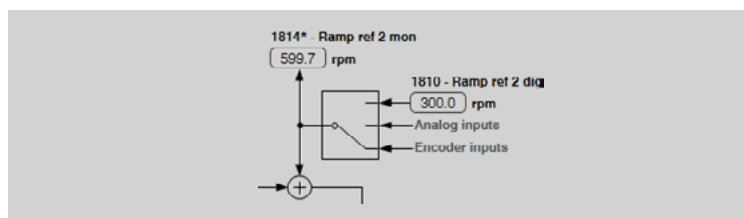


Figure 7-37: Logic diagram when Encoder 2 dest = Ramp Ref 2

766	Enc 2 speed	Speed measurement provided by encoder 2, expressed in [rpm]
778	Enc 2 error code	Code indicating the type of error detected on encoder 2: Enc 2 error code = 0: no error Enc 2 error code = 1: error on channels A-B Enc 2 error code = 2: error on channel Z Enc 2 error code = 3: error on channels A-B and Z

Digital encoder 2 can be used as a speed feedback source by setting parameter IPA 650-**Speed fbk sel** to **Encoder 2**, or as a ramp (1/2) or speed (1/2) reference via parameter IPA 764-**Enc 2 dest**.

Before connecting encoder 2, the user must ensure that the **+24VE2 switch** on the **R-TPD500** control board is properly set.

When connecting an encoder that requires a 24 V power supply, power generation must be enabled by setting the **+24VE2** switch to **ON** (the corresponding LED on the control board will turn on).

When connecting an encoder that requires a 5 V power supply, encoder 2 power generation must be enabled using parameter IPA 754-**Enc 2 supply enable**, and the voltage can be adjusted between 5.2 V and 6.4 V via parameter IPA 758-**Enc 2 Vdc supply**.

This voltage adjustment is used to compensate for any voltage drop in the cable connecting the sensor to the drive.

To select the correct value, measure the voltage directly at the encoder's power supply terminals. The drive features a self-diagnostic function to detect possible connection issues or encoder 2 faults.

This check can be disabled (None), enabled on **A-B** channels only, or on **A-B-Z** (index), via parameter IPA 762-**Enc 2 check**.

Any detected fault is reported through parameter IPA 778-**Enc 2 error code**, and may trigger feedback bypass or generate a Speed fbk loss alarm, which can be managed through parameters in the **ALARM CONFIG/SPEED FBK LOSS** menu.

7.12.4 Tachogenerator

The **SPEED FEEDBACK/TACHO** menu provides parameters for configuring the tachogenerator, which can be used to measure motor speed.

IPA		DESCRIPTION
682	Tacho filter	Filter time constant on the speed measurement provided by the tachometer, expressed in [ms]
684	Tacho DIP switch sel	Setting made with selector S4 on the R-TPD500 control board, based on the correspondence given in Table 4-6: Dip-switch S4 - Input voltage adjustment of the tachometer response
686	Tacho voltage scale	Tachometer sensitivity rating
688	Tacho scale tuning	Gain allowing finer cascade calibration at Tacho voltage scale
690	Tacho offset	Offset that can be used to correct the speed measurement provided by the tachometer
696	Tacho speed	Tachometer speed measurement monitor, which is assigned to the motor speed IPA 234- Motor speed when IPA 650- Speed fbk sel = Tacho
698	Tacho sat error	Monitor of the error signal generated by the tachometer

To configure the drive, the setting made using selector S4 must be confirmed via parameter IPA 684-**Tacho DIP switch sel** (see **Table 4-6: Dip-switch S4 – Input voltage adaptation for tacho feedback**), and the rated sensitivity value must be entered in parameter IPA 686-**Tacho voltage scale**.

A fine calibration can also be performed to remove any measurement offset using parameter IPA 690-**Tacho offset**, or to compensate for possible gain errors using parameter IPA 688-**Tacho scale tuning**.

If the input voltage reaches saturation, an error signal is generated and shown in parameter IPA 698-**Tacho sat error**. This triggers a Speed fbk loss alarm, which can be configured via parameters in the **ALARM CONFIG\SPEED FBK LOSS** menu. In such a case, it is important to enable either the alarm or the feedback bypass via parameter IPA 656-**Speed fbk bypass**, otherwise the motor could run away.

When the tachometer sensor is selected as speed feedback, it is also possible to enable comparison with the armature voltage via parameter IPA 658-**Speed fbk control**, to prevent any wiring problems or sensor faults from causing the motor to run away.

7.12.5 Speed estimation

Motor speed is estimated based on the motor nameplate data:

- IPA 604-**Arm rated current**
- IPA 606-**Arm rated voltage**
- IPA 1052-**Arm resistance** which is the armature resistance estimated through autotuning of the current regulator (see **CURRENT CONTROL\CURR REG TUNE** menu)
- Current–flux curve

and the system state variables:

- IPA 214-**Armature current [%]**, which is the armature current
- IPA 210-**Armature voltage**, which is the armature voltage
- IPA 1340-**Field reference**, which is the flux reference

Therefore, to ensure an accurate estimation, the nameplate data must be correctly set.

NOTE!

If parameter IPA 612-**Motor EMF constant** is set to a value other than 0, the motor EMF constant is used instead of the rated voltage for speed estimation.

NOTE!

If the IPA 656-**Speed fbk bypass** parameter is set to ON, the speed estimate must be correct in order to obtain the correct speed in the event of a bypass, i.e. when there is a problem with the speed sensor.

7.13 Motor speed control

The **SPEED CONTROL** menu provides parameters for configuring the drive's speed control, which is based on a **PI** regulator.

The parameters are organized into dedicated submenus, described in detail below.

7.13.1 Speed regulator

The speed regulator is configured using the following parameters in the **SPEED CONTROL\SPEED REG** menu.

IPA		DESCRIPTION
800	Speed reg enable	Allows dynamic switching from speed control to torque control, even with the drive enabled. If set to ON , the speed controller is enabled, while if set to OFF , the speed controller is disabled and parameter IPA 1900- C/T ref 1 dig becomes the reference for the current controller.

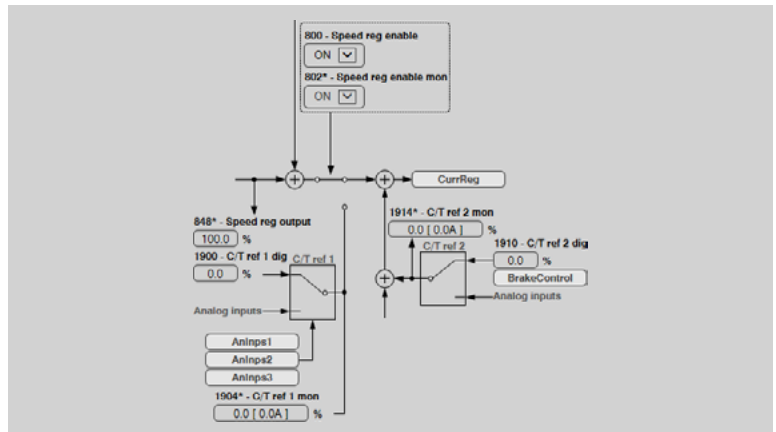


Figure 7-38: Speed control enable management diagram

802	Speed reg enable mon	Monitor of the speed controller enable status, which can also be assigned by programmable digital inputs or fieldbus
804	Speed reg lock	Used to separate the speed controller output from the current controller during operation. When this happens, the current reference is set to zero and the drive stops. The stopping time therefore depends on the load inertia. When the connection between the speed and current controllers is restored, speed control resumes
806	Speed reg lock mon	IPA 804- Speed reg lock status monitor, which can also be assigned by programmable digital inputs or fieldbus
808	Speed reg lock I	Allows the integral action of the speed controller to be blocked
810	Speed reg lock I mon	Monitor of the speed controller integral action block parameter, which can also be assigned by programmable digital inputs or fieldbus
838	Speed auto capture	Enables the fly-in function to be enabled on a motor that is already rotating. When the converter Start command is set to ON , the motor speed is detected and the ramp is adjusted accordingly, while if set to OFF , the ramp always starts with zero reference. This feature is useful for fly-in coupling to a motor already set in motion by the load (e.g. with fluid-driven pump motors) or for restarting after an alarm has been triggered. If the function is disabled, it is advisable to enable the converter only when the motor is stopped, otherwise the converter's current regulator could reach the current limits and cause a sudden deceleration
848	Speed reg output	Speed regulator output, expressed as a percentage of the motor's rated armature current, which acts as a reference for the current regulator

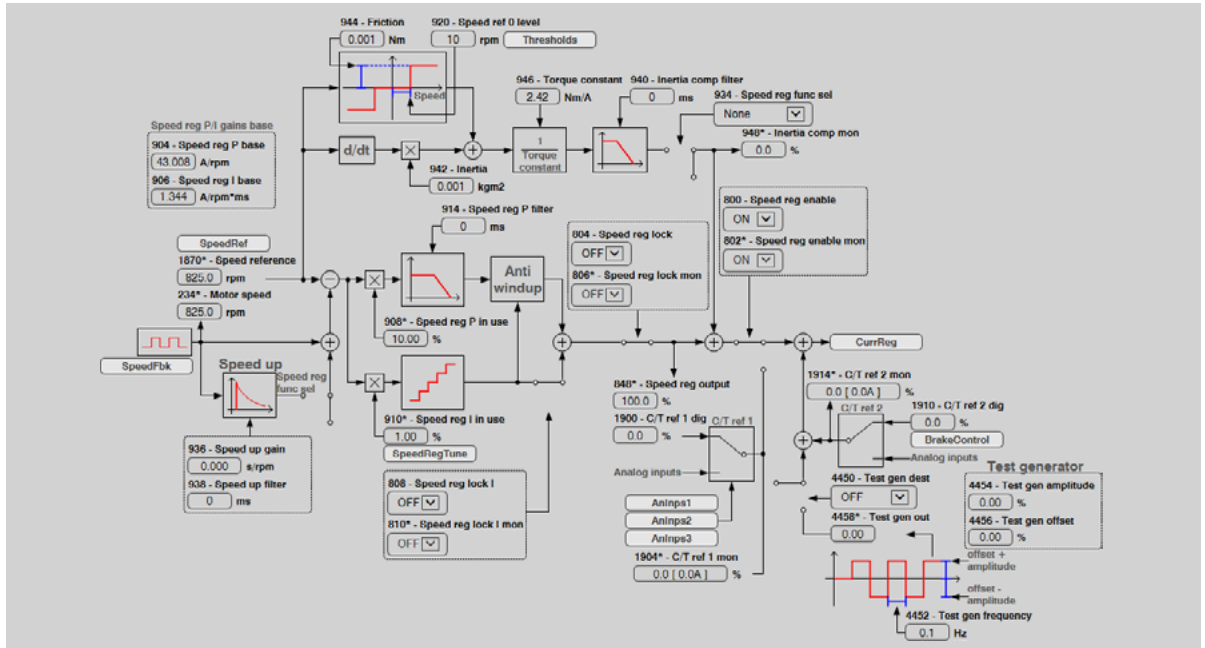


Figure 7-39: General diagram of speed control (Speed Regulator diagram)

The converter includes a motor speed regulation function that can be flexibly adapted to various applications. Under standard factory settings, the regulator operates as a PI controller with constant P-I gains across the entire regulation range.

The speed regulator's task is to bring the motor to the reference speed IPA 1870-**Speed reference** generated by the speed reference function, by producing the current reference IPA 848-**Speed reg output** for the current regulator. If the speed regulator is disabled via parameter IPA 800-**Speed reg enable**, the **Speed reg output** is deactivated, allowing direct current/torque control using references IPA 1900-**C/T ref 1 dig** and IPA 1910-**C/T ref 2 dig**, which generate the armature current reference IPA 1020-**Armature current ref**.

The speed feedback IPA 234-**Motor speed** is either estimated from the armature voltage or provided by an encoder or tacho mounted on the motor shaft.

The following auxiliary functions are also available:

- **Speed up** function (see section 6.13.5) to prevent oscillations with high-inertia loads
- **Inertia compensation** function (see section 6.13.5)
- **Zero speed logic** to control regulator behaviour when the motor is stopped (see section 6.13.3)
- **Adaptive speed control** for optimizing regulation based on motor speed (see section 6.13.4)

7.13.2 Speed regulator limits

Speed limits are managed using the following parameters in the **SPEED CONTROL/SPEED REG LIMIT** menu.

IPA		DESCRIPTION
850	Speed min pos/neg	Set the minimum speed reference in rpm for both directions of rotation (4B). It is not possible to go below this value; the function operates on the ramp input, regardless of the reference set. When this parameter is changed, the parameters IPA 852- Speed min pos and IPA 854- Speed min neg are also set to the same value. These parameters can also be changed individually and made different from each other.
856	Speed max pos/neg	Set the maximum speed reference in rpm for both directions of rotation (4B). The function operates on the speed regulator input and takes into account both the references coming from the ramp and those entered directly. When this parameter is changed, the parameters IPA 858- Speed max pos and IPA 860- Speed max neg are also set to the same value. These parameters can also be changed individually and made different from each other.
852	Speed min pos	Set the minimum speed reference for positive motor rotation. It is not possible to go below this value, regardless of the reference set. The function operates on the ramp input
858	Speed max pos	Set the maximum speed reference for positive motor rotation. The parameter operates on the speed controller input and takes into account both the references coming from the ramp and those entered directly

854	Speed min neg	Set the minimum speed reference for the negative direction of rotation of the motor (4B). It is not possible to go below this value, regardless of the reference set. The parameter operates on the ramp input
860	Speed max neg	Set the maximum speed reference for the negative direction of rotation of the motor (4B). The parameter operates on the speed controller input and takes into account both the references coming from the ramp and those introduced directly

Speed limited is a digital output available in the selection lists of the **DIGITAL OUTPUTS** menu. It indicates that the speed reference is currently being limited by the configured minimum and/or maximum values. The output is at logic low only when the reference is within the defined limits.

NOTE!

By convention, the positive direction of rotation is clockwise.

NOTE!

The parameters **Speed min pos** and **Speed min neg** apply only to the **Ramp ref 1 mon** and **Multispeed references**, but not to the **Ramp ref 2 mon** reference.

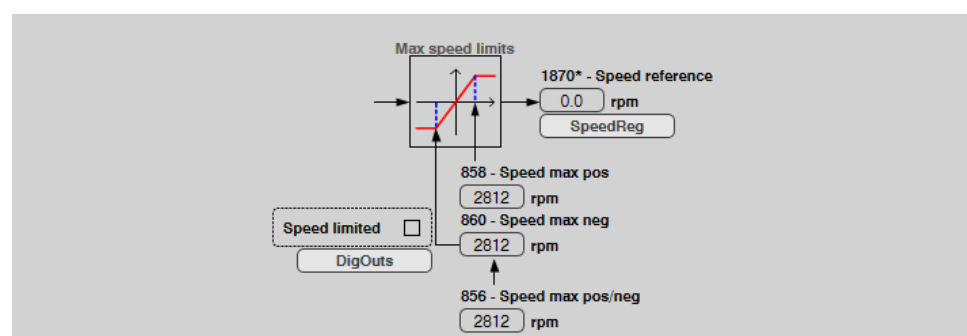


Figure 7-40: Operating diagram of Speed Limits on the speed reference

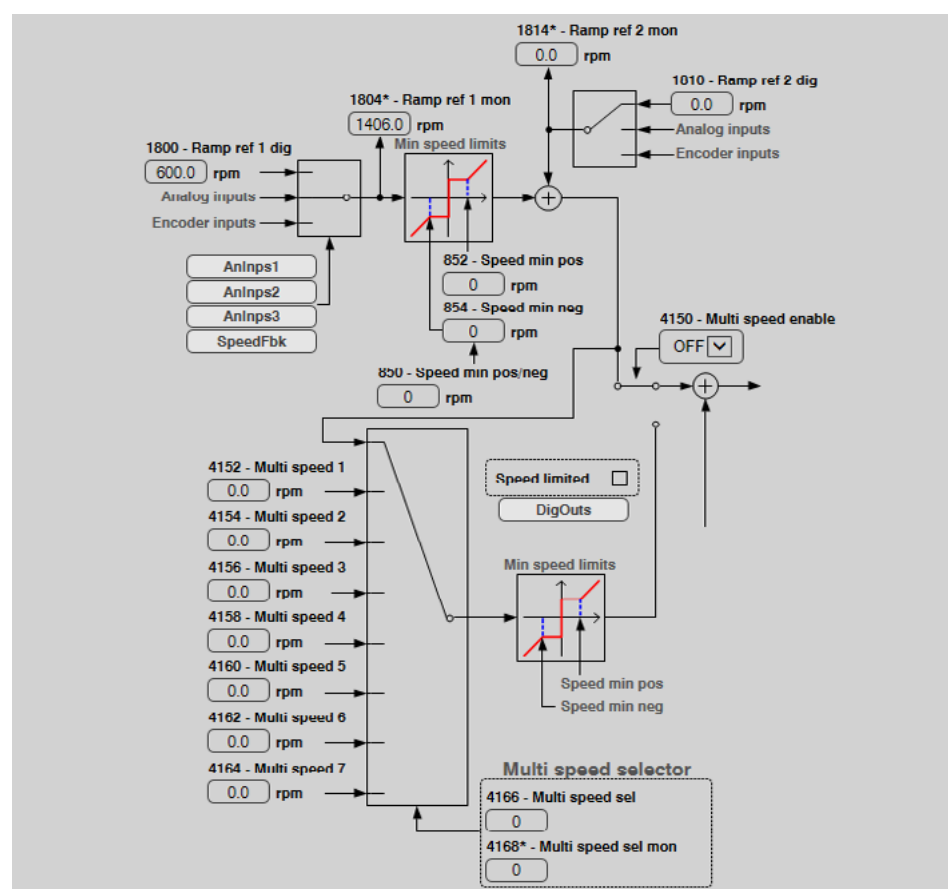


Figure 7-41: Operating diagram of Speed Limits on the ramp reference

7.13.3 Speed regulator tuning

The speed regulator gains are configured using the following parameters in the **SPEED CONTROL\SPEED REG TUNE** menu.

IPA		DESCRIPTION
900	Speed reg P	Proportional gain Kp of the speed controller, expressed as a percentage of the base gain IPA 904- Speed reg P base
902	Speed reg I	Integral gain Ki of the speed controller, expressed as a percentage of the base gain IPA 906- Speed reg I base
904	Speed reg P base	Base proportional coefficient Kp of the speed controller, expressed in [A/rpm]
906	Speed reg I base	Integral coefficient Ki base of the speed controller, expressed in [A/rpm*ms]
908	Speed reg P in use	Monitor of the current proportional gain of the speed controller, expressed as a percentage of the base coefficient IPA 904- Speed reg P base . Under standard supply conditions, Speed reg P in use = Speed reg P
910	Speed reg I in use	Monitor of the current integral gain of the speed regulator, expressed as a percentage of the base coefficient IPA 906- Speed reg I base . Under standard supply conditions, Speed reg I in use = Speed reg I
914	Speed reg P filter	Time constant of the low-pass filter applied to the proportional action of the speed regulator
920	Speed ref 0 level	Speed used to define the intervention threshold for managing the speed controller gains at zero speed. The Reference 0 thr signal indicates that the speed reference (Ramp reference if Ramp enable = ON or Speed reference if Ramp enable = OFF) is below the IPA 920- Speed ref 0 level threshold

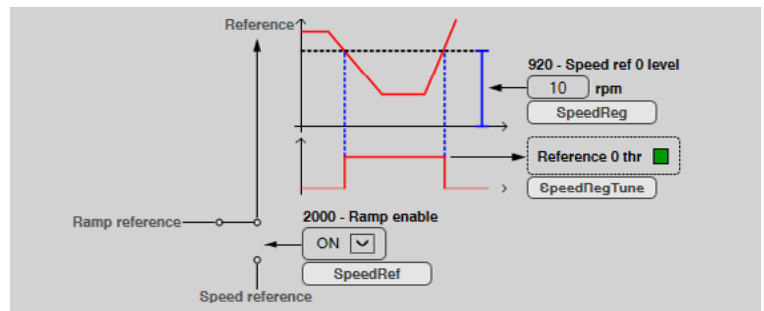


Figure 7-42: Operation of signals dependent on Reference 0 thr

922	Speed=0 P gain	Proportional gain of the speed controller at zero speed, expressed as a percentage of the base gain IPA 904 - Speed reg P base , active only if IPA 928 - Speed=0 P enable is set to ON
924	Speed=0 I enable	Parameter enabling the reset of the integral gain of the speed controller at zero speed. Two selections are possible: ON: the integral gain is reset when the Speed 0 thr and Reference 0 thr signals are activated, regardless of the Speed=0 P enable setting, i.e. when the motor speed drops below the IPA 812-Speed 0 level threshold with the delay time given by the IPA 814-Speed 0 delay parameter and when the ramp reference drops below the IPA 920-Speed ref 0 level threshold OFF: integral gain is also active when the motor is stopped
926	Speed=0 R enable	It should only be used when IPA 928-Speed=0 P enable is set to ON. Two selections are possible: ON: the proportional and integral gains are equal to Speed=0 P gain and 0 respectively when the Reference 0 thr and Speed 0 thr signals are activated, i.e. when the ramp reference falls below the IPA 920-Speed ref 0 level threshold and the speed falls below IPA 812-Speed 0 level, and are restored (to their previous values) only when the reference is above the Reference 0 thr OFF: to the Reference 0 thr condition of the ON case, the Speed 0 thr condition must also be added, obtaining a behaviour similar to when Speed=0 P enable = ON

Parameter for enabling speed controller gains at zero speed. Two selections are possible:

ON: the proportional and integral gains are equal to **Speed=0 P gain** and **0** respectively when the **Speed 0 thr** and **Reference 0 thr** signals are activated, i.e. when the motor speed drops below the IPA 812-**Speed 0 level** threshold with the delay time given by parameter IPA 814-**Speed 0 delay** and when the speed reference drops below the IPA 920-**Speed ref 0 level** threshold.

OFF: Proportional gain is active even when the motor is switched off.

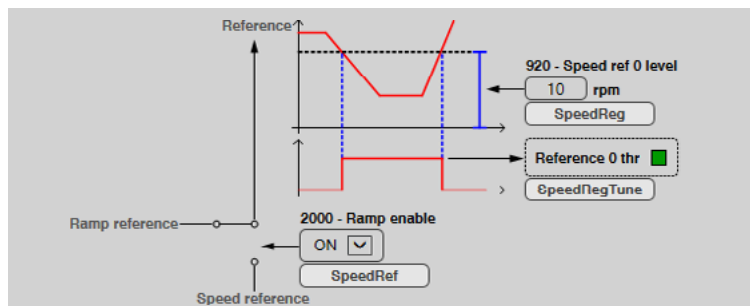


Figure 7-43: Operation of signals dependent on Reference 0 thr

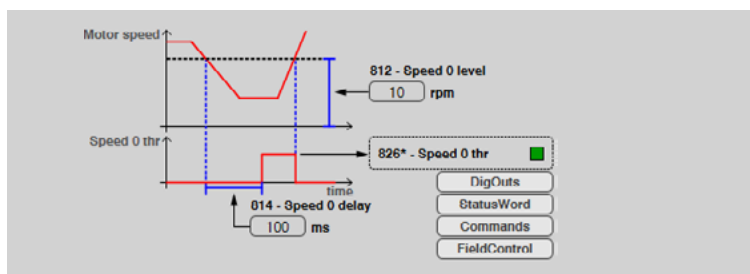


Figure 7-44: Operation of signals dependent on Speed 0 thr

Proportional gain of the speed controller, expressed as a percentage of the base gain IPA 904-**Speed reg P** applied following activation of the feedback bypass function when feedback from an encoder or tachometer automatically switches to a speed estimate based on the armature (in this case, lower gains should be used).

Integral gain of the speed controller, expressed as a percentage of the base gain IPA 906-**Speed reg I** applied following activation of the feedback bypass function when feedback from an encoder or tachometer automatically switches to a speed estimate based on the armature (in this case, lower gains should be used).

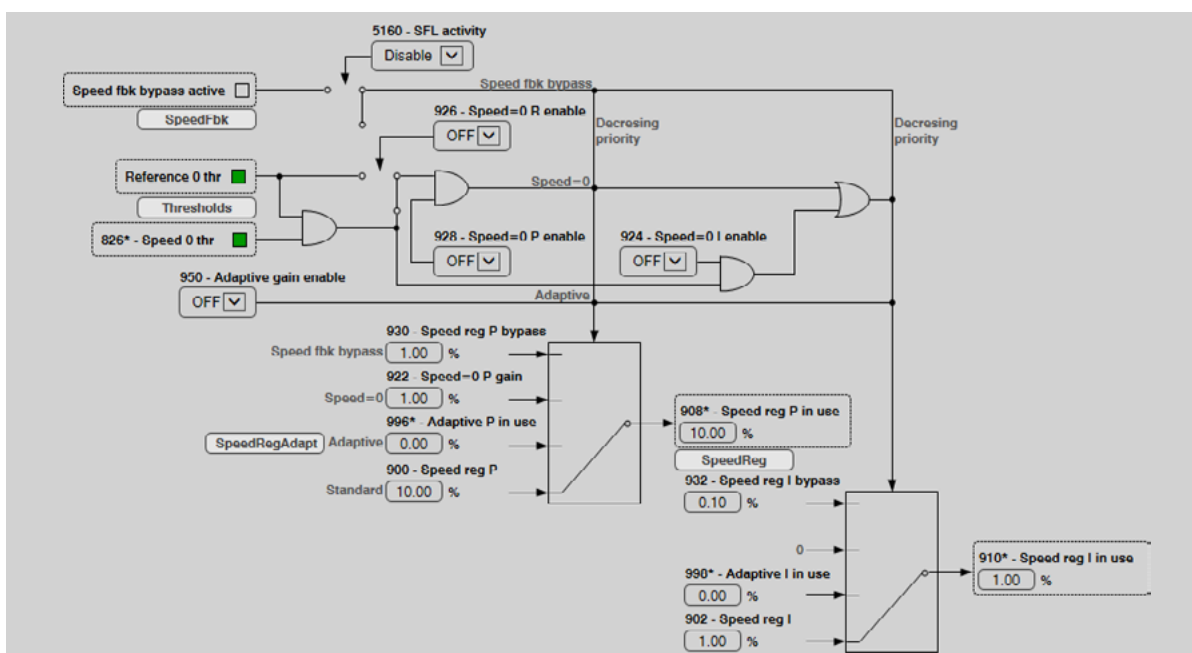


Figure 7-45: General diagram of speed control parameters (Speed Reg Tune diagram)

The proportional and integral gains of the PI speed regulator are divided into a base value, expressed in engineering units, and a percentage of that value, according to the following formulas:

$$K_P = K_{P\%} \times K_{Pbase} / 100 = [A/rpm]$$

$$K_I = K_{I\%} \times K_{Ibase} / 100 = [A/(rpm \times ms)]$$

There are therefore four possible sources and switching modes for the speed regulator gains, with decreasing priority in case of simultaneous activation (see figure 6-39):

1. **Speed fbk bypass**: this mode has the highest priority and is activated by the speed feedback bypass function.

In this case:

- **Speed reg P in use = Speed reg P bypass**
- **Speed reg I in use = Speed reg I bypass**

The **Speed = 0**, **Adaptive** and **Standard** modes are disabled.

2. **Speed = 0**: this mode is based on zero-speed gains.

In this case:

- **Speed reg P in use = Speed=0 P gain**
- **Speed reg I in use = 0**

The **Adaptive** and **Standard** modes are disabled.

3. **Adaptive**: this mode is based on adaptive gain control.

In this case:

- **Speed reg P in use = Adaptive P in use**
- **Speed reg I in use = Adaptive in I use**

The **Standard** mode is disabled.

4. **Standard**: this is the lowest-priority mode, active only when the **Speed fbk bypass**, **Speed = 0**, and **Adaptive** modes are not active.

In this case:

- **Speed reg P in use = Speed reg P**
- **Speed reg I in use = Speed reg I**

That is, the gains set directly by the user are applied.

7.13.4 Adaptive speed regulator

The adaptive speed function allows the **PI** speed regulator gains to vary based on motor speed or another variable (selected via **Adaptive ref**).

This makes it possible to optimize the behaviour of the speed regulator according to the specific needs of the application.

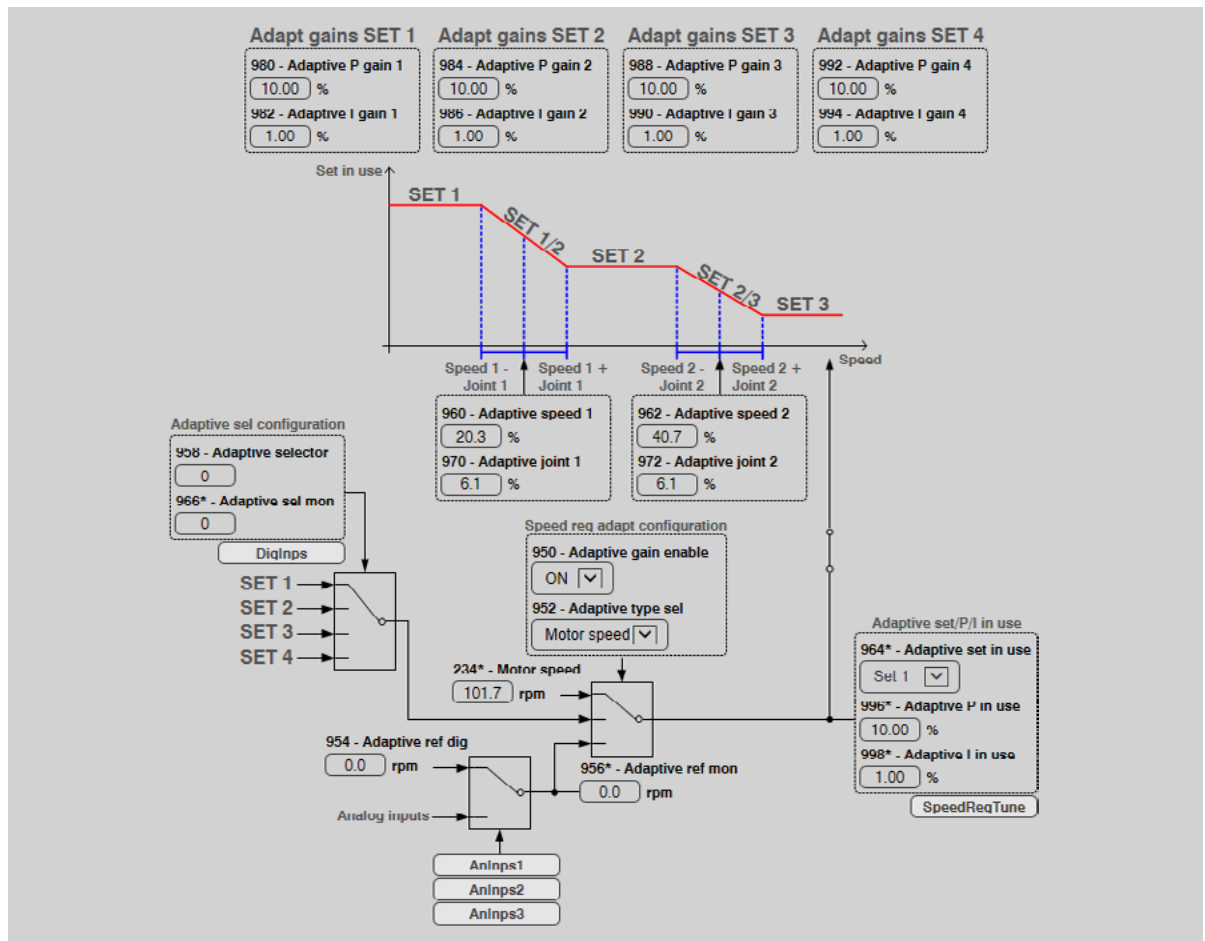


Figure 7-46: General diagram of adaptive speed regulation parameters (Speed Reg Adapt diagram)

The function is managed using the following parameters in the **SPEED CONTROL\SPEED REG ADAPT** menu.

IPA		DESCRIPTION
950	Adaptive gain enable	Enables speed adaptation
952	Adaptive type sel	Allows you to select the magnitude by which to vary the speed controller gains: 0 Motor speed selection: gains are varied according to motor speed 1 Adaptive ref selection: gains are varied according to Adaptive ref mon 2 Adaptive sel selection: gains are varied by selecting a dedicated SET that can also be selected from digital inputs. Only under these operating conditions are 4 PI gain SETs available (SET 1 - SET 2 - SET 3 - SET 4)
954	Adaptive ref dig	Allows, only if Adaptive type sel=Adaptive ref , to set the speed at which to vary the speed controller gains.
956	Adaptive ref mon	Speed monitor at which to vary the gains, which can also be assigned by analogue inputs or fieldbus
958	Adaptive selector	Allows, only if Adaptive type sel=Adaptive sel , to select a SET of PI gains from 1 to 4
966	Adaptive sel mon	Monitor of the PI gain SET selector, which can also be assigned by combining two digital inputs (selections Adapt sel 1 / Adapt sel 2)
960	Adaptive speed 1	Central speed of the connection band between SET 1 and SET 2 , defined as [Speed 1 - Joint 1 , Speed 1 + Joint 1], expressed as a percentage of Full scale speed
970	Adaptive joint 1	Defines the width of the connection band between SET 1 and SET 2

962	Adaptive speed 2	Central speed of the connection band between SET 2 and SET 3 , defined as [Speed 2 - Joint 2 , Speed 2 + Joint 2], expressed as a percentage of Full scale speed
972	Adaptive joint 2	Defines the width of the connection band between SET 2 and SET 3
980	Adaptive P gain 1	Proportional gain P of SET 1 , expressed as a percentage of Speed reg P base
982	Adaptive I gain 1	Integral gain I of SET 1 , expressed as a percentage of Speed reg I base
984	Adaptive P gain 2	Proportional gain P of SET 1 , expressed as a percentage of Speed reg I base
986	Adaptive I gain 2	Integral gain I of SET 2 , expressed as a percentage of Speed reg I base
988	Adaptive P gain 3	Proportional gain P of SET 3 , expressed as a percentage of Speed reg P base
990	Adaptive I gain 3	Integral gain I of SET 3 , expressed as a percentage of Speed reg I base
992	Adaptive P gain 4	Proportional gain P of SET 4 , expressed as a percentage of base Speed reg P
994	Adaptive I gain 4	Integral gain I of SET 4 , expressed as a percentage of base Speed reg I
964	Adaptive set in use	Monitor of the status of the PI gain SET in use
996	Adaptive P in use	Monitor of the adaptive P gain in use
998	Adaptive I in use	Monitor of the adaptive I gain in use

To activate adaptive gains for the speed regulator, parameter IPA 950-**Adaptive gain enable** must be set to *ON*.

By default, the gains depend on motor speed. However, they can also vary based on a programmable speed level using the **Adaptive ref dig** parameter, or be selected directly and dynamically via the **Adaptive selector** parameter.

The parameters **Adaptive speed 1**, **Adaptive joint 1**, **Adaptive speed 2** and **Adaptive joint 2** allow the definition of five gain ranges, named as follows:

- **SET 1**: range with constant PI gains
- **SET 1 / 2**: linear transition range between SET 1 and SET 2
- **SET 2**: range with constant PI gains
- **SET 2 / 3**: linear transition range between SET 2 and SET 3
- **SET 3**: range with constant PI gains

These ranges correspond to the possible states displayed by the parameter **Adaptive set in use**.

Parameter IPA 970-**Adaptive joint 1** enables a smooth transition between **SET 1** and **SET 2**.

If set to 0.0, the **SET 1 / 2** range does not exist, and the gain transition between **SET 1** and **SET 2** is abrupt.

Similarly, parameter IPA 972-**Adaptive joint 2** enables a smooth transition between **SET 2** and **SET 3**.

If set to 0.0, the **SET 2 / 3** range does not exist, and the gain transition between **SET 2** and **SET 3** is abrupt.

When adaptive speed regulator gains are enabled, the standard gains IPA 900-**Speed reg P** and IPA 902-**Speed reg I** are inactive.

7.13.5 Speed regulator – Auxiliary functions

The converter's PI speed regulator provides auxiliary **Speed up** and **Inertia compensation** functions to optimize speed control performance. These functions are mutually exclusive.

The auxiliary compensation functions of the speed regulator are configured using the following parameters in the **SPEED CONTROL\SPEED REG FUNC** menu.

IPA		DESCRIPTION
934	Speed reg func sel	Enables the speed controller compensation functions. Three selections are possible: 0 None: the Speed up and Inertia comp functions are both disabled 1 Speed up: the Speed up function is enabled and the Inertia comp function is disabled 2 Inertia comp: the Inertia comp function is enabled and the Speed up function is disabled
936	Speed up gain	Speed up function gain, expressed in s/rpm and applied to the derivative of the speed measurement IPA 234- Motor speed
938	Speed up filter	Time constant of the low-pass filter acting downstream of the derivative of the speed measurement, after application of the gain IPA 936- Speed up gain
940	Inertia comp filter	Time constant, expressed in ms, of the low-pass filter acting on the output generated by the inertia compensation function
942	Inertia	Total value of the inertia at the motor shaft, expressed in [Kg·m ²]
944	Friction	Friction value, expressed in [Nm]
946	Torque constant	Motor torque constant, expressed in [Nm/A]
948	Inertia comp mon	Monitor of the output produced by the inertia compensation function, expressed as a percentage of the motor's rated armature current and added to the output of the speed regulator Speed reg output (see figure 6-42)

The Speed up function can be used to prevent speed oscillations in the presence of loads with high inertia or variable cyclic loads applied to the motor (e.g., cams).

Compensation is achieved by modifying the speed regulator feedback: instead of using the measured motor speed (**Motor speed**), the feedback becomes the sum of **Motor speed** and the output of the **Speed up** function (see Figure 6-41).

This output is obtained by applying in cascade the gain IPA 936-**Speed up gain** to the derivative of IPA 234-**Motor speed**, followed by the low-pass filter IPA 938-**Speed up filter**.

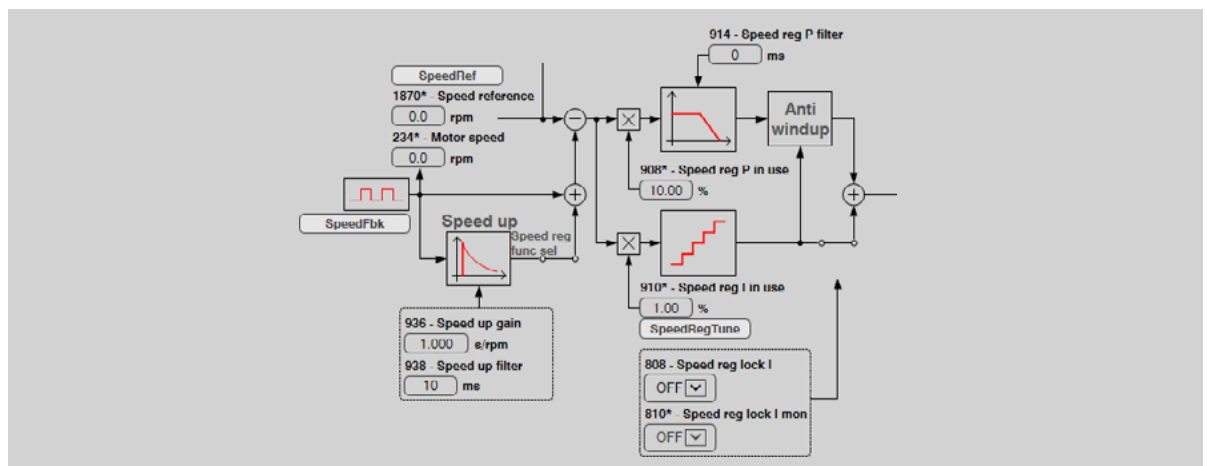


Figure 7-47: Operating diagram of the Speed Up control function

The **Inertia compensation** function performs feed-forward compensation of inertia and friction to improve the dynamic response of the speed regulator to variations in IPA 1870-**Speed reference**.

The current required to overcome inertia and friction is estimated and added to the PI speed regulator output **Speed reg output** (see Figure 6-42).

A low-pass filter with a programmable time constant is included to reduce noise caused by the derivative used in the inertia compensation process.

To achieve good results, it is essential that the parameters IPA 942-**Inertia**, IPA 944-**Friction**, and IPA 946-**Torque constant**, which characterize the load, are set as close as possible to their actual values.

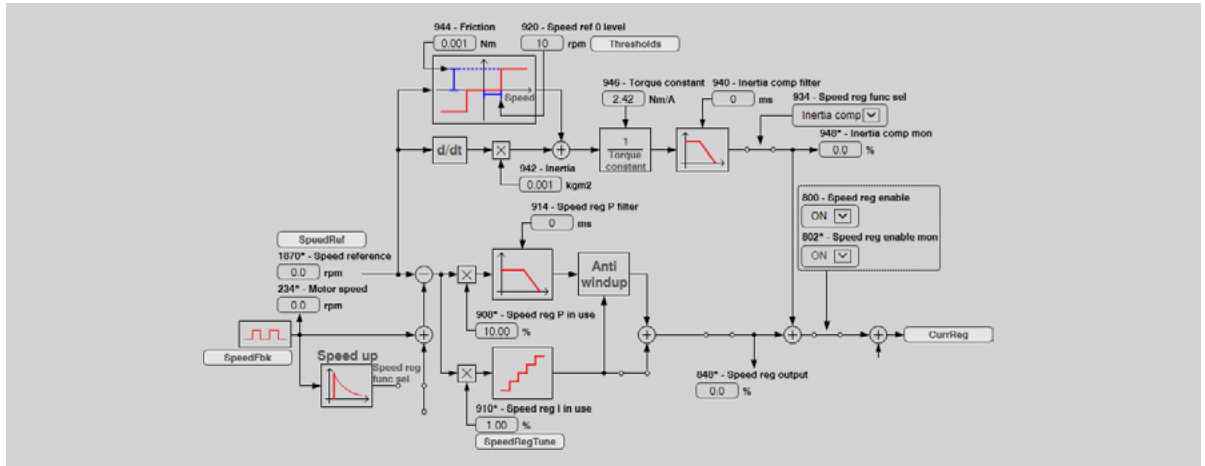


Figure 7-48: Operating diagram of the Inertia Comp control function

7.14 Armature current control

The **CURRENT CONTROL** menu provides parameters for configuring the drive's armature current control, which is based on either a predictive or PI-type regulator.

7.14.1 Current regulator

The armature current regulator operates downstream of the PI speed regulator, generating the control signals for the converter's power board in order to ensure that a DC current equal to the **Armature current ref** is delivered to the load, as provided by the speed regulator.

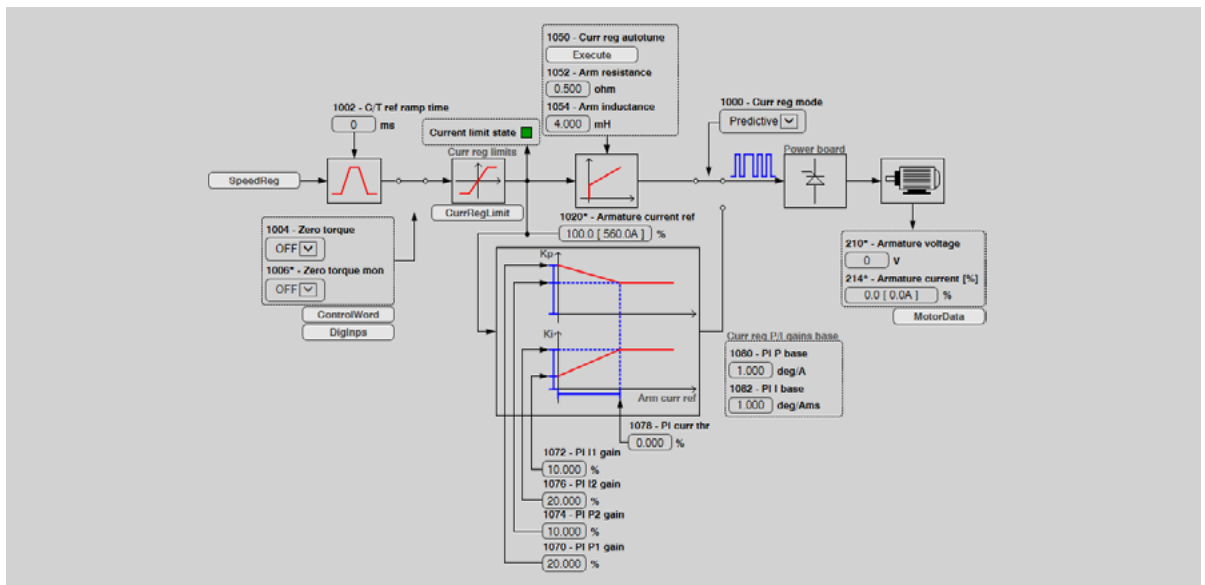


Figure 7-49: Armature current control diagram (Current reg diagram)

The armature current regulator is configured using the following parameters in the **CURRENT CONTROL\CURR REG** menu.

IPA		DESCRIPTION
1000	Curr reg mode	Allows you to set the type of armature current regulator. Two selections are possible: 0 Predictive: predictive type regulator, which can be used in electric motors to reach the required current reference more quickly. The predictive current regulator guarantees excellent performance if the inductance and resistance values are set correctly. For this reason, it is essential to self-calibrate the current regulator before using the drive for the first time or when the load is changed. The regulator consists of a predictive part, which acts in an open loop, and an integral action that has the task of zeroing the current error; this term can be monitored via the IPA 1060-Compensation output parameter, which can be used as an indicator of the quality of the predictive part and therefore as an aid to fine tuning. The predictive part must be calibrated as accurately as possible to ensure a fast, precise response without current overshoots. 1 PI: proportional-integral controller, which can be used for loads with very high inductance values and not necessarily with electric motors
1002	C/T ref ramp time	It acts between the output of the speed regulator and the input of the current regulator limitation block by setting the linear ramp time that the current reference must take to go from zero to the nominal armature current value of the motor IPA 604 - Arm rated current . In this way, it is possible to ensure that changes in the current reference are not applied in steps but gradually
1004	Zero torque	Armature current ref reset command, so that the drive immediately stops supplying torque.
1006	Zero torque mon	Monitor for the armature current reference reset command, which can also be assigned by programmable digital inputs or fieldbus

7.14.2 Current regulator limits

The torque current limits, which act on the input of the current regulator and refer only to armature current, are managed using the following parameters in the **CURRENT CONTROL\CURR REG LIMIT** menu.

IPA		DESCRIPTION
1104	C/T lim pos dig	Set the drive current limit for positive current direction (clockwise rotation and counterclockwise braking), expressed as a percentage of the motor's rated armature current
1106	C/T lim pos mon	Positive current limit monitor, which can also be assigned by analogue inputs. This parameter can be displayed in two units of measurement, [%-A]
1108	C/T lim neg dig	Sets the drive current limit for the negative current direction (counterclockwise rotation and clockwise braking), expressed as a percentage of the motor's rated armature current
1110	C/T lim neg mon	Negative current limit monitor, which can also be assigned from analogue inputs. In the case of symmetrical limits, it is equal to C/T lim pos mon (with sign -). For this parameter, dual unit display is available, [%-A]
1112	C/T lim sym enable	Enables symmetrical current limits for both current directions. In this case, there is only one current limit that can actually be set, given by the C/T lim pos mon parameter, which acts as both a positive and negative limit, while the negative limit C/T lim neg dig becomes ineffective. By setting this parameter to ON , symmetrical limits can be managed with a single analogue input.

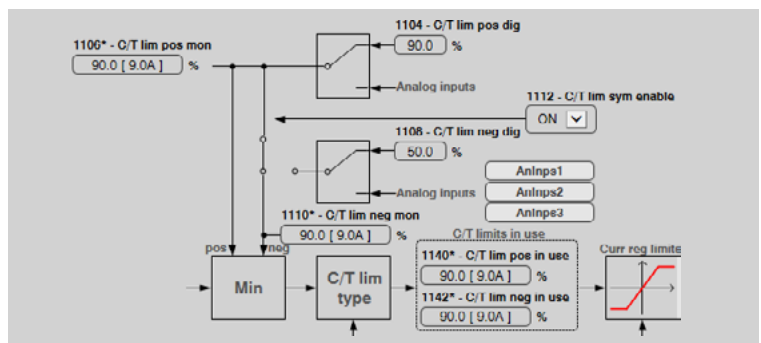


Figure 7-50: Control diagram for symmetrical torque limits

1120	C/T lim reduction	Allows you to set the level of current limit reduction, enabling this function via parameter IPA 1122- C/T lim reduct cmd
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1122	C/T lim reduct cmd	Allows you to enable current limit reduction. When reduction is active, the current limits are lowered to the level set in parameter IPA 1120-C/T lim reduction
1124	C/T lim reduct mon	Monitor of the status of the current reduction command, which can also be assigned by programmable digital inputs
1140	C/T lim pos in use	Monitor of the positive current limit actually in use, downstream of all contributions that may be present in the limit chain, expressed as a percentage of the motor's rated armature current. For this parameter, dual unit display is available, [%-A]
1142	C/T lim neg in use	Monitor of the negative current limit actually in use, downstream of any contributions present in the limit chain, expressed as a percentage of the motor's rated armature current. This parameter can be displayed in two units of measurement, [%-A]

NOTE!

The maximum default value for all torque current limits is 100%, but it can be increased to 150% by enabling one of the various types of overload allowed via the IPA 4300 - **Overload mode** parameter in the **FUNCTIONS\OVERLOAD** menu (see paragraph 7.18.9).

IPA	DESCRIPTION
1126 C/T lim type	Determines the operation of the converter at the current limits. If Pos/neg is selected, the active positive current limit is C/T lim pos mon and the active negative current limit is C/T lim neg mon. If Mot/gen is selected, three conditions are possible: - If the motor speed is greater than +1% of Motor rated speed - the active positive current limit is C/T lim pos mon - the active negative current limit is C/T lim pos mon - If the motor speed is less than -1% of the Motor rated speed - the active positive current limit is C/T lim neg mon - the active negative current limit is C/T lim pos mon - If the motor speed is between -1% and +1% of the Motor rated speed - the active positive and negative current limit is C/T lim pos mon

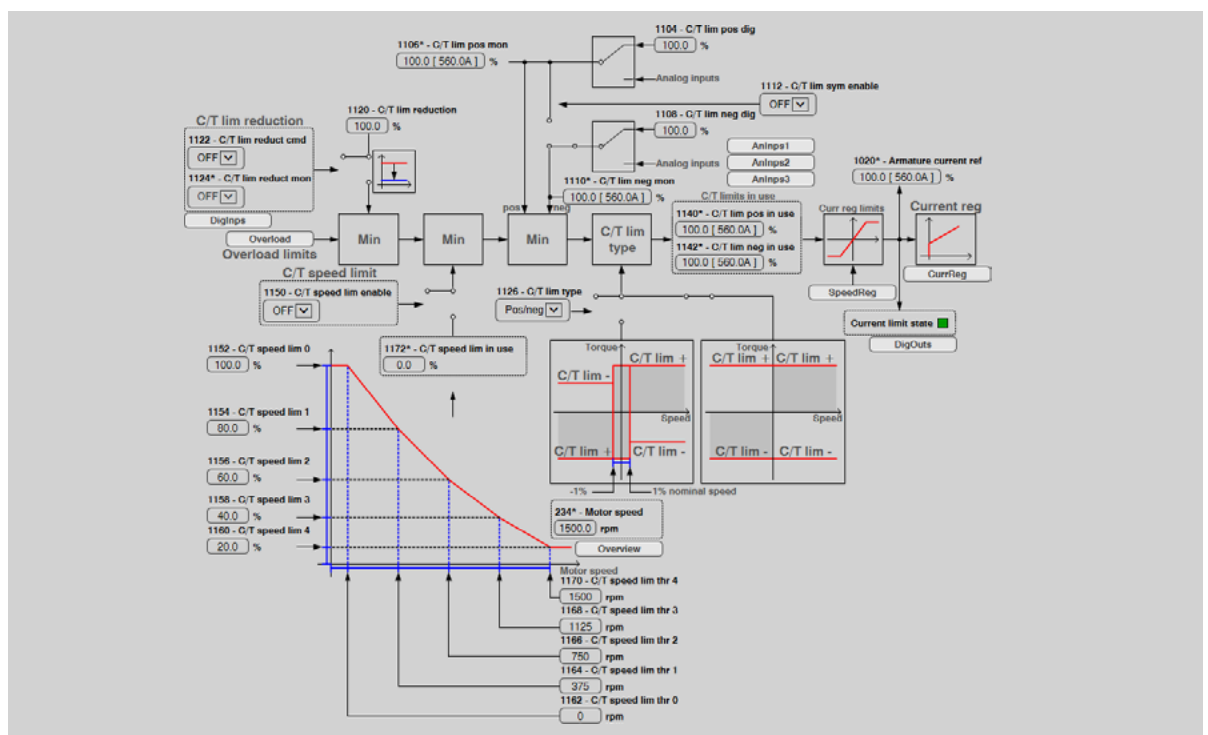


Figure 7-51: General diagram of current limit management (Curr Reg Limit diagram)

Current limit state is a digital output available in the selection lists of the **DIGITAL OUTPUTS** menu, used to indicate that the converter is operating under current limiting conditions. In this case, the **ILim** LED on the keypad is turned on.

NOTE!

The effective current/torque limits applied to the current regulator, represented by parameters IPA 1140 - **C/T lim pos in use** and IPA 1142 - **C/T lim neg in use**, result from a cascade of contributions from different functions. The final applied limit is always the minimum value among all of them:

- Positive/negative torque limits set by user parameters IPA 1106 - **C/T lim pos mon** and IPA 1110 - **C/T lim neg mon**
- Torque limits defined by the **limit reduction** parameter IPA 1120 - **C/T lim reduction**
- Torque limits set by the overload function via parameter IPA 4324 - **C/T overload lim mon**
- Torque limits based on motor speed, defined by parameter IPA 1172 - **C/T speed lim in use**

7.14.3 Current regulator tuning

The current regulator gains are configured using the following parameters in the **CURRENT CONTROL\CURR REG TUNE** menu.

IPA	DESCRIPTION
1050 Curr reg autotune	Command for executing a self-tuning cycle of the current regulator (valid only when IPA 1000- Curr reg mode = Predictive). The calculated armature resistance and inductance values are automatically assigned to the IPA 1052- Arm resistance and IPA 1054- Arm inductance parameters at the end of the procedure.
1052 Arm resistance	Load armature resistance, expressed in [Ω]. When performing a self-calibration cycle, this parameter is overwritten with the calculated value, but can be changed manually if necessary
1054 Arm inductance	Load armature reactance, expressed in [mH]. When performing an autotuning cycle, this parameter is overwritten with the calculated value, but can be changed manually if necessary
1060 Compensation output	Monitor useful for assessing whether the current regulator is correctly calibrated (only valid when IPA 1000- Curr reg mode = Predictive). The value should be as small as possible, typically less than $\pm 30 \dots 40$ V
1070 PI P1 gain	Percentage value of the proportional gain of the current PI controller, expressed in [%] relative to the base value IPA 1080- PI P base , with current reference at zero.
1072 PI I1 gain	Percentage value of the integral gain of the current PI controller, expressed in [%] relative to the base value IPA 1082- PI I base , with current reference at zero
1074 PI P2 gain	Percentage value of the proportional gain of the current PI controller, expressed as a percentage of the base value IPA 1080- PI P base , with a current reference higher than IPA 1078- PI curr thr
1076 PI I2 gain	Percentage value of the integral gain of the current PI controller, expressed as a percentage of the base value IPA 1082- PI I base , with a current reference greater than IPA 1078- PI curr thr
1078 PI curr thr	Threshold below which the proportional and integral gains of the current controller vary linearly with the current reference from value 1 to value 2. Above this threshold, the PI P2 gain and PI I2 gain values are maintained (see figure 6-46).
1080 PI P base	Base value of the proportional gain of the current PI controller, expressed in [deg/A]
1082 PI I base	Base value of the integral gain of the current PI controller, expressed in [deg/A x ms]

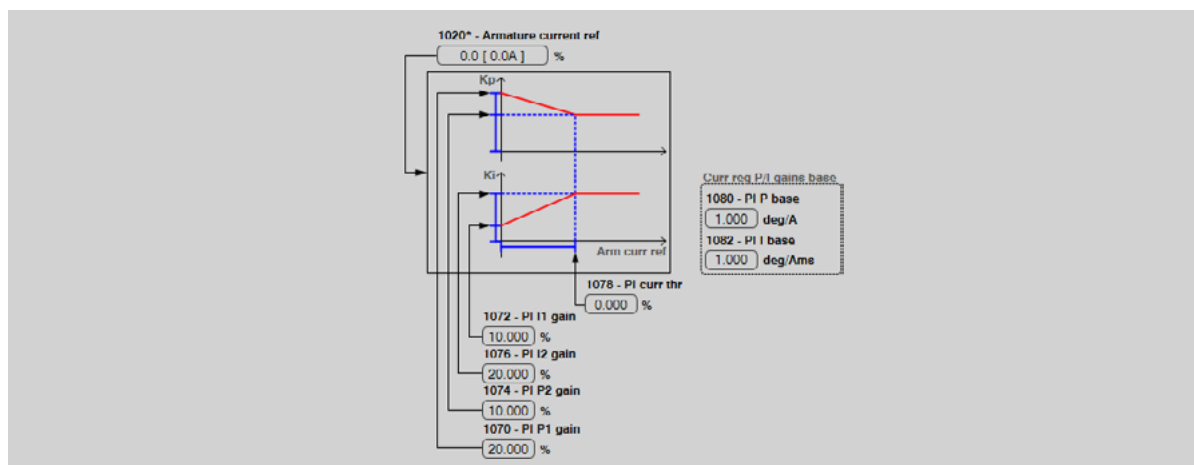


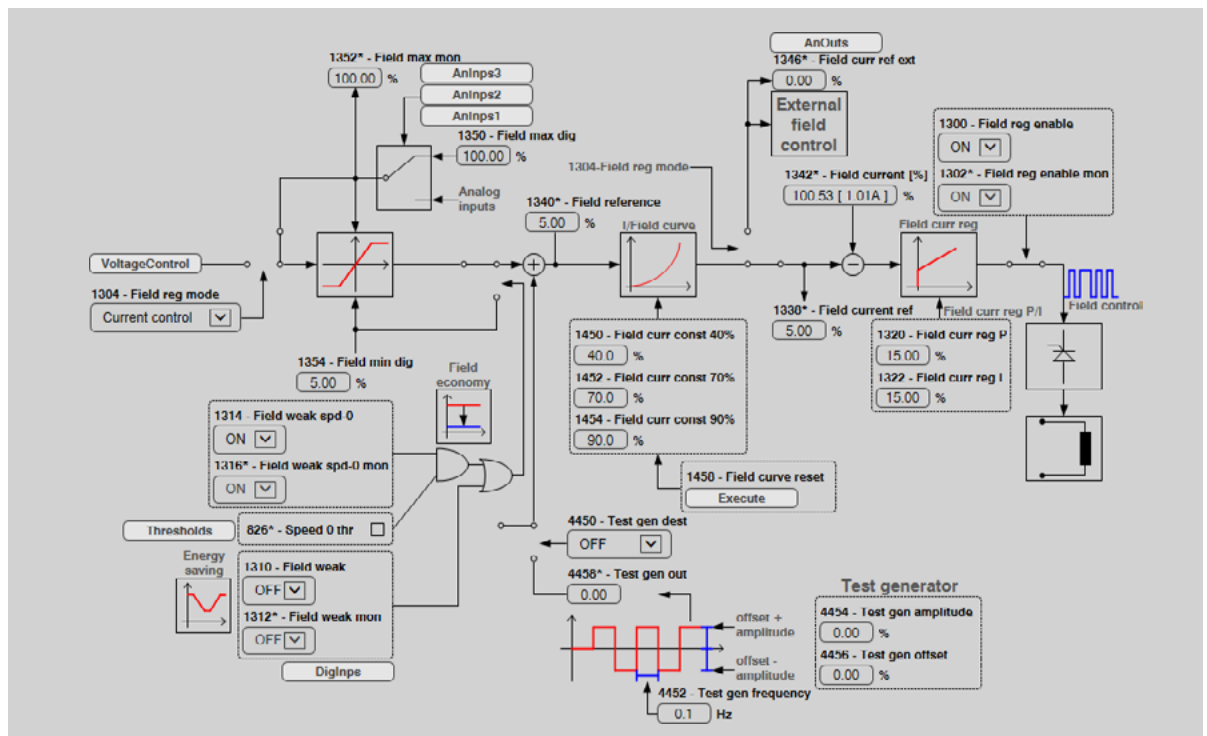
Figure 7-52: Diagram of current control parameter management when using the PI regulator

7.15 Field current control

The various parameters are organized into dedicated submenus, described in detail below.

7.15.1 Field current regulator

When the drive is operated with a constant field, regulator tuning may not be necessary; however, precise tuning becomes essential when a good dynamic response is required, such as in field weakening applications.



The field current regulator is configured using the following parameters in the **FIELD CONTROL\FIELD REG** menu.

IPA		DESCRIPTION
1300	Field reg enable	Field converter enable command. When set to <i>OFF</i> , the field current is zero because the field power board is disabled
1302	Field reg enable mon	Field converter enable command monitor, which can also be assigned by programmable digital inputs or fieldbus

Allows you to configure the field converter operating mode according to the type of system to be controlled and the drive in use.

Five selections are possible:

0 Current control: the field current applied depends on the flow reference and the set I/F curve (see figure 6-47). The controller takes the value of IPA 1352-**Field max mon** as the flow reference if no flow reductions (energy saving or field economy) are active, otherwise it takes the value of IPA 1354-**Field min dig**. The controller then performs constant flow control, unless an analogue input is set as **Field max**. In this mode, the armature voltage controller is disabled

1 Voltage control: this mode allows the nominal motor speed to be exceeded by weakening the field, which is managed independently by the drive based on the voltage of the motor armature circuit. The PI armature voltage regulator modifies the flow reference to ensure that the armature voltage is equal to **Volt control ref mon * Arm rated voltage**. The output of this controller is limited between IPA 1354-**Field min dig** and IPA 1352-**Field max mon** (see [figure 7-48](#)). If the I/F flow-current curve is correctly calibrated, the speed estimate is still valid, allowing it to be used as speed feedback.

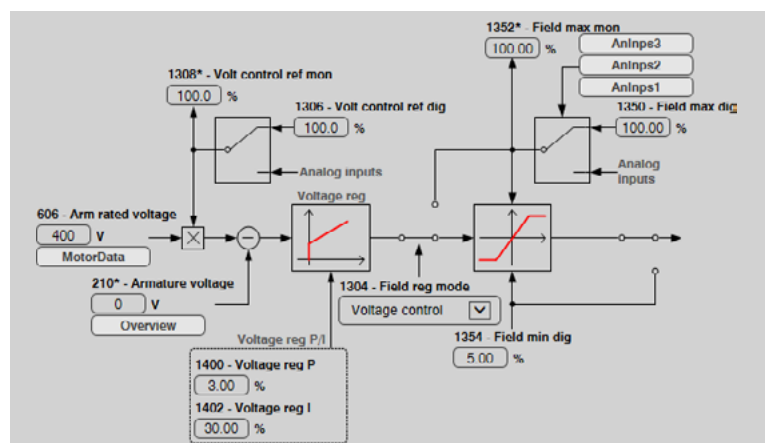


Figure 7-54: General voltage control diagram

2 External control: The field current is regulated by a device external to the drive. In this mode, the field current reference is calculated by controlling the armature voltage with automatic derating, as is typical for voltage control. The **TPD500** drive (master) regulates the armature current and supplies the field reference to the external device via an analogue output or field bus. The **TPD500** acts as if the actual field is always adhering to the reference requested by it, which is why the **Field loss alarm** signal is no longer managed internally but can come from a digital input configured as **Field Loss ext**, in order to inhibit the enabling of the armature in the absence of a field. The internal PI field current regulator is disabled

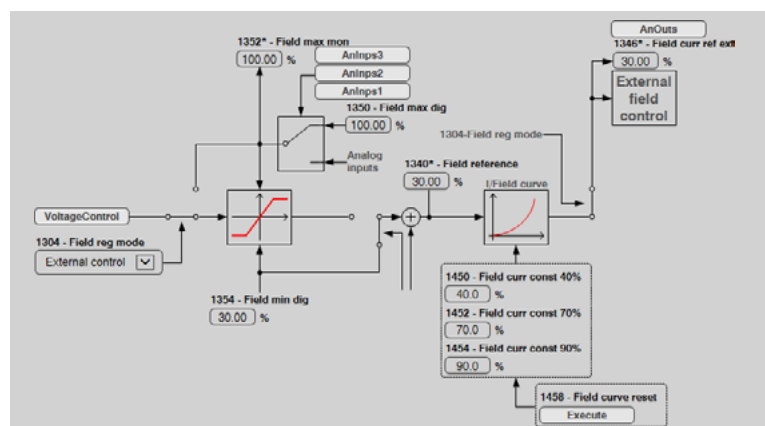


Figure 7-55: Voltage control when Field reg mode = External Control

4 Ext wired FC volt: The field current is regulated by an external **TPD500-FC** unit via a wired connection on standard I/O. In this mode, the field current reference is calculated by the armature voltage control with automatic current reduction typical of the **Voltage control case**.

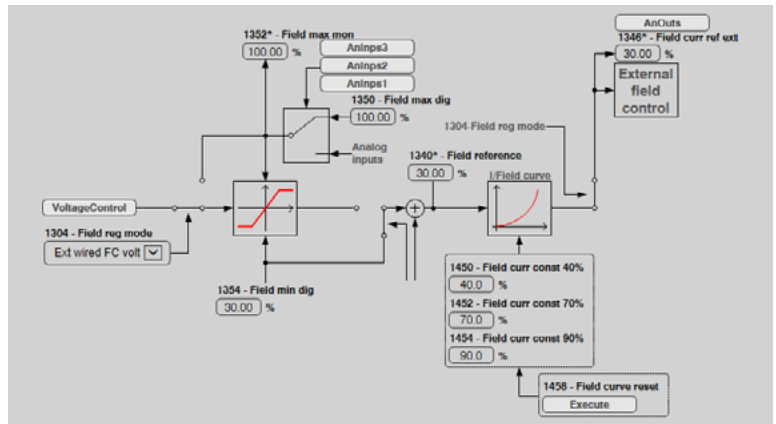


Figure 7-56: Voltage control when Field reg mode = External Wired FC Volt

The TPD500 drive (master) regulates the armature current and provides the field current reference to the TPD500-FC external unit. The internal PI field current regulator is disabled. To use this mode, connect a digital signal received from the TPD500-FC external unit and send an analogue signal to it, then configure the following parameters on the TPD500 drive:

- A digital input destination set as **Wired FC enable**, indicating the enable status of the external field controller **TPD500-FC**
- A selection of analogue outputs set as **Wired FC ref**, indicating the field current reference for the external unit **TPD500-FC**

Table 7-4: Connection diagram for managing the TPD500-FC

TPD500 (master)	
IPA 3500 An output 1 sel	IPA 3000 Digital input 1 dest
Wired FC ref	Wired FC EN
21	31
1	26
T current ref 1	Wired FC EN
IPA 3400 An input 1 sel	IPA 3200 Digital output 1 sel
TPD500-FC	

6 Ext wired FC curr: Field current adjustment performed by an external **TPD500-FC** unit via wired connection on standard I/O. In this mode, the field current reference is calculated in the same way as for **Current control** (constant flow).

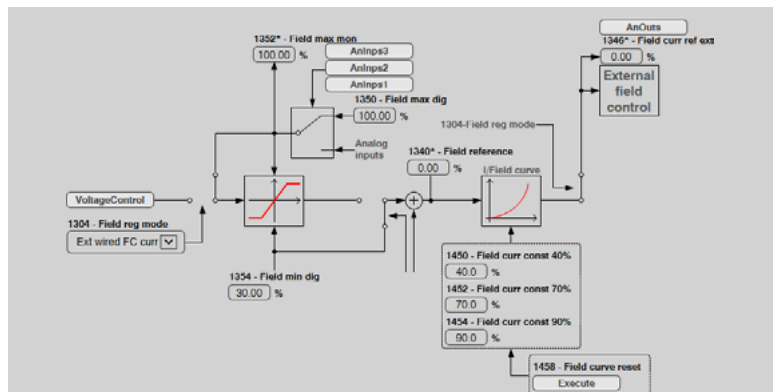
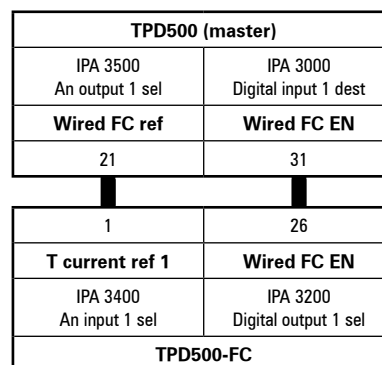


Figure 7-57: Voltage control when Field reg mode = External Wired FC Curr

The TPD500 drive (master) regulates the armature current and provides the field current reference to the TPD500-FC external unit. The internal PI field current regulator is disabled. To use this mode, connect a digital signal received from the external TPD500-FC unit and send an analogue signal to it, then configure the following parameters on the TPD500 drive (same wiring as for Ext wired FC volt):

- A digital input destination set as **Wired FC enable**, indicating the enable status of the **TPD500-FC/TPD32 EV-FC** external field controller
- A selection of analogue outputs set as **Wired FC ref**, indicating the field current reference for the **TPD500-FC/TPD32 EV-FC** external unit

Table 7-5: Connection diagram for managing the TPD500-FC



7 Optic FC volt The field current is controlled by an external **TPD500-FC** unit via a fiber-optic connection.

In this mode, the field current reference is calculated by controlling the armature voltage using the automatic current reduction typical of the Voltage Control mode.

The **TPD500** drive (master) regulates the armature current and provides the field current reference to the external **TPD500-FC** unit. The internal PI field current regulator is disabled. To use this mode, configure the TPD500 drive as follows:

Set IPA 1304-**Field reg mode** to Optic FC volt.

Configure the optical fiber communication module by setting IPA 5300-Optic mode to Master and selecting FC in 5302/5304/5306/5308 Optical device x to match the setting of the -FC drive. For example, when using FC as device 1, the two drives must be configured as shown in [Table 7-5](#)

8 Optic FC curr: Field current control performed by an external **TPD500-FC** unit connected via optical fiber. In this mode, the field current reference is calculated in a manner equivalent to the Current control (constant flux) mode.

The **TPD500** drive (master) regulates the armature current and provides the field current reference to the external **TPD500-FC** unit. The internal PI field current controller is disabled. To use this mode, configure the TPD500 drive as follows:

Set IPA 1304-**Field reg mode** to **Optic FC curr**.

Configure the optical fiber communication module by setting IPA 5300-**Optic mode** to Master and selecting FC in 5302/5304/5306/5308 **Optic device** 1/2/3/4 to match the setting of the TPD500-FC drive. For example, when using FC as device 1, the two drives should be set as follows

TPD500

IPA		Value
5300	Optical mode	Master
5302	Optical device 1	FC

TPD500-FC

IPA		Value
5300	Optical mode	Device 1

1310 Field weak

Field weakening enable command. When set to **ON**, the field reference takes the value **Field min dig**, while when set to **OFF**, the field current is supplied according to the selection of the **Field reg mode** parameter and the operating point of the drive.

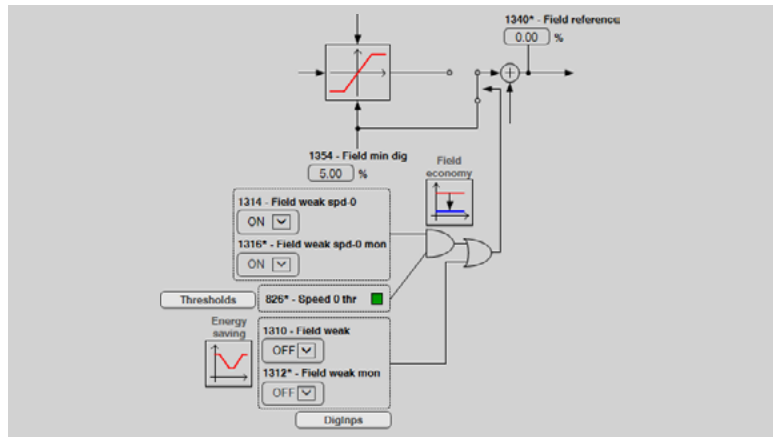


Figure 7-58: Field weakening control diagram

1312	Field weak mon	Monitor for field weakening enable command, which can also be assigned by programmable digital inputs or fieldbus
1314	Field weak spd-0	Command to enable field weakening at zero speed. When set to ON , the field reference takes on the value Field min dig when the zero speed signal Speed 0 thr takes on a high logic value and the converter is disabled. This function is useful to prevent overheating of motors that must remain stationary or to prevent condensation from forming in motors operating outdoors
1316	Field weak spd-0 mon	Monitor for field weakening command at zero speed, which can also be assigned by programmable digital inputs or fieldbus

7.15.2 Field current regulator limits

The field current limits, which act on the input of the field regulator IPA 1340 - **Field reference**, are managed using the following parameters in the **FIELD CONTROL\FIELD REG LIMIT** menu.

IPA	DESCRIPTION
1350	Field max dig Maximum flow reference, expressed as a percentage of the motor's nominal value, i.e. that obtained at the nominal field current. The maximum value of 100% therefore corresponds to the circulation of a current equal to the field rated current in the motor's field circuit. If no I/F flow-current curve is defined using parameters IPA 1450- Field curr const 40% , IPA 1452- Field curr const 70% and IPA 1454- Field curr const 90% , the variation of the parameter has a linear effect on the circulating field current
1352	Field max mon Maximum flow monitor, expressed as a percentage of the nominal motor flow, which can also be assigned by analogue inputs or fieldbus
1354	Field min dig Minimum flow, expressed as a percentage of the nominal motor current, i.e. that obtained at the Field rated current . Its value determines the circulation of a minimum current in the motor field circuit. The field loss alarm threshold corresponds to 50% of the Field min dig value

Field current limits are active for all selections of parameter IPA 1304-**Field reg mode**.

In cases where **Field reg mode** = **Current control** or **Ext wired FC const**, the field current regulator uses **Field max mon** as its input reference, thus achieving constant flux regulation (see [Figure 7-53](#)).

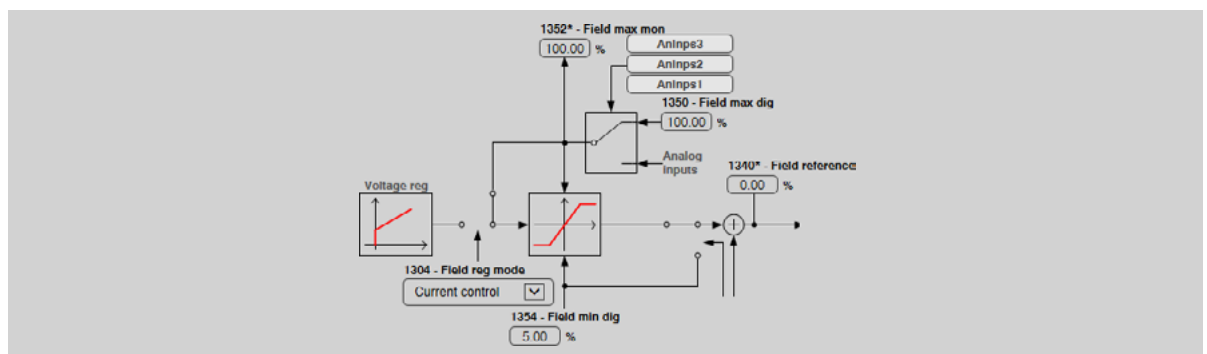


Figure 7-59: Operating diagram for Field Reg Limit = Current Control

In cases where **Field reg mode = Voltage control**, **External control**, or **Ext wired FC**, the output of the armature voltage regulator is limited between the values **Field min dig** and **Field max mon** (see [Figure 7-54](#))

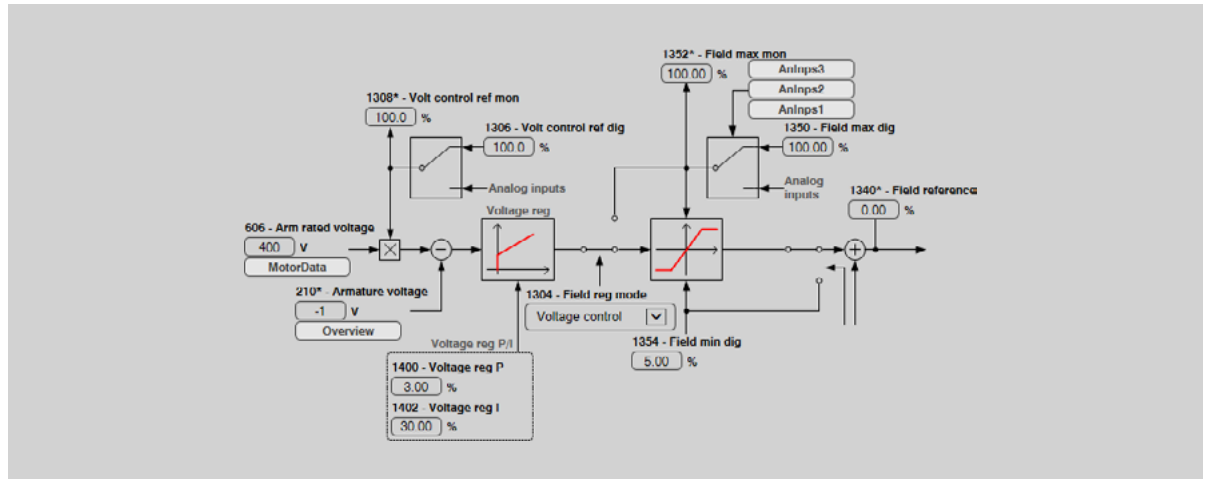


Figure 7-60: Operating diagram when Field Reg Limit = Voltage Control

7.15.3 Field current regulator calibration

The gains of the field current regulators are set using the following parameters in the **FIELD CONTROL\FIELD REG TUNE** menu.

IPA		DESCRIPTION
1320	Field curr reg P	Proportional gain Kp of the field current controller, expressed in [%] relative to the base gain IPA 1324- Field curr P base
1322	Field curr reg I	Integral Ki gain of the field current regulator, expressed in [%] relative to the base gain IPA 1326- Field curr I base
1324	Field curr P base	Proportional coefficient Kp base of the field current regulator
1326	Field curr I base	Integral coefficient Ki base of the field current regulator
1450	Field curr const 40%	Field current that results in a flow equal to 40% of the nominal flow
1452	Field curr const 70%	Field current that results in a flow equal to 70% of the nominal flow
1454	Field curr const 90%	Field current that results in a flow equal to 90% of the nominal flow
1458	Field curve reset	Command to restore the set flow curve by modifying parameters IPA 1450- Field curr const 40% , IPA 1452- Field curr const 70% and IPA 1454- Field curr const 90%

The proportional and integral gains of the PI field current regulators are divided into a base value and a percentage of that value, according to the following formulas:

$$K_p = K_{p\%} \times K_{pbase} / 100$$

$$K_i = K_{i\%} \times K_{ibase} / 100$$

The relationship between motor flux and field current can be described by a **flux–current curve**.

This curve is useful when manual or automatic field weakening is applied by setting parameter IPA 1304-**Field reg mode** to **Voltage control**, as it allows for optimized field regulation and accurate motor speed estimation.

The converter estimates the curve based on the values defined at 40%, 70%, and 90% of the flux, which can be set using the following parameters:

- IPA 1450-**Field curr const 40%**
- IPA 1452-**Field curr const 70%**
- IPA 1454-**Field curr const 90%**

The curve can be restored to default conditions by executing the command associated with parameter IPA 1458-**Field curve reset**.

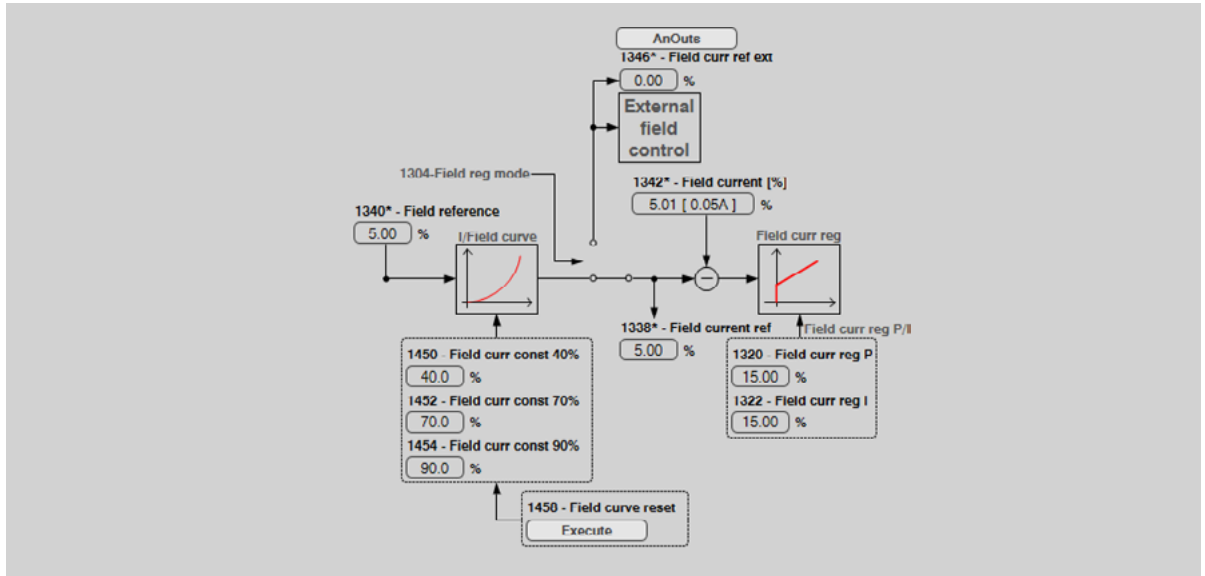


Figure 7-61: General diagram for managing flux references

7.15.4 Field current regulator reversal

The inversion of the field current regulators is set using the following parameters in the **FIELD CONTROL\FIELD REG INV** menu.

IPA		DESCRIPTION
1360	Field 2B inv mode	This parameter modifies the inversion modes with contactors according to the following modes: Normal: in this mode, field reversal is performed whenever the required current is opposite in sign to the actual current. Jog: in this mode, field reversal is performed only in Jog mode. Fast stop: in this mode, field reversal is performed only in Fast stop mode. Jog/Fast stop: in this mode, field reversal is performed only in Fast Stop and Jog modes
1362	Field 2B inv speed 0	By activating this parameter, it is possible to limit field reversal only when IPA 826- Speed 0 thr is active, i.e. when the speed is lower than IPA 812- Speed 0 level . If the parameter is OFF, reversal is performed whenever the speed controller requests a current of opposite sign to that applied. This limitation is ignored in the case of Fast stop; in this case, braking will be performed regardless of the value of this parameter
1364	Field 2B curr thr	Current threshold, as a percentage of the nominal field current, below which both contactors are opened, thereby discharging the inductor onto the discharge resistor
1366	Field 2B wait time	Minimum time that must elapse between the end of one reversal sequence and the start of the next
1368	Field 2B res time	This parameter allows you to set how long the Field contact + and Field contact - contactors remain open and the current is circulated in the discharge resistor.

7.16 Armature voltage control

The **VOLTAGE CONTROL** menu provides parameters for configuring the motor armature voltage control, which is based on a PI-type regulator.

7.16.1 Armature voltage regulator

TPD500 series drives can perform field weakening based on the motor armature circuit voltage.

This operating mode allows the motor to exceed its rated speed through a field weakening process managed automatically by the drive via a PI-type armature voltage regulator.

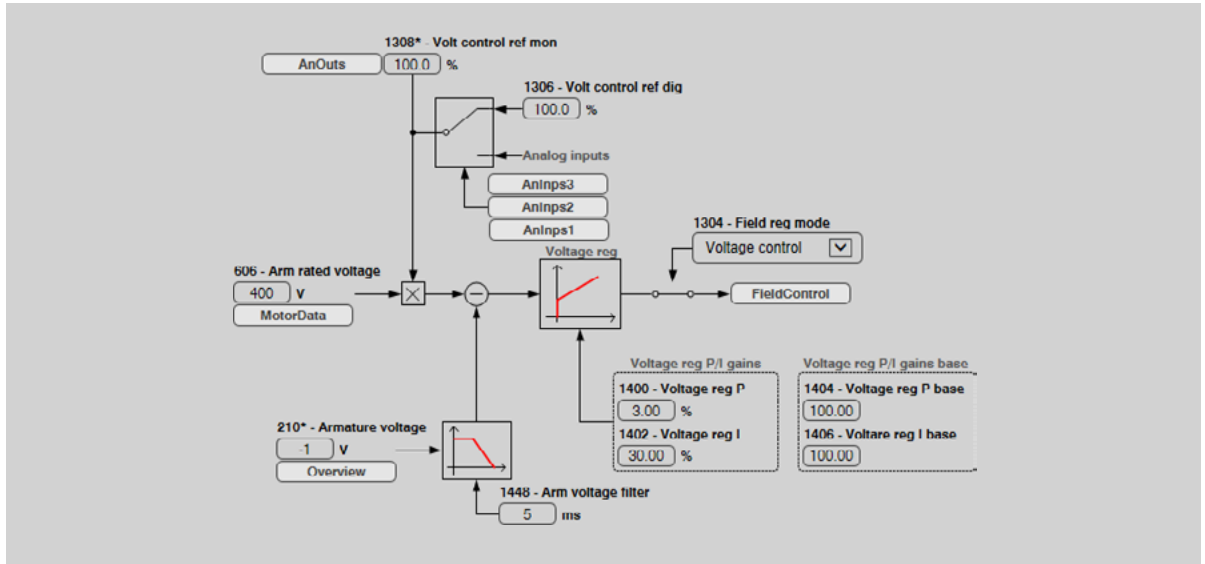


Figure 7-62 Voltage control management diagram (Voltage Control diagram)

The armature voltage regulator is configured using the following parameters in the **VOLTAGE CONTROL\VOLT REG** menu.

IPA	DESCRIPTION
1306 Volt control ref dig	Armature voltage reference, expressed as a percentage of the motor's rated armature voltage. Arm rated voltage is used when IPA 1304- Field reg mode = Voltage control , External control or Ext wired FC . The converter provides a PI-type armature voltage regulator that modifies the flux reference at the input to the field regulator to ensure that the armature voltage is equal to Volt control ref mon * Arm rated voltage . The output of this regulator is limited between IPA 1354- Field min dig and IPA 1352- Field max mon .

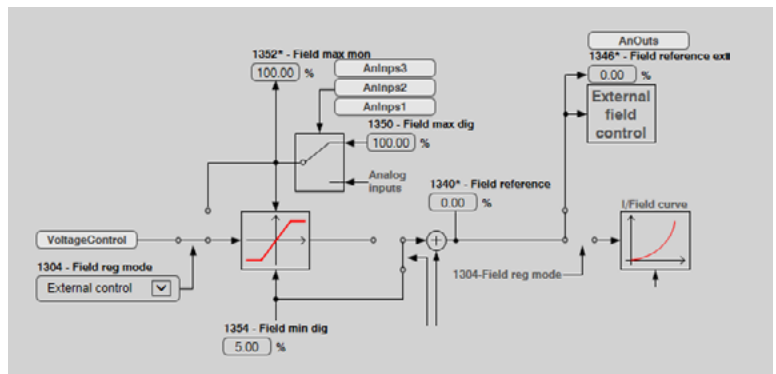


Figure 7-63: Voltage control reference diagram

1308 Volt control ref mon	Armature voltage reference monitor, which can also be assigned from programmable analogue inputs or fieldbus
1448 Arm voltage filter	Time constant of the low-pass filter applied to the voltage used by the armature voltage regulator, downstream of the Armature voltage parameter

7.16.2 Armature voltage regulator tuning

The gains of the armature voltage regulator (see section 6.16.1) are set using the following parameters in the **VOLTAGE CONTROL\VOLT REG TUNE** menu.

IPA	DESCRIPTION
1400 Voltage reg P	Proportional gain Kp of the armature voltage regulator, expressed as a percentage of the base gain IPA1404- Voltage reg P base
1402 Voltage reg I	Integral gain Ki of the armature voltage regulator, expressed as a percentage of the base gain IPA 1406- Voltage reg I base
1404 Voltage reg P base	Base proportional coefficient Kp of the armature voltage regulator
1406 Voltage reg I base	Base integral coefficient Ki of the armature voltage regulator

The proportional and integral gains of the PI armature voltage regulator are divided into a base value and a percentage of that value, according to the following formulas:

$$K_p = K_{p\%} \times K_{pbase} / 100$$

$$K_i = K_{i\%} \times K_{ibase} / 100$$

7.17 Analogue and digital interface (IOs)

7.17.1 Digital inputs

The menu provides parameters for managing eight programmable digital inputs (1...8), used to control the activation of certain drive functions.

Four inputs are available as standard, while the remaining four are available through an optional board (**TBO-32**).

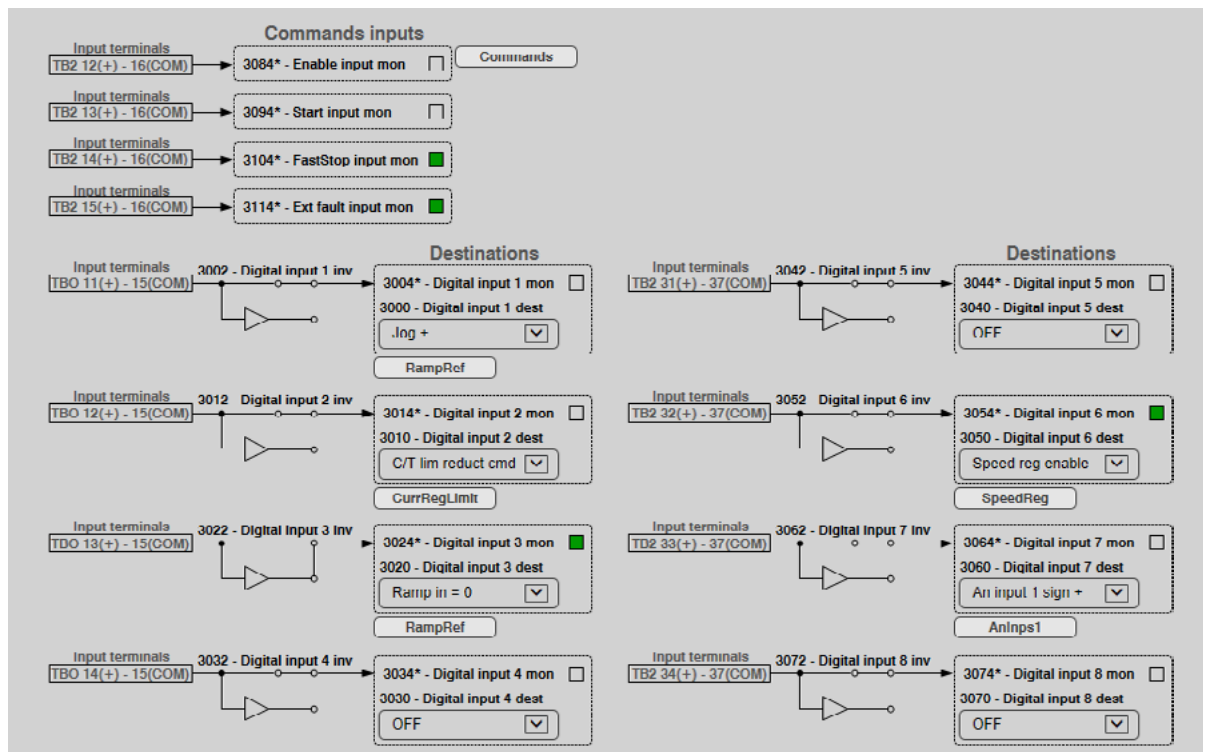


Figure 7-64: General diagram of digital input commands (Digital Inputs diagram)

IPA	DESCRIPTION
3000 Digital input 1 dest	Selection of the function to be controlled via Digital input 1
3010 Digital input 2 dest	Selection of the function to be controlled via Digital input 2
3020 Digital input 3 dest	Selection of the function to be controlled via Digital input 3
3030 Digital input 4 dest	Selection of the function to be controlled via Digital input 4
3040 Digital input 5 dest	Selection of the function to be controlled via Digital input 5
3050 Digital input 6 dest	Selection of the function to be controlled via Digital input 6
3060 Digital input 7 dest	Selection of the function to be controlled via Digital input 7
3070 Digital input 8 dest	Selection of the function to be controlled via Digital input 8
3002 Digital input 1 inv	Enabling signal polarity reversal Digital input 1
3012 Digital input 2 inv	Enabling signal polarity reversal Digital input 2
3022 Digital input 3 inv	Enabling signal polarity reversal Digital input 3
3032 Digital input 4 inv	Enabling signal polarity reversal Digital input 4
3042 Digital input 5 inv	Enabling signal polarity reversal Digital input 5
3052 Digital input 6 inv	Enabling signal polarity reversal Digital input 6
3062 Digital input 7 inv	Enabling signal polarity reversal Digital input 7

3072	Digital input 8 inv	Enabling signal polarity reversal Digital input 8
3004	Digital input 1 mon	Monitor (0/1) of the status of signal Digital input 1
3014	Digital input 2 mon	Monitor (0/1) of the status of signal Digital input 2
3024	Digital input 3 mon	Monitor (0/1) of the status of signal Digital input 3
3034	Digital input 4 mon	Monitor (0/1) of the status of signal Digital input 4
3044	Digital input 5 mon	Monitor (0/1) of the status of signal Digital input 5
3054	Digital input 6 mon	Monitor (0/1) of the status of signal Digital input 6
3064	Digital input 7 mon	Monitor (0/1) of the status of signal Digital input 7
3074	Digital input 8 mon	Monitor (0/1) of the status of signal Digital input 8

For each digital input (1...8), the following functions (destinations) can be selected:

- 0 **OFF**: destination disabled, the input does not control any function
- 1 **Motorpot preset**: motor potentiometer preset command
- 2 **Motorpot up**: motor potentiometer increase command
- 3 **Motorpot down**: motor potentiometer decrease command
- 4 **Motorpot invert**: motor potentiometer inversion command
- 5 **Jog +**: positive jog command
- 6 **Jog -**: negative jog command
- 7 **Alarm reset**: alarm reset command (effective if the alarm has cleared)
- 8 **C/T lim reduct cmd**: torque limit reduction command
- 10 **Ramp out = 0**: ramp output reset command
- 11 **Ramp in = 0**: ramp input reset command
- 12 **Ramp freeze**: ramp hold command
- 13 **Speed reg lock**: disconnects speed regulator output from current regulator
- 14 **Speed reg lock I**: locks the integral part of the speed regulator
- 15 **Speed autocapture**: enables flying speed capture
- 16 **An input 1 sign +**: select positive sign for analog input 1
- 17 **An input 1 sign -**: select negative sign for analog input 1
- 18 **An input 2 sign +**: select positive sign for analog input 2
- 19 **An input 2 sign -**: select negative sign for analog input 2
- 20 **An input 3 sign +**: select positive sign for analog input 3
- 21 **An input 3 sign -**: select negative sign for analog input 3
- 22 **Zero torque**: torque zeroing command
- 23 **Multi speed sel 0**: bit 0 for multi-speed selection (1 to 7)
- 24 **Multi speed sel 1**: bit 1 for multi-speed selection (1 to 7)
- 25 **Multi speed sel 2**: bit 2 for multi-speed selection (1 to 7)
- 26 **Multi ramp sel 0**: bit 0 for multi-ramp selection (1 to 4)
- 27 **Multi ramp sel 1**: bit 1 for multi-ramp selection (1 to 4)
- 28 **Field loss ext**: external field loss alarm signal
- 29 **Speed reg enable**: speed PI regulator enable command
- 30 **Field reg enable**: field current regulator enable command
- 31 **Field weak**: field weakening enable command
- 32 **Field weak spd-0**: field weakening enable command at zero speed
- 33 **PAD A bit 0**: force bit 0 of Bitword PAD A (state 0/1)
- 34 **PAD A bit 1**: force bit 1 of Bitword PAD A (state 0/1)
- 35 **PAD A bit 2**: force bit 2 of Bitword PAD A (state 0/1)
- 36 **PAD A bit 3**: force bit 3 of Bitword PAD A (state 0/1)
- 37 **PAD A bit 4**: force bit 4 of Bitword PAD A (state 0/1)
- 38 **PAD A bit 5**: force bit 5 of Bitword PAD A (state 0/1)
- 39 **PAD A bit 6**: force bit 6 of Bitword PAD A (state 0/1)
- 40 **PAD A bit 7**: force bit 7 of Bitword PAD A (state 0/1)
- 41 **PAD A bit 8**: force bit 8 of Bitword PAD A (state 0/1)
- 42 **PAD A bit 9**: force bit 9 of Bitword PAD A (state 0/1)
- 43 **PAD A bit 10**: force bit 10 of Bitword PAD A (state 0/1)
- 44 **PAD A bit 11**: force bit 11 of Bitword PAD A (state 0/1)
- 45 **PAD A bit 12**: force bit 12 of Bitword PAD A (state 0/1)
- 46 **PAD A bit 13**: force bit 13 of Bitword PAD A (state 0/1)
- 47 **PAD A bit 14**: force bit 14 of Bitword PAD A (state 0/1)
- 48 **PAD A bit 15**: force bit 15 of Bitword PAD A (state 0/1)
- 68 **Forward**: forward direction command
- 69 **Reverse**: reverse direction command
- 70 **An input 1 enable**: enable command for analog input 1
- 71 **An input 2 enable**: enable command for analog input 2
- 72 **An input 3 enable**: enable command for analog input 3
- 73 **Droop enable**: droop function enable command
- 74 **Enable digital**: enable command in **Digital** mode (only valid if IPA 502-**Control mode** = Remote)

- 75 **Start digital**: start command in **Digital** mode (only valid if IPA 502-**Control mode** = Remote)
76 **FastStop digital**: fast stop command in **Digital** mode (only valid if IPA 502-**Control mode** = Remote)
84 **Brake fbk**: mechanical brake feedback
86 **Adapt sel 1**: bit 0 for adaptive speed set selection
87 **Adapt sel 2**: bit 1 for adaptive speed set selection
88 **Wired FC enable**: enable command for field control via FC unit with standard I/Os
89 **Wired FC inv seq**: indicates field control performed during inversion sequence
90 **Wired FC active brg**: indicates currently active bridge (positive or negative) of the FC unit
91 **Field contactors**: activation of the field reversal function, acts on IPA 312-**Drive 2B inversion**
• input = OFF → IPA 312-**Drive 2B inversion** = OFF
• input = ON → IPA 312-**Drive 2B inversion** = Field contactors
92 **Field cont pos fbk**: "positive" contactor status for field reversal with contactors
93 **Field cont neg fbk**: "negative" contactor status for field reversal with contactors
94 **Field cont res fbk**: status of the field reversal discharge resistance contactor with contactors
95 **Speed drop enable**: **Speed drop** function enable command

NOTE!

The selections **Multi speed sel 0**, **Multi speed sel 1** and **Multi speed sel 2** must be used together.

NOTE!

The selections **Multi ramp sel 0** and **Multi ramp sel 1** must be used together.

For some of the selections available in the digital input destination lists, a corresponding ON/OFF user parameter also exists. In such cases, the general rule follows the example below:

- IPA 2018-**Ramp in** = 0 is the ramp input reset command, located in the **RAMPS** menu
- IPA 2020-**Ramp in** = 0 mon is the actual status of the command, also in the **RAMPS** menu
- IPA 3000-**Digital input 1 dest** set to **Ramp in** = 0

NOTE!

In this case, the **Ramp in** = 0 parameter becomes ineffective and the actual function status, monitored by **Ramp in** = 0 mon, is controlled by **digital input 1**.

Therefore, digital inputs take precedence over the corresponding assignable user command parameters.

7.17.2 Digital outputs

In the **DIGITAL OUTPUTS** menu, parameters are available for managing eight programmable digital outputs (1...8) used to signal the status of certain drive functions.

Four outputs are available as standard, while the remaining four are available through the optional **TBO-32** board.

Additionally, two programmable relay outputs, R1 and R2, are available on the FIR board, connected to terminals 35–36 and 75–76, respectively.

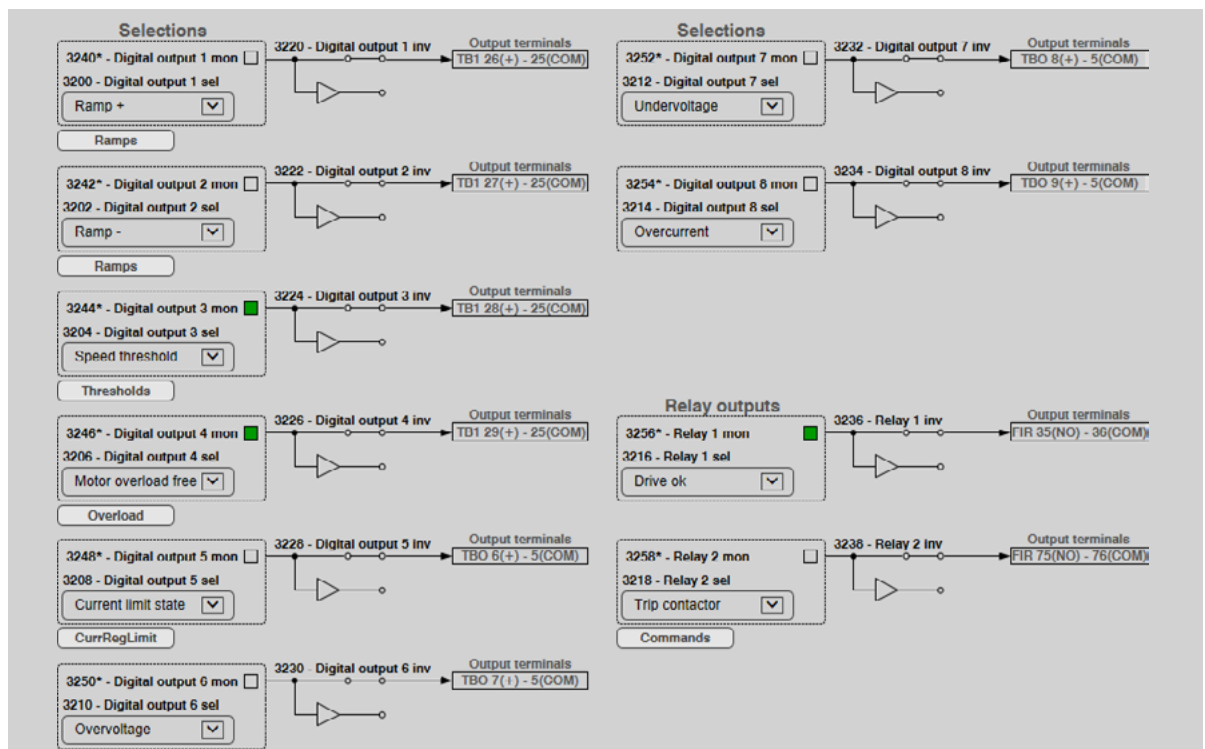


Figure 7-65: General diagram of digital output signals (Digital Outputs diagram)

IPA		DESCRIPTION
3200	Digital output 1 sel	Selecting the function to be assigned to Digital output 1
3202	Digital output 2 sel	Selecting the function to be assigned to Digital output 2
3204	Digital output 3 sel	Selecting the function to be assigned to Digital output 3
3206	Digital output 4 sel	Selecting the function to be assigned to Digital output 4
3208	Digital output 5 sel	Selecting the function to be assigned to Digital output 5
3210	Digital output 6 sel	Selecting the function to be assigned to Digital output 6
3212	Digital output 7 sel	Selecting the function to be assigned to Digital output 7
3214	Digital output 8 sel	Selecting the function to be assigned to Digital output 8
3216	Relay 1 sel	Selecting the function to assign to Relay 1
3218	Relay 2 sel	Selecting the function to assign to Relay 2
3220	Digital output 1 inv	Enabling signal inversion Digital output 1
3222	Digital output 2 inv	Enabling signal inversion Digital output 2
3224	Digital output 3 inv	Enabling signal inversion Digital output 3
3226	Digital output 4 inv	Enabling signal inversion Digital output 4
3228	Digital output 5 inv	Enabling signal inversion Digital output 5
3230	Digital output 6 inv	Enabling signal inversion Digital output 6
3232	Digital output 7 inv	Enabling signal inversion Digital output 7
3234	Digital output 8 inv	Enabling signal inversion Digital output 8
3236	Relay 1 inv	Enabling signal reversal Relay 1
3238	Relay 2 inv	Enabling signal reversal Relay 2
3240	Digital output 1 mon	Monitor (0/1) of the status of signal Digital output 1
3242	Digital output 2 mon	Monitor (0/1) of the status of signal Digital output 2
3244	Digital output 3 mon	Monitor (0/1) of the status of signal Digital output 3
3246	Digital output 4 mon	Monitor (0/1) of the status of signal Digital output 4
3248	Digital output 5 mon	Monitor (0/1) of the status of signal Digital output 5
3250	Digital output 6 mon	Monitor (0/1) of the status of signal Digital output 6
3252	Digital output 7 mon	Monitor (0/1) of the status of signal Digital output 7
3254	Digital output 8 mon	Monitor (0/1) of the status of signal Digital output 8
3256	Relay 1 mon	Monitor (0/1) of the status of signal Relay 1
3258	Relay 2 mon	Monitor (0/1) of the status of signal Relay 2

For each digital output (1...8), the following functions (sources) can be selected:

- 0 **OFF**: output set to 0 (logic low)
- 100 **ON**: output set to 1 (logic high)
- 1 **Speed 0 thr**: speed zero threshold signal
- 2 **Speed threshold**: speed within programmed thresholds
- 3 **Speed set**: speed reached (with programmable tolerance band)
- 4 **Current limit state**: drive at current limit
- 5 **Drive ready**: drive in Ready state
- 6 **Motor overload free**: motor overload protection available
- 8 **Ramp +**: ramp increasing
- 9 **Ramp -**: ramp decreasing
- 10 **Speed limited**: speed limitation active
- 11 **Undervoltage**: **Undervoltage** alarm active
- 12 **Overvoltage**: **Overvoltage** alarm active
- 13 **Heatsink**: **Heatsink** alarm active
- 14 **Overcurrent**: **Overcurrent** alarm active
- 15 **Motor overtemp**: **Motor overtemperature** alarm active
- 16 **External fault**: **External fault** alarm active
- 17 **Failure supply**: Power supply **failure** alarm active
- 18 **Pad A bit**: status of **Bitword Pad A** bit n-1 on digital output n
- 19 **Pad B bit**: status of **Bitword Pad B** bit n-1 on digital output n
- 20 **Control word bit**: status of **Control word mon** bit n-1 on digital output n
- 21 **Torque sign**: output torque sign indication
- 23 **Trip contactor**: contactor disabled after delayed stop
- 24 **Field loss**: **Field loss** alarm active

- 25 **Speed fbk loss: Speed feedback loss** alarm active
- 26 **Bus loss: Bus loss** alarm active
- 30 **Enc 1 state ok: Encoder 1** status OK
- 31 **Enc 2 state ok: Encoder 2** status OK
- 35 **Enable seq err: Enable sequence error** alarm active
- 42 **Drive ok:** drive running with no alarms
- 49 **An inp 1 cmp match:** analog input 1 comparator match reached
- 50 **Enable state mon:** drive enable status
- 51 **Start state mon:** drive start status
- 52 **FastStop state mon:** fast stop status
- 60 **Acceleration state:** ramp in acceleration phase
- 61 **Deceleration state:** ramp in deceleration phase
- 62 **Brake cmd mon:** mechanical brake open command
- 63 **Brake fault: Brake fault** alarm active
- 65 **Motor l2t alert:** motor overload alert at 80%
- 66 **Drive l2t alert:** drive overload alert at 80%
- 67 **Drive overload free:** drive overload protection available
- 68 **Motor l2t overload: Motor overload** alarm active
- 69 **Drive l2t overload: Drive overload** alarm active
- 70 **Arm curr threshold:** armature current threshold exceeded
- 71 **Overspeed: Overspeed** alarm active
- 72 **Delta freq err: Delta frequency error** alarm active
- 76 **Drv ready to start:** drive ready to start
- 77 **Remote control: Remote control** mode active
- 80 **Firing:** armature circuit firing active
- 81 **Cont current:** continuous conduction mode active
- 82 **Sustained curr: Sustained current** alarm active
- 83 **Field cont pos cmd:** "positive" contactor command for field reversal with contactors
- 84 **Field cont neg cmd:** "negative" contactor command for field reversal with contactors
- 85 **Field cont res cmd:** command of the discharge resistance contactor for field reversal with contactors

NOTE!

Digital outputs associated with alarm states are meaningful even if the corresponding alarm is ignored.
For example, if IPA 5070-EF activity = **Ignore**, it is still possible to monitor the alarm status by assigning IPA 3200-Digital output 1 sel to **External fault**.

NOTE!

Digital outputs associated with alarm states are active low.

NOTE!

The **Drv ready to start** signal is at logic high if and only if the following conditions are met:

- Power supply is present
- No active alarms
- Three-phase mains synchronization achieved

7.17.3 Analog inputs

The **ANALOG INPUTS** menu provides parameters for managing three programmable analog inputs (1...3), used to set certain control parameters of the drive.

Each of the three inputs is managed through a dedicated submenu: **ANALOG INPUT 1**, **ANALOG INPUT 2**, and **ANALOG INPUT 3**.

7.17.3.1 Analog input 1

The **ANALOG INPUT 1** menu provides parameters for managing analog input 1, which is programmable and connected to terminals 1–2 of the **R-TPD500** control board, to set certain drive control parameters.

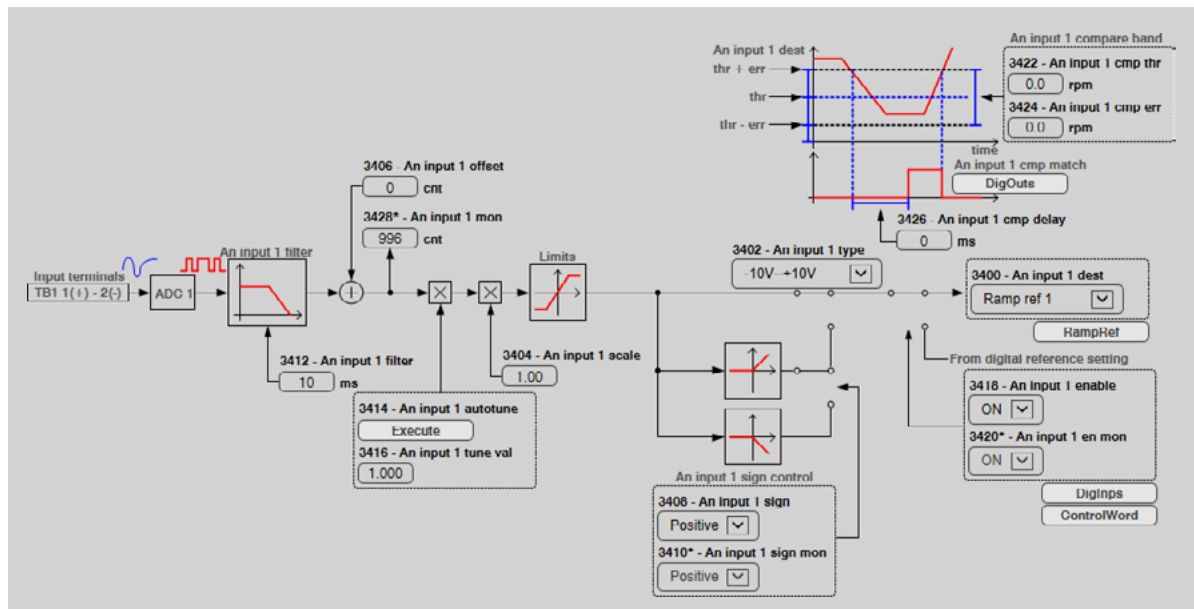


Figure 7-66: General diagram of analog input 1 management (Analog Input 1 diagram)

IPA	DESCRIPTION
3400	An input 1 dest
	Select the parameter whose value is to be received from analogue input 1. The following selections are available:
	0 OFF : destination disabled, the input does not control any parameters
	1 Jog ref : Jog reference
	2 Speed ref 1 : speed reference 1
	3 Speed ref 2 : speed reference 2
	4 Ramp ref 1 : ramp reference 1
	5 Ramp ref 2 : ramp reference 2
	6 C/T ref 1 : current/torque reference 1
	7 C/T ref 2 : current/torque reference 2
	8 Adaptive ref : speed reference for adaptive gains
	10 C/T lim pos : positive current/torque limit
	11 C/T lim neg : negative current/torque limit
	12 Pad 0 : Pad 0
	13 Pad 1 : Pad 1
	14 Pad 2 : Pad 2
	15 Pad 3 : Pad 3
	16 Pad 4 : Pad 4
	17 Pad 5 : Pad 5
	18 Pad 6 : Pad 6
	19 Pad 7 : Pad 7
	24 Load comp : input for the Droop function
	25 Field max : maximum current field value
	26 Volt control ref : voltage reference in Voltage control mode
	27 Brake pretorque : pre-torque level for mechanical brake release
	28 Speed draw ratio : speed ratio level in action at the ramp exit

3402	An input 1 type	Selection of input type (voltage or current). Depending on the input signal used, jumpers must be positioned on the R-TPD500 board. In the standard delivery condition, the inputs are coded for voltage signals, see Table 4-5: Jumpers and Dip-Switches on the control board. The following selections are available: Selection -10V±10V: A maximum voltage of ±10V is connected to analogue input 1. If the signal is used as a reference, the direction of rotation can be reversed by reversing the polarity of the voltage (4B converters only). 2B converters only accept positive speed references; negative references are ignored and the drive remains stationary Selection 0...20 mA, 0...10V: A maximum voltage of 10V or a current signal of 0...20 mA is connected to analogue input 1. If the signal is used as a reference, the direction of rotation can be reversed using parameter IPA 3408 - An input 1 sign (4B converters only) or the An input 1 sign+/An input 1 sign- selections of the digital inputs Selection 4...20 mA: A 4...20 mA current signal is connected to analogue input 1. The signal must be positive. If the signal is used as a reference, the direction of rotation can be reversed using parameter IPA 3408 - An input 1 sign (4B converters only) or the An input 1 sign+/An input 1 sign- selections of the digital inputs
3404	An input 1 scale	Analogue input scale factor 1
3416	An input 1 tune val	It acts in cascade at An input 1 scale for fine adjustment of analogue input 1 when the maximum signal does not correspond exactly to the nominal value. With An input 1 scale = 1 and An input 1 tune val = 1, 10 V or 20 mA at the input correspond to the following full scale values, depending on the selected destination: 0 OFF: destination disabled 1 Jog ref: IPA 400-Full scale speed (see paragraph 6.7) 2 Speed ref 1: IPA 400-Full scale speed 3 Speed ref 2: IPA 400-Full scale speed 4 Ramp ref 1: IPA 400-Full scale speed 5 Ramp ref 2: IPA 400-Full scale speed 6 C/T ref 1: maximum permissible armature current (150% with overload) 7 C/T ref 2: maximum permissible armature current (150% with overload) 8 Adaptive ref: IPA 400-Full scale speed 10 C/T lim pos: maximum permissible armature current (150% with overload) 11 C/T lim neg: maximum permissible armature current (150% with overload) 12 Pad 0: 32767.0 count 13 Pad 1: 32767.0 count 14 Pad 2: 32767.0 count 15 Pad 3: 32767.0 count 16 Pad 4: 32767.0 count 17 Pad 5: 32767.0 count 18 Pad 6: 32767.0 count 19 Pad 7: 32767.0 count 24 Load comp: maximum permissible armature current (150% with overload) 25 Field max: IPA 608-Field rated current (100%) 26 Volt control ref: IPA 608-Field rated current (100%) 27 Brake pretorque: maximum permissible armature current (150% with overload) 28 Speed draw ratio: 2.0000
3414	An input 1 autotune	Command to perform automatic fine tuning of analogue input 1. In this case, An input 1 tune val is calculated automatically so that the available input signal corresponds to the maximum value of the associated variable, for example IPA 400-Full scale speed. To perform automatic tuning, two conditions must be met: • Input voltage greater than 1 V or input current greater than 2 mA • Positive polarity
3406	An input 1 offset	Allows you to compensate for a small offset on the analogue signal
3408	An input 1 sign	Sign reversal command in the case of unipolar input signal (0...20mA, 0...10V, 4...20mA)
3410	An input 1 sign mon	Sign reversal command monitor, which can also be assigned by digital inputs
3412	An input 1 filter	Time constant of the low-pass filter applied to the measurement of analogue input signal 1

3418	An input 1 enable	Analogue input 1 enable command. If set to <i>OFF</i> , the target variable set via An input 1 dest is not assigned via analogue input but only from the respective user value, as in the following example: An input 1 dest = Ramp ref 1 An input 1 enable = OFF Ramp ref 1 dig = 1000.0 rpm (user value) Ramp ref 1 mon = 1000.0 rpm regardless of the voltage level of analogue input 1
3420	An input 1 mon	Monitor for the enable command of analogue input 1, which can also be assigned from digital inputs
3428	An input 1 en mon	Monitor in count of analogue input signal 1, after A/D conversion, filtering and offset application

Only **analog input 1** supports the comparison function, which signals when the input reaches a programmable threshold using the following parameters:

- **IPA 3422-An input 1 cmp thr**: sets the comparison threshold, in the same unit as the variable assigned to **An input 1 dest**
- **IPA 3424-An input 1 cmp error**: sets a tolerance band around **An input 1 cmp thr**, also in the same unit as the assigned variable
- **An inp 1 cmp match**: available in the digital output selection list (see [section 7.17.2](#)), indicates when the input reaches the comparison threshold (match)
- **IPA 3426-An input 1 cmp delay**: delay in milliseconds before signaling that the threshold has been reached (match)

To use the comparison function, refer to the following example.

To signal when **Ramp ref 1** reaches **700 rpm** through a digital output, with a tolerance band of **100 rpm**, configure the following:

IPA 3200-Digital output 1 sel = An imp 1 cmp match
 IPA 3400-An input 1 dest = Ramp ref 1
 IPA 3422-An input 1 cmp thr = 700 rpm
 IPA 3424-An input 1 cmp error = 100 rpm
 IPA 3426-An input a cmp delay = 1000 ms

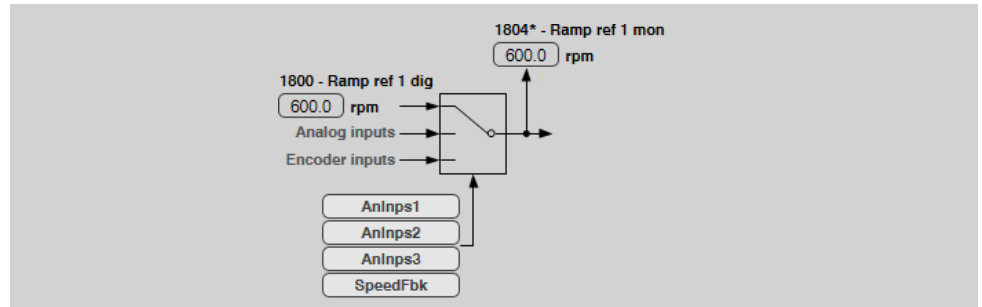
The digital output **An inp 1 cmp match** switches from 0 to 1 with a 1-second delay after **Ramp ref 1 mon** reaches **600 rpm**, and returns to 0 as soon as **Ramp ref 1 mon** exceeds **800 rpm** (see [Figure 7-60](#)).

For all selections available in the analog input destination lists, a corresponding numerical user parameter also exists. In such cases, the general rule follows the example below:

IPA 1800-**Ramp ref 1 dig** is the ramp reference 1 (user-set value), found in the **REFERENCES\RAMP REF** menu

IPA 1804-**Ramp ref 1 mon** is the monitor for ramp reference 1 (normally follows **Ramp ref 1 dig**)

IPA 3400-**An input 1 dest** is set to **OFF** or any value other than **Ramp ref 1**. In this case, **Ramp ref 1 mon** follows **Ramp ref 1 dig**, as shown by the selector in the diagram below.



NOTE!

Figure 7-67: Logic diagram when An input 1 dest $\neq$ Ramp Ref 1

If instead **An input 1 dest** is set to **Ramp ref 1**, the parameter **Ramp ref 1 dig** becomes ineffective (while retaining its value) and the actual reference value, monitored by **Ramp ref 1 mon**, is determined by the voltage or current level of **analog input 1**, as shown by the selector switch in the diagram below.

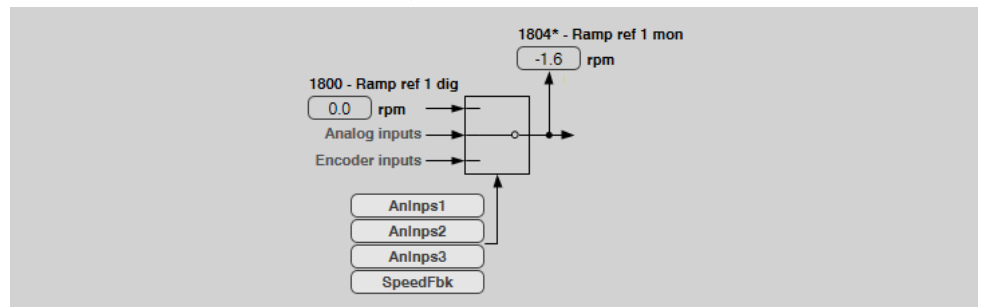


Figure 7-68: Logic diagram when An input 1 dest = Ramp Ref 1

The analog inputs therefore have a higher priority than the corresponding user parameters with assignable numerical values.

7.17.4 Analog outputs

The **ANALOG OUTPUTS** menu provides parameters for managing four programmable analog outputs (1...4), which can be used to transmit the status of selected analog monitor variables from the drive to external systems. Two outputs are available as standard, while the other two are available via the optional expansion board (TBO-32).

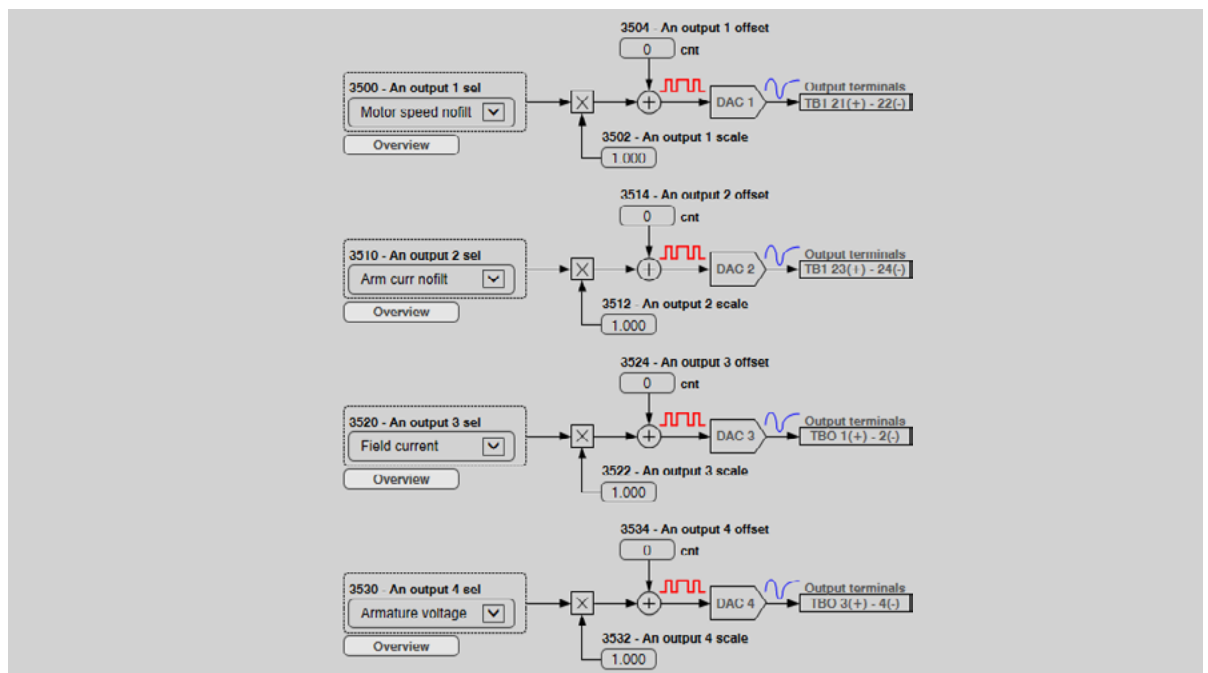


Figure 7-69: General operating diagram of the analog outputs (Analog Outputs diagram)

IPA	DESCRIPTION
3500 An output 1 sel	Selecting the variable to be assigned to Analog output 1
3510 An output 2 sel	Selecting the variable to be assigned to Analog output 2
3520 An output 3 sel	Selecting the variable to be assigned to Analog output 3
3530 An output 4 sel	Selecting the variable to be assigned to Analog output 4
3502 An output 1 scale	Analogue output scale factor 1
3512 An output 2 scale	Analogue output scale factor 2
3522 An output 3 scale	Analogue output scale factor 3
3532 An output 4 scale	Analogue output scale factor 4
3504 An output 1 offset	Analogue output 1 offset compensation
3514 An output 2 offset	Analogue output 2 offset compensation
3524 An output 3 offset	Analogue output 3 offset compensation
3534 An output 4 offset	Analogue output 4 offset compensation

Each analogue output 1...4 can be controlled by the following monitor variables:

- 0 **OFF**: output disabled, set to 0 V
- 1 **Speed ref 1 mon**: speed reference 1 monitor
- 2 **Speed ref 2 mon**: speed reference 2 monitor
- 3 **Ramp ref 1 mon**: ramp reference 1 monitor
- 4 **Ramp ref 2 mon**: ramp reference 2 monitor
- 5 **Ramp reference**: overall ramp reference
- 6 **Speed reference**: overall speed reference
- 7 **Ramp output**: ramp function output
- 8 **Motor speed nofilt**: unfiltered motor speed monitor
- 9 **C/T ref 1 mon**: current/torque reference 1 monitor
- 10 **C/T ref 2 mon**: current/torque reference 2 monitor
- 11 **Armature current ref**: armature current reference
- 15 **Speed reg output**: speed regulator output
- 16 **Arm curr nofilt**: unfiltered armature current monitor
- 20 **Armature voltage**: armature voltage monitor
- 24 **An input 1 mon**: analog input 1 monitor
- 25 **An input 2 mon**: analog input 2 monitor
- 26 **An input 3 mon**: analog input 3 monitor
- 27 **Field current**: field current monitor
- 31 **Pad 8**: value of parameter Pad 8
- 32 **Pad 9**: value of parameter Pad 9
- 33 **Pad 10**: value of parameter Pad 10
- 34 **Pad 11**: value of parameter Pad 11
- 35 **Pad 12**: value of parameter Pad 12
- 36 **Pad 13**: value of parameter Pad 13
- 37 **Pad 14**: value of parameter Pad 14
- 38 **Pad 15**: value of parameter Pad 15
- 70 **Field reference**: field reference monitor
- 79 **Volt control ref**: voltage reference in **Voltage Control** mode
- 80 **Field curr max mon**: maximum field current monitor
- 81 **Motor speed**: filtered motor speed monitor
- 82 **Armature current**: filtered armature current monitor
- 84 **Speed draw out**: **Speed Draw** function output monitor
- 88 **Output power**: output power monitor
- 95 **Wired FC ref**: field current reference for external FC converter
- 96 **Motorpot out**: Motopotentiometer function output speed
- 97 **Speed drop trigger**: filtered derivative of the armature current reference

With **An output 1/2/3/4 scale = 1**, **10V** is generated when the selected monitor variable reaches the following full-scale values:

- 0 **OFF**: output disabled, set to 0 V
- 1 **Speed ref 1 mon**: IPA 400-Full scale speed
- 2 **Speed ref 2 mon**: IPA 400-Full scale speed
- 3 **Ramp ref 1 mon**: IPA 400-Full scale speed
- 4 **Ramp ref 2 mon**: IPA 400-Full scale speed
- 5 **Ramp reference**: IPA 400-Full scale speed
- 6 **Speed reference**: IPA 400-Full scale speed
- 7 **Ramp output**: IPA 400-Full scale speed
- 8 **Motor speed nofilt**: IPA 400-Full scale speed

- NOTE!**

The analog output scaling factor can be used to adapt the 0–10 V signal—generated when the drive reaches its maximum speed—to an analog measuring instrument with a display range of 0– V_{max} (where V_{max} is less than 10 V). In this case, the scaling factor should be set to $V_{max}/10$.

7.18 Additional functions

The **FUNCTIONS** menu provides several general-purpose auxiliary functions that allow customization or alternative control of some of the basic features already available in the drive (such as speed control and ramp function). These functions are normally disabled, but each one has a dedicated enable parameter. Each function is managed through a dedicated menu and is described in detail below.

7.18.1 Motorpotentiometer

The **Motorpotentiometer** function acts on the ramp reference chain (see **Figure 7-14**) with the purpose of adjusting the drive speed by applying dedicated Up/Down commands. It features its own ramp times, which are independent from the main speed control ramp.

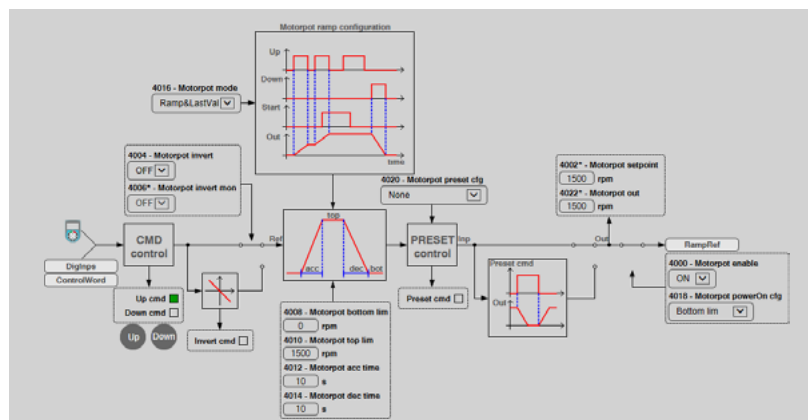


Figure 7-70: General functional diagram of the Motorpotentiometer function (Motorpot diagram)

The function is managed through the following parameters in the **FUNCTIONS\MOTORPOT** menu:

IPA		DESCRIPTION
4000	Motorpot enable	Enables the motor potentiometer function
4002	Motorpot setpoint	Motor potentiometer output speed, expressed in [rpm], which can be increased or decreased by applying the Up/Down commands
4004	Motorpot invert	Motor potentiometer output reversal command
4006	Motorpot invert mon	Output reversal command monitor, which can also be assigned by programmable digital inputs
4008	Motorpot bottom lim	Lower limit of the motor potentiometer output speed, expressed in [rpm]
4010	Motorpot top lim	Upper limit of the motor potentiometer output speed, expressed in [rpm]
4012	Motorpot acc time	Motor potentiometer ramp acceleration time, between the lower limit and the upper limit, expressed in [s]
4014	Motorpot dec time	Motor potentiometer ramp deceleration time, between the upper limit and the lower limit, expressed in [s]
4016	Motorpot mode	Setting of the motor potentiometer operating mode. Four selections are possible:

0 Ramp&LastVal: by applying the **Up/Down** commands, the output is subject to the ramp set with the **Motorpot acc time** / **Motorpot dec time** parameters and, in the absence of commands, it maintains the value even when the **Start** command is removed.

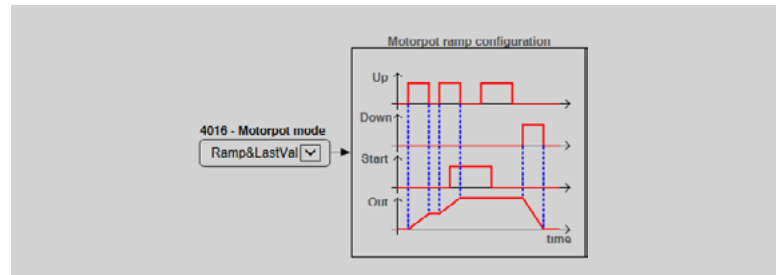


Figure 7-71: Logic diagram in the case of Motorpot mode = Ramp&LastVal selection

1 Ramp&Follow: by applying the **Up/Down** commands, the output is subjected to the ramp action set with the **Motorpot acc time** / **Motorpot dec time** parameters and, in the absence of commands, does not maintain the value when the **Start** command is removed.

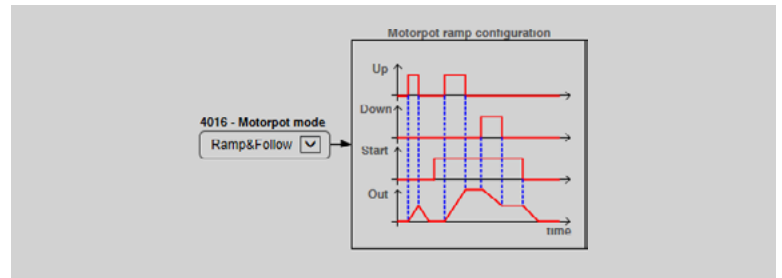


Figure 7-72: Logic diagram for Motorpot mode = Ramp&Follow selection

2 Fine&LastVal: by pressing the **Up/Down** commands once, the output varies by 1 rpm, while pressing and holding (for at least 1 second) activates the ramp set with the **Motorpot acc time** / **Motorpot dec time** parameters. In the absence of commands, it maintains the value even when the **Start** command is removed.

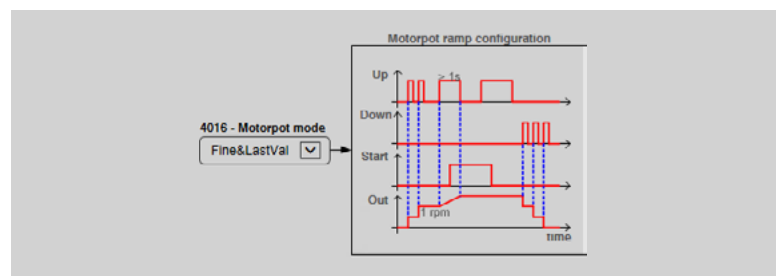


Figure 7-73: Logic diagram in the case of Motorpot mode = Fine&LastVal selection

3 Fine&Follow: by pressing the **Up/Down** commands once, the output varies by 1 rpm, while pressing and holding (for at least 1 second) causes the ramp set with the **Motorpot acc time / Motorpot dec time** parameters to be activated. If no commands are given, the value is not maintained when the **Start** command is removed.

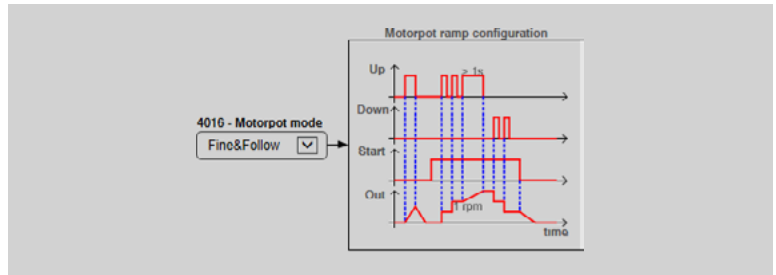


Figure 7-74: Logic diagram in the case of Motorpot mode = Fine&Follow selection

4018 Motorpot powerOn Cfg

Allows you to select the initial value of the motor potentiometer output when the drive is switched on. Four selections are possible:

- 0 Last power off:** the output starts from the last reference set before shutdown
- 1 Zero:** output starts from 0 rpm
- 2 Bottom lim:** the output starts from **Motorpot bottom lim**
- 3 Top lim:** the output starts from **Motorpot top lim**

4020 Motorpot preset cfg

Enables the preset command to act in various ways on the output speed of the motor potentiometer. Twelve selections are possible:

- 0 None:** the preset command is disabled
- 1 Inp=0:** The preset command sets the output to 0 with ramp, which returns to the previous value after the command is removed.

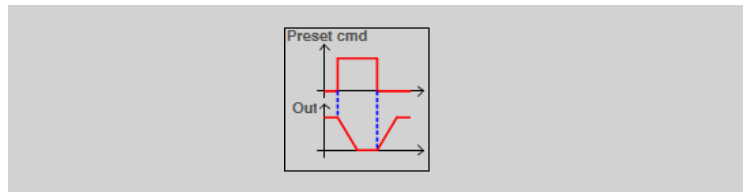


Figure 7-75: Logical diagram of Motorpot Preset operation cfg = Inp=0

- 2 Inp=bottom lim:** The preset command sets the output to **Motorpot bottom lim** with ramp, which returns to the previous value after the command is removed

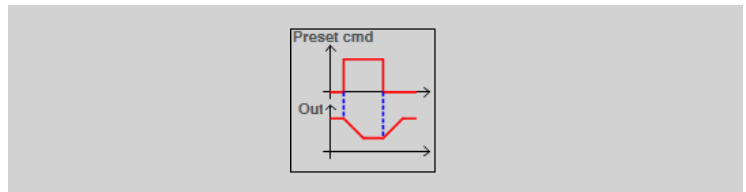


Figure 7-76: Logical diagram of Motorpot Preset operation cfg = Inp=bottom lim

- 3 Inp&ref=0:** the preset command sets the output to 0 with ramp, which remains at 0 even after the command is removed.

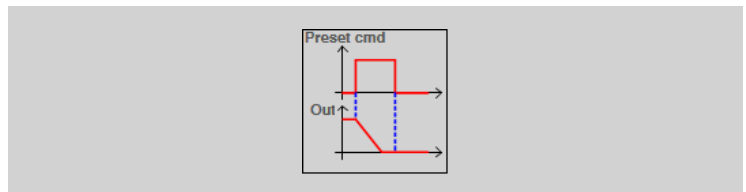


Figure 7-77: Logical diagram of Motorpot Preset operation cfg = Inp&ref=0

- 4 Inp&ref=bottom lim:** the preset command sets the output to **Motorpot bottom lim** with ramp, which remains at **Motorpot bottom lim** even after the command is removed.

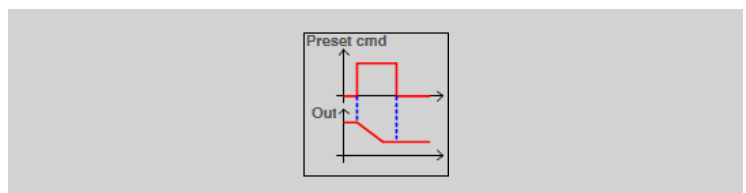


Figure 7-78: Logical diagram of Motorpot Preset operation cfg = Inp&ref=bottom lim

- 5 **Out=0**: the preset command sets the output to 0 without ramping, returning to the previous value immediately after the command is removed.

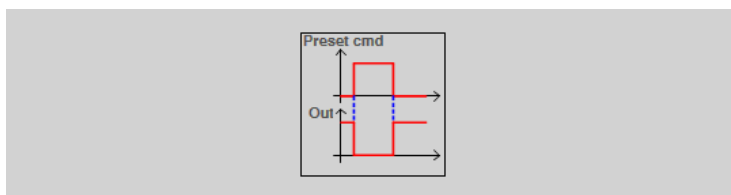


Figure 7-79: Logical diagram of Motorpot Preset operation $\text{cfg} = \text{Out}=0$

- 6 **Out=bottom lim**: the preset command sets the output to **Motorpot bottom lim** without ramp, which returns to the previous value immediately after the command is removed.

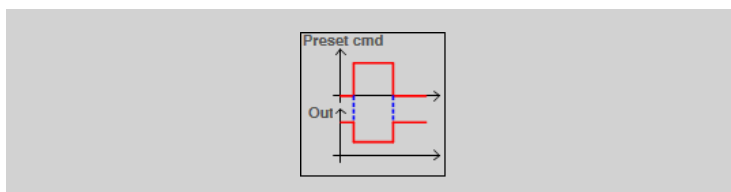


Figure 7-80: Logical diagram of Motorpot Preset operation $\text{cfg} = \text{Out}=\text{bottom lim}$

- 7 **Out&ref=0**: the preset command sets the output to 0 without ramping, and it remains at 0 even after the command is removed.

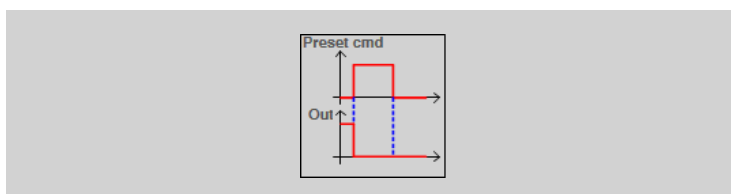


Figure 7-81: Logical diagram of Motorpot Preset operation $\text{cfg} = \text{Out}\&\text{ref}=0$

- 8 **Out&ref=bottom lim**: the preset command sets the output to **Motorpot bottom lim** without ramp, which remains at **Motorpot bottom lim** even after the command is removed.

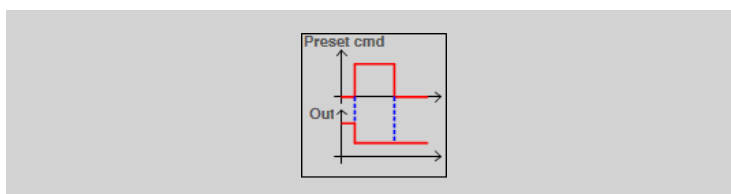


Figure 7-82: Logical diagram of Motorpot Preset operation $\text{cfg} = \text{Out}\&\text{ref}=\text{bottom lim}$

- 9 **Inp=top lim**: the preset command sets the output to **Motorpot top lim** with ramp, which returns to the previous value after the command is removed.

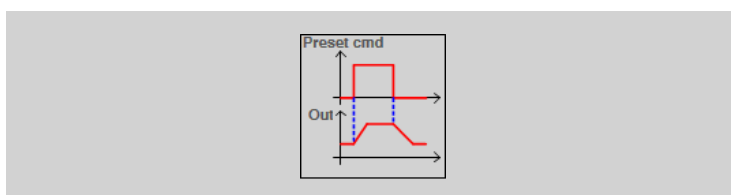


Figure 7-83: Logical diagram of Motorpot Preset operation $\text{cfg} = \text{Inp}=\text{top lim}$

- 10 **Inp&ref=top lim**: the preset command sets the output to **Motorpot top lim** with ramp, which remains at **Motorpot top lim** even after the command is removed.

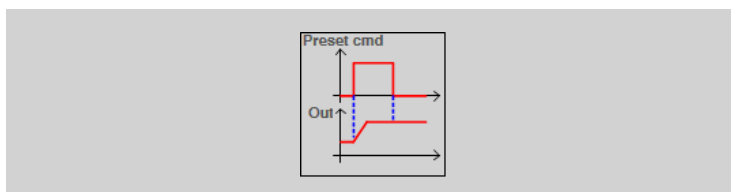


Figure 7-84: Logical diagram of Motorpot Preset operation $\text{cfg} = \text{Inp}\&\text{ref}=\text{top lim}$

11 Inp freeze: the preset command causes the output to lock, which only returns to responding to the **Up/Down** commands when the command is removed.

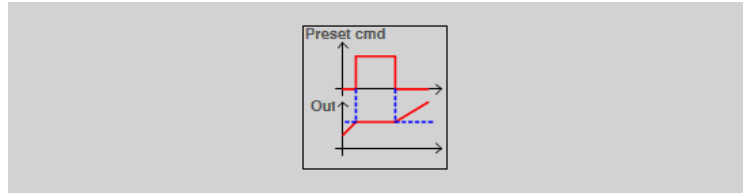


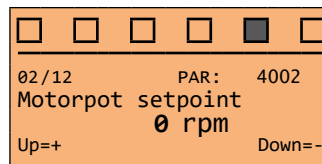
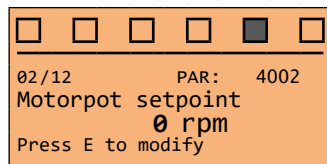
Figure 7-85: Logical diagram of Motorpot Preset operation $\text{cfg} = \text{Inp} = \text{freeze}$

4022 Motorpot out

Monitor of the motor potentiometer output, at the input to the ramp reference chain after the **Multispeed** function and before the **FWD/REV** logic (see [figure 7-14](#)), expressed in [rpm]. This parameter can be assigned to the analogue outputs.

The Motorpotentiometer can be controlled in the following ways:

- Via **digital inputs**
In the **DIGITAL INPUTS** menu, the digital inputs can be configured with the following selections:
 1. **Motorpot preset** assigns the preset command
 2. **Motorpot up** assigns the Up (+) command
 3. **Motorpot down** assigns the Down (–) command
 4. **Motorpot invert** assigns the output inversion command
- Via the **Up (+)** and **Down (–)** keys on the keypad
Access parameter IPA 4002-**Motorpot setpoint** and press the E, Up, and Down keys as shown in the following figures to generate the Up (+) and Down (–) commands.



- Via dedicated Up and Down commands in the **MOTORPOT** diagram of the **WEG_DriveLabs** configurator, accessible from the **DIAGRAMS MENU\FUNCTIONS\MOTORPOT** node.

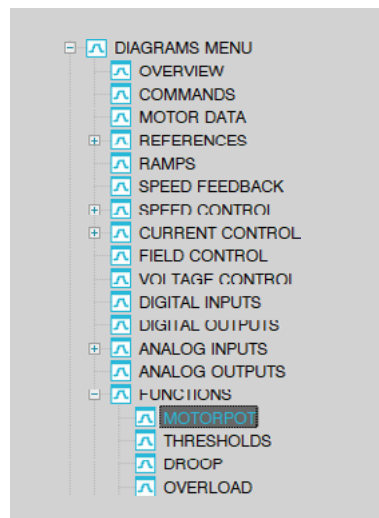


Figure 7-86: Positioning of the Motorpot menu in the diagram list

The **Up (+)** command increases the output of the Motorpotentiometer.
The **Down (–)** command decreases the output of the Motorpotentiometer.

NOTE!

Pressing the Up (+) and Down (–) keys on the keypad has no effect if the Motorpotentiometer is configured to be controlled by digital inputs, which have higher priority than the dedicated keys.

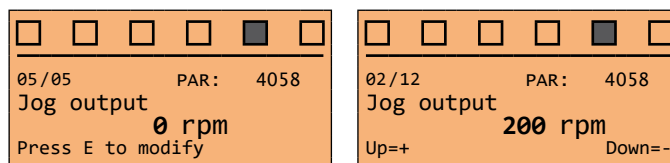
7.18.2 Jog

The Jog function allows pulse-controlled operation of the drive. It is managed through the following parameters in the **FUNCTIONS\JOG** menu:

IPA		DESCRIPTION
4050	Jog enable	Jog function enable command
4052	Jog ref dig	Jog function enable command
4054	Jog ref mon	Monitor of the ramp reference or speed of the Jog function, which can also be assigned via analogue inputs or fieldbus
4056	Jog selection	Allows you to select the mode of operation of the Jog function. Two selections are possible: 0 Speed ref: the Jog acts on the speed reference 1 Ramp ref: the Jog acts on the ramp reference
4058	Jog output	Monitor of the Jog function output expressed in [rpm]

Jog operation can be controlled in the following ways:

- Via digital inputs
In the **DIGITAL INPUTS** menu, two digital inputs can be configured with the selections **Jog +** and **Jog -** to generate the Jog +/- commands.
- Via the **Up (+)** and **Down (-)** keys on the keypad
Access parameter IPA 4058-**Jog output** and press the E, Up, and Down keys as shown in the following figures to generate the Jog +/- commands.



- Via dedicated **Jog+** and **Jog-** commands in the **RAMP REF** and **SPEED REF** diagrams of the **WEG_DriveLabs** configurator, accessible from the **DIAGRAMS MENU\REFERENCES\RAMP REF** and **DIAGRAMS MENU\REFERENCES\SPEED REF** nodes

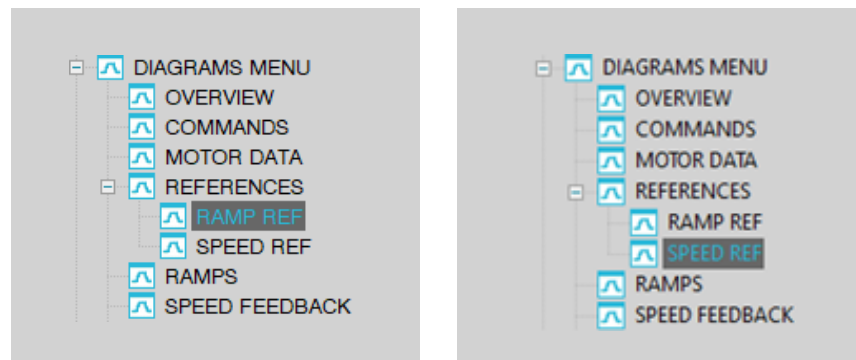


Figure 7-87: Positioning of the menus in the diagram list

The **Jog+** command corresponds to pulse-controlled motion in the clockwise direction.

The **Jog-** command corresponds to pulse-controlled motion in the counterclockwise direction, which is only possible with four-quadrant (4Q) drives.

If parameter IPA 4056-**Jog selection** is set to **Ramp ref**, the Jog output acts directly after the ramp reference chain, bypassing all previous contributions (**Ramp ref 1 mon**, **Ramp ref 2 mon**, **Multi speed**, **Motorpotentiometer** and **Test generator**) (see Figure 6-82). In this case, the Jog output acts directly on Ramp reference and is therefore subject to the ramp function.

NOTE!

It is not possible to apply the **Jog +** and **Jog -** commands simultaneously; in such case, the Jog reference is reset to zero.

NOTE!

Pressing the **Up (+)** and **Down (-)** keys on the keypad has no effect if the Jog function is configured to be controlled by digital inputs, which have higher priority than the dedicated keys.

7.18.3 Multi speed

The **Multi speed** function operates within the ramp reference chain (see **Figure 7-14**) and allows on-the-fly selection - also via digital inputs - of up to seven preconfigured ramp references (1...7).

The function is managed using the following parameters in the **FUNCTIONS\MULTI SPEED** menu:

IPA		DESCRIPTION
4150	Multi speed enable	Enables the Multi speed function
4152	Multi speed 1	Multi speed 1 can be used as a ramp reference, expressed in [rpm]
4154	Multi speed 2	Multi speed 2 can be used as a ramp reference, expressed in [rpm]
4056	Multi speed 3	Multi speed 3 can be used as a ramp reference, expressed in [rpm]
4058	Multi speed 4	Multi speed 4 can be used as a ramp reference, expressed in [rpm]
4160	Multi speed 5	Multi speed 5 can be used as a ramp reference, expressed in [rpm]
4162	Multi speed 6	Multi speed 6 can be used as a ramp reference, expressed in [rpm]
4064	Multi speed 7	Multi speed 7 can be used as a ramp reference, expressed in [rpm]
4066	Multi speed 8	Multi speed 8 can be used as a ramp reference, expressed in [rpm]
4166	Multi speed sel	Selector for the desired multi speed setting, ranging from 0 to 7
4168	Multi speed sel mon	Monitor for the desired multi speed selector, which can also be assigned via digital inputs or fieldbus

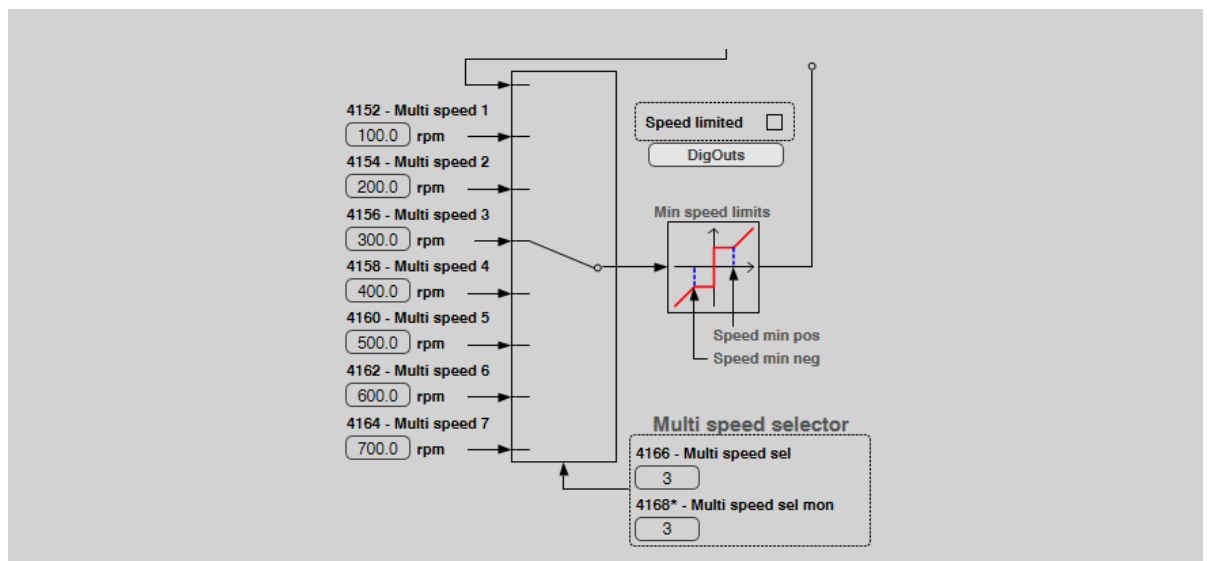


Figure 7-91: General diagram of Multi-Speed reference management

By enabling the **Multi speed** function via parameter IPA 4150-**Multi speed enable** set to **ON**, the ramp references **Ramp ref 1 mon** and **Ramp ref 2 mon** are excluded from the ramp reference chain. However, if the **Multi speed sel** selector is set to 0, it is still possible to use the sum **Ramp ref 1 mon + Ramp ref 2 mon** as the active reference instead of one of the predefined multi speed values 1...7.

The selected speed is processed by the **Min speed limits** limiter before being applied as the ramp reference, after the drive has received the enable and start commands.

The seven predefined speeds can also be negative. Therefore, in four-quadrant (4Q) drives, the direction of rotation can be determined via multi-speed selection. Two-quadrant (2Q) drives only accept positive reference values; negative multi speed values are interpreted as zero.

In the **DIGITAL INPUTS** menu, up to three digital inputs can be configured with the selections **Multi speed sel 0**, **Multi speed sel 1** and **Multi speed sel 2**, which generate the value of the Multi speed sel mon selector based on the state of the inputs, according to the following rule:

$$\text{Multi speed sel mon value} = (\text{state of digital input set to Multi speed sel 0}) \times 1 + (\text{state of digital input set to Multi speed sel 1}) \times 2 + (\text{state of digital input set to Multi speed sel 2}) \times 4$$

Table 7-6: Multi speed sel mon encoding

Multi speed sel 2	Multi speed 1	Multi speed sel 0	Multi speed sel mon
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	3
1	0	0	4
1	0	1	5
1	1	0	6
1	1	1	7

The selection via digital inputs has higher priority than the corresponding user parameter **Multi speed sel**, which becomes ineffective in this case.

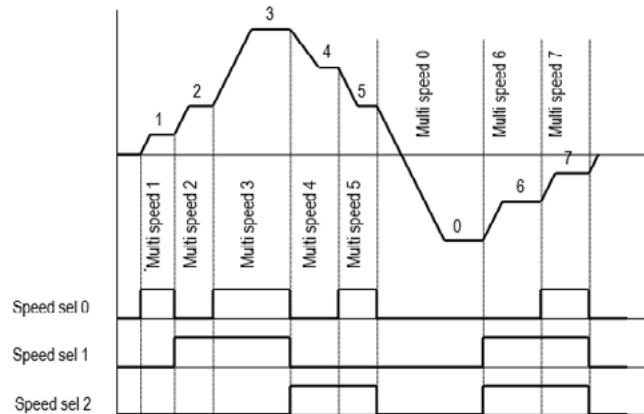


Figure 7-92: Operating logic using the Multi-speed selector

7.18.4 Multi Ramp

The **Multi ramp** function operates at the input of the ramp function (see [Figure 7-21](#)), allowing on-the-fly selection, also via digital inputs, of up to four predefined ramp sets (1...4).

Each set allows the configuration of both linear and S-curve ramps, for both acceleration and deceleration phases.

The function is managed using the following parameters in the **FUNCTIONS\MULTI RAMP** menu:

IPA	DESCRIPTION
4200 Multi ramp enable	Enables the Multi ramp function
4202 Multi ramp sel	Selector for the desired multiramp set, ranging from 1 to 4
4204 Multi ramp sel mon	Monitor for the desired multiramp set selector, which can also be assigned via digital inputs or fieldbus
4210 Acc speed 1	Acceleration speed of multiramp 1 expressed in [rpm]
4220 Acc time 1	Acceleration time of multiramp 1 expressed in [s]
4230 Acc time jerk 1	Multiramp 1 acceleration jerk time expressed in [ms]
4240 Dec speed 1	Multiramp 1 deceleration speed expressed in [rpm]
4250 Dec time 1	Multiramp 1 deceleration time expressed in [s]
4260 Dec time jerk 1	Multiramp 1 deceleration jerk time expressed in [ms]
4212 Acc speed 2	Multiramp 2 acceleration speed expressed in [rpm]
4222 Acc time 2	Multiramp 2 acceleration time expressed in [s]
4232 Acc time jerk 2	Multiramp 2 acceleration jerk time expressed in [ms]
4242 Dec speed 2	Deceleration speed of multiramp 2 expressed in [rpm]
4252 Dec time 2	Deceleration time of multiramp 2 expressed in [s]
4262 Dec time jerk 2	Jerk time in deceleration of multiramp 2 expressed in [ms]
4214 Acc speed 3	Acceleration speed of multiramp 3 expressed in [rpm]
4224 Acc time 3	Acceleration time of multiramp 3 expressed in [s]
4234 Acc time jerk 3	Multiramp 3 acceleration jerk time expressed in [ms]

4244	Dec speed 3	Multiramp 3 deceleration speed expressed in [rpm]
4254	Dec time 3	Multiramp 3 deceleration time expressed in [s]
4264	Dec time jerk 3	Multiramp 3 deceleration jerk time expressed in [ms]
4216	Acc speed 4	Multiramp 4 acceleration speed expressed in [rpm]
4226	Acc time 4	Multiramp 4 acceleration time expressed in [s]
4236	Acc time jerk 4	Multiramp 4 acceleration jerk time expressed in [ms]
4246	Dec speed 4	Multiramp 4 deceleration speed expressed in [rpm]
4256	Dec time 4	Multiramp 4 deceleration time expressed in [s]
4266	Dec time jerk 4	Multiramp 4 deceleration jerk time expressed in [ms]

By enabling the **Multi ramp** function via parameter IPA 4200-**Multi ramp enable** set to **ON**, the parameters from the standard ramp set (IPA 2002-**Acc speed**, IPA 2004 - **Acc time**, IPA 2006-**Dec speed**, IPA 2008-**Dec time**, IPA 2014-**Acc time jerk**, and IPA 2016-**Dec time jerk**) are excluded from the generation of the linear and/or S-curve ramp. Instead, the ramp follows the profile defined by the selected set. For example, if **Multi ramp sel = 2** and IPA 2010-**Ramp shape = Linear**, the drive performs a linear ramp using as reference the parameters **Acc speed 2** and **Acc time 2** during acceleration, and **Dec speed 2** and **Dec time 2** during deceleration (see [Figure 7-87](#)).

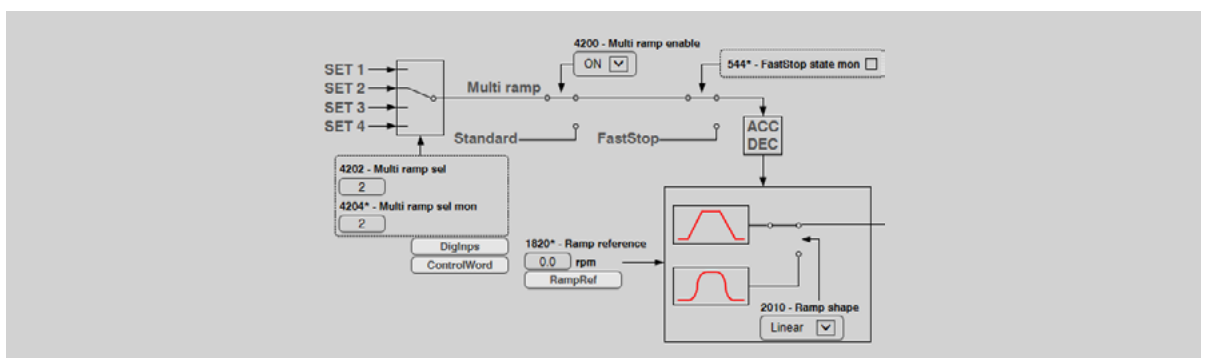


Figure 7-93: Multi-ramp selector management diagram

In the **DIGITAL INPUTS** menu (see paragraph 6.17.1), up to two digital inputs can be configured with the selections **Multi ramp sel 0** and **Multi ramp sel 1** to generate, based on the state of the inputs, the value of the **Multi ramp sel mon** selector, according to the following rule:

Multi ramp sel mon value = (state of digital input set to **Multi ramp sel 0**) x 1 +
(state of digital input set to **Multi ramp sel 1**) x 2

Table 7-7: Multi ramp sel mon encoding

Multi ramp sel 1	Multi ramp sel 0	Multi ramp sel mon
0	0	0
0	1	1
1	0	2
1	1	3

The selection via digital inputs has higher priority than the corresponding user parameter **Multi ramp sel**, which becomes ineffective in this case.

7.18.5 Threshold

The drive provides a set of motor speed and current signals, used by control functions and also available in the selection lists for digital outputs ([see paragraph 7.17.2](#)). For example, in the case of IPA 3200-**Digital output 1 sel**, it is possible to select:

- 1 Speed 0 thr
- 2 Speed threshold
- 3 Speed set
- 70 Arm curr threshold
- ...

The operation of these signals is defined by the following parameters in the **FUNCTIONS\THRESHOLDS** menu:

IPA		DESCRIPTION
812	Speed 0 level	Speed threshold for Speed 0 thr signal, expressed in [rpm]
814	Speed 0 delay	Time delay for Speed 0 thr signal, expressed in [ms]
816	Speed thr pos	Positive speed threshold for Speed threshold signal, expressed in [rpm]
818	Speed thr neg	Negative speed threshold for Speed threshold signal, expressed in [rpm]
820	Speed thr delay	Time delay for Speed threshold signal, expressed in [ms]
822	Speed set error	Speed threshold for Speed set signal, expressed in [rpm]
824	Speed set delay	Time delay for Speed set signal, expressed in [ms]
1012	Arm curr thr	Current threshold for Arm curr threshold signal, expressed as [%] of the motor's rated armature current
1018	Arm curr thr delay	Time delay for Arm curr threshold signal, expressed in [ms]

The **Speed 0 thr** signal (see **Figure 7-88**) switches to a high logic level with a time delay defined by parameter IPA 814-**Speed 0 delay**, after the motor speed (in absolute value), IPA 234-**Motor speed**, drops below the threshold set by parameter IPA 812-**Speed 0 level**. The signal returns to a low logic level as soon as the speed rises above the same threshold.

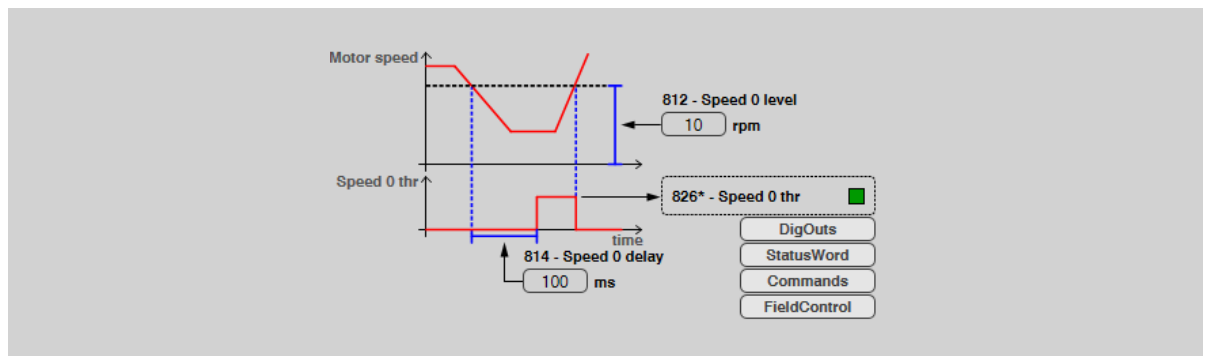


Figure 7-94: Logic diagram of the Speed 0 thr signal operation

The **Speed 0 thr** signal is used by the control software in the following cases:

Management of the **n=0** LED on the keypad (see **Table 5-1**)

- Field weakening management at zero speed via IPA 1314-**Field weak spd-0** (see **paragraph 7.15.1**)
- Start/stop logic management via IPA 504-**Stop mode** and IPA 506-**Speed 0 trip delay** (see **paragraph 7.8**)
- Speed PI regulator gain management via IPA 928-**Speed=0 P enable** (see **paragraph 7.13.3**)

The **Speed threshold** signal (see **Figure 7-89**) switches to a high logic level with a time delay defined by parameter IPA 820-**Speed thr delay**, when the motor speed IPA 234-**Motor speed** falls within the range [**Speed thr neg**, **Speed thr pos**]. The signal returns to a low logic level as soon as the speed falls outside this range.

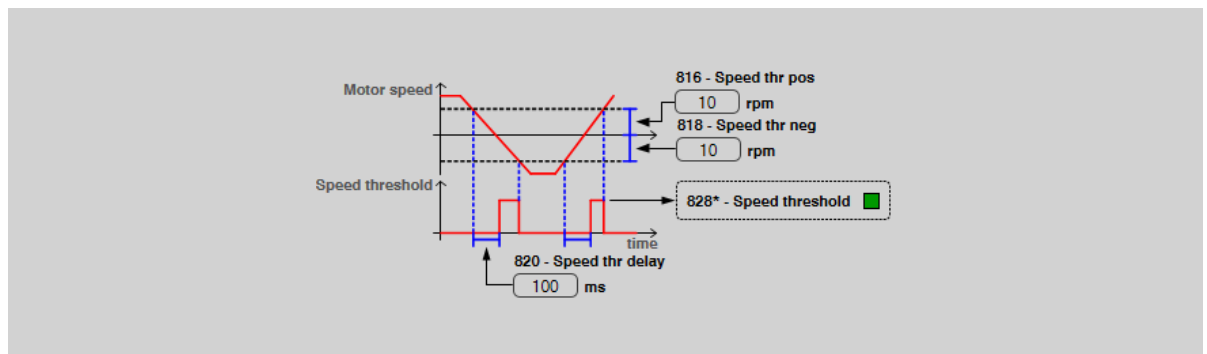


Figure 7-95: Logic diagram of the Speed threshold signal operation

The **Speed threshold** signal can therefore be used to indicate that a given speed threshold, whether positive or negative, has not been exceeded.

The **Speed set** signal (see **Figure 7-90**) switches to a high logic level with a time delay defined by parameter IPA 824-**Speed set delay**, when the motor speed is within the range [reference - **Speed set error**, reference + **Speed set error**]. The signal returns to a low logic level as soon as the speed falls outside this range.

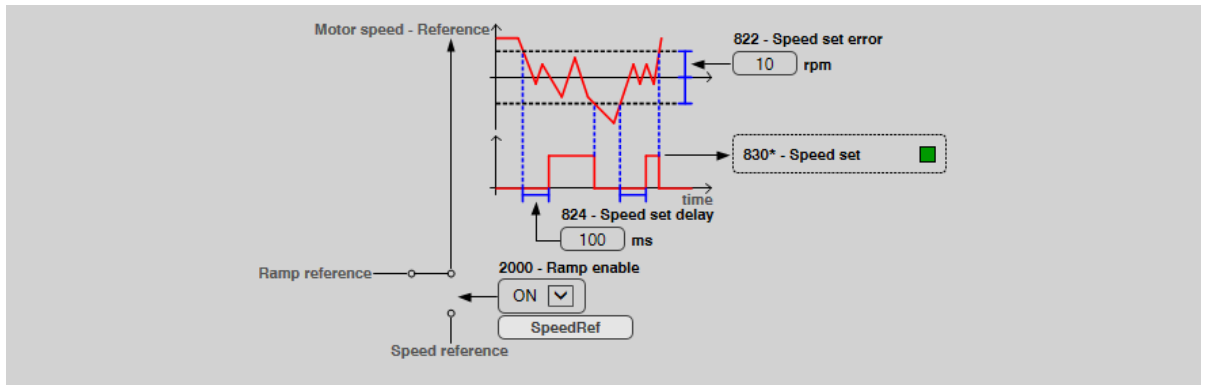


Figure 7-96: Logic diagram of the Speed set signal operation

The choice of the reference used for comparison depends on the enable status of parameter IPA 2000-**Ramp enable**:

- If **ON**, the reference used is IPA 1820-**Ramp reference**
- If **OFF**, the reference used is IPA 1870-**Speed reference**

The **Speed set** signal can therefore be used to indicate that the motor speed matches the target reference, meaning the speed has reached the reference within a programmable tolerance.

The **Arm curr threshold** signal (see Figure 7-91) switches to a high logic level with a time delay defined by parameter IPA 1018-**Arm curr thr delay**, when the motor armature current (absolute value), IPA 214-**Armature current [%]**, exceeds the threshold set by IPA 1012-**Arm curr thr**. The signal returns to a low logic level as soon as the current drops below the same threshold.

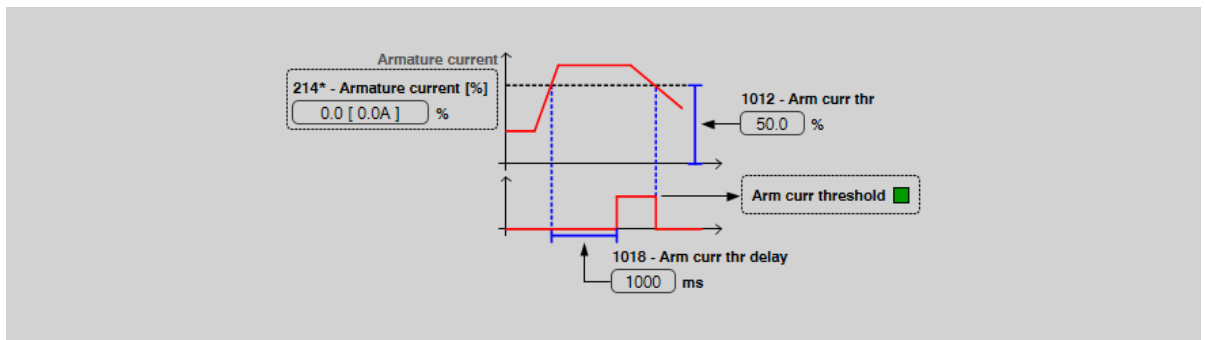


Figure 7-97: Logic diagram of the Arm curr threshold signal operation

7.18.6 Droop

The **Droop** function is used to achieve current balancing.

A typical application is when two motors are mechanically coupled (for example, connected to the same shaft) and therefore must rotate at the same speed. Due to differences that may exist between the two speed controllers, the motors, or the measurement systems, one motor may tend to rotate at a higher speed, entering an overload condition, while the second motor behaves like a brake. This leads to an imbalance between the currents of the two motors.

The Droop function corrects this malfunction by adding a correction term to the drive's speed reference, which is proportional to the load difference between the two units.

As a result, the motor currents are balanced, with the additional benefit of keeping both speed regulators enabled.

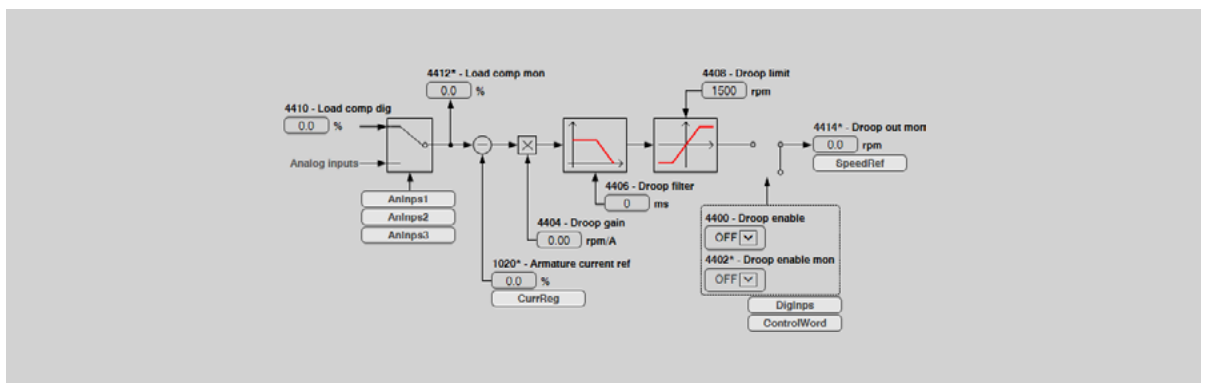


Figure 7-98: General diagram of the Droop function

Operation is defined using the following parameters in the **FUNCTIONS\DROOP** menu:

IPA	DESCRIPTION
4400 Droop enable	Enables the Droop function, inserting the Droop out mon output produced by the function in the drive speed reference chain, in addition to the Speed ref 2 mon speed reference (see figure 7-93).

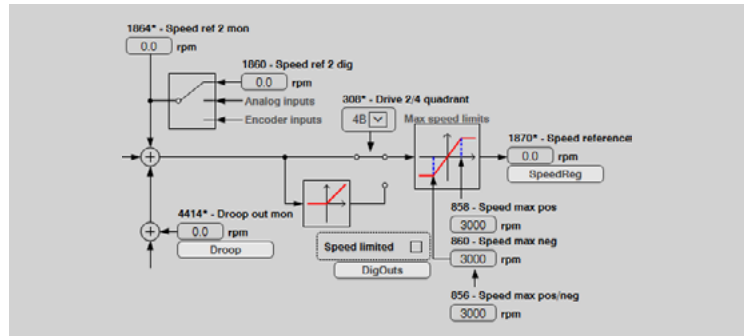


Figure 7-99: Diagram of speed reference management for the Droop function

4402 Droop enable mon	Monitor of the Droop function enable parameter, which can also be assigned by programmable digital inputs
4404 Droop gain	Proportional gain of the Droop function, expressed in [rpm/A]
4406 Droop filter	Time constant of the filter applied between the gain and the output limitation block of the Droop function
4408 Droop limit	Maximum absolute value that the Droop out mon output can take, i.e. it represents the minimum/maximum limits of the speed reference compensation
4410 Load comp dig	Current value supplied by the Master drive (see figure 7-94), provided via fieldbus, expressed as a % of the motor's rated armature current
4412 Load comp mon	Monitor of the current supplied by the Master drive (see figure 7-94), which can also be assigned by programmable analogue inputs
4414 Droop out mon	Monitor of the output of the Droop function, expressed in rpm, which acts on the speed reference chain in addition to the other contributions (see figure 7-94)

The **Droop** function can be used as shown in the following example, based on a steel tube processing machine:

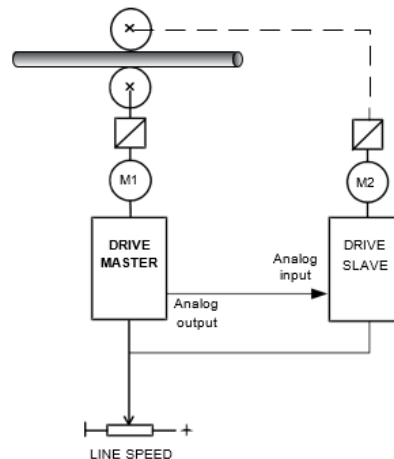


Figure 7-100: Block diagram of the use of the Droop function

The torque of motor 1 (M1), controlled by the MASTER drive, must match the torque of motor 2 (M2), controlled by the SLAVE drive:

DRIVE A (Master)

- Set **An input 1 dest** = **Speed ref 1** via analog input 1 (shared with the slave)
- Set **An output 1 sel** = **Armature curr ref** via analog output 1, connected to the slave's analog input 1

DRIVE B (Slave)

- Set **An input 1 dest** = **Speed ref 1** via analog input 1 (shared with the master)
- Set **An input 2 dest** = **Load comp** and wire this input to the master's analog output 1
- Set **Droop enable** = **ON** and adjust the parameters Droop gain, Droop filter, and Droop limit as needed

With this configuration, the master and slave drives share the same speed reference, while the armature current reference from the master drive acts as the reference signal for the **Droop** function, which is enabled only on the slave. In this way, the current error - defined as the difference between the master's current reference and the slave's current reference - is processed by a proportional controller to generate a correction factor. This correction is applied to the slave's speed reference chain in order to achieve current balancing between master and slave drives.

7.18.7 Speed Draw

The **Speed draw** function allows a configurable scaling factor to be applied to the drive's main speed reference. This function is useful in multi-drive systems where a slip value is required between the different motors used ([see Figure 7-96](#)).

The operation is defined by the following parameters in the **FUNCTIONS\SPEED DRAW** menu:

IPA		DESCRIPTION
4350	Speed draw ratio dig	Allows you to set the scale factor, with a resolution of 0.0001
4352	Speed draw ratio mon	Scale factor monitor, which can also be assigned via programmable analogue inputs or fieldbus
4354	Speed draw out	Monitor of the speed reference output from the function, after application of the scale factor, directly present on the speed reference chain (see figure 6-95)

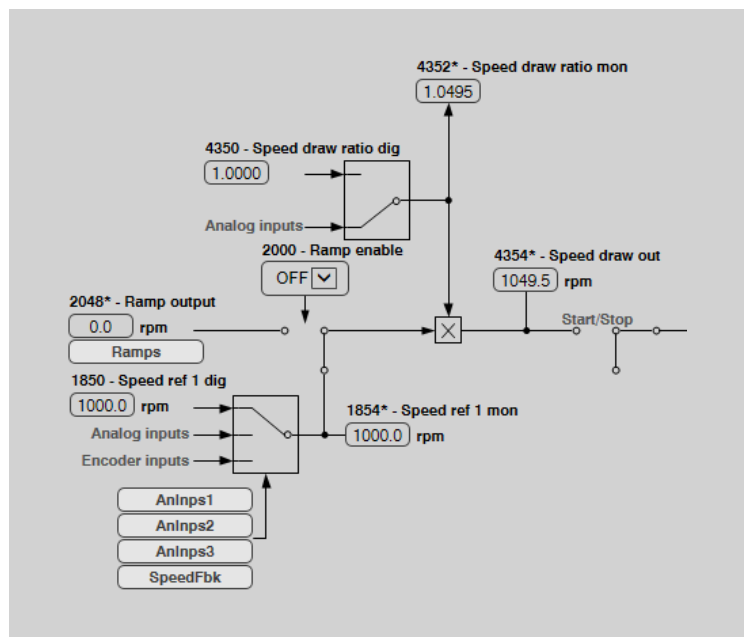


Figure 7-101: Speed reference management diagram for the Speed Draw function

The effective scale factor is given by **Speed draw ratio mon** and is applied to:

- IPA 2048-**Ramp output** if ramp enabled (IPA 2000-**Ramp enable** = ON)
- IPA 1854-**Speed ref 1 mon** if ramp disabled (IPA 2000-**Ramp enable** = OFF)

The **Speed draw** function can be used as in the following example, referring to a calender for rubber processing:

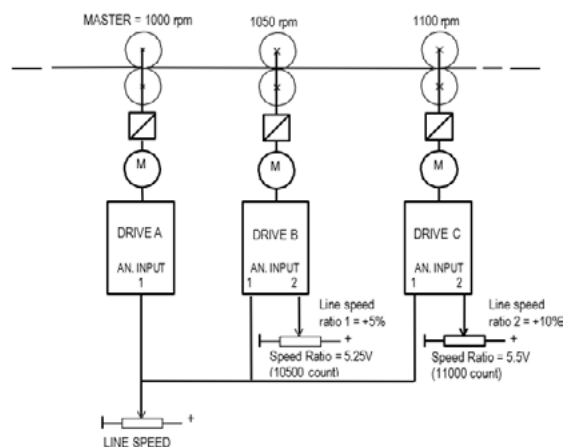


Figure 7-102: Application principle diagram of the Speed Draw function

1. DRIVE A (master)

- Line speed = 1000 rpm
- Set **An input 1 dest = Ramp ref 1** via analog input 1

2. DRIVE B (slave 1)

- Line speed ratio 1 = Line speed + 5% (1050 rpm)
- Set **An input 1 dest = Ramp ref 1** via analog input 1
- Use the **Speed draw** function by setting **Speed draw ratio dig** = 1.0500 or use analog input 2 by setting **An input 2 dest = Speed draw ratio** with a voltage level such that **Speed draw ratio mon** = 1.05 (5.25 V, since 10 V = full scale 2.0 for this selection)

3. DRIVE C (slave 2)

- Line speed ratio 2 = Line speed + 10% (1100 rpm)
- Set **An input 1 dest = Ramp ref 1** via analog input 1
- Use the **Speed draw** function by setting **Speed draw ratio dig** = 1.1000 or use analog input 2 by setting **An input 2 dest = Speed draw ratio** with a voltage level such that **Speed draw ratio mon** = 1.10 (5.5 V, since 10 V = full scale 2.0 for this selection)

7.18.8 Speed drop

The drive provides a **speed drop** function for use in industrial rolling processes to prevent billets from becoming stuck at the entrance or exit of the rolling mill.

The speed reference is compensated appropriately when the bar arrives or exits (load pick-up or release), which is detected when the current derivative exceeds a programmable value.

The compensation operation is defined by the following parameters in the **FUNCTIONS\SPEED DROP** menu:

IPA	DESCRIPTION
4360 Speed drop enable	Enables compensation, which can also be assigned by programmable digital inputs. If set to OFF , the Speed drop ref output assumes a value of 0.0 rpm.
4362 Speed drop trigger	Monitor of the filtered derivative of the armature current reference, after application of the Speed drop gain , expressed in [%/ms]

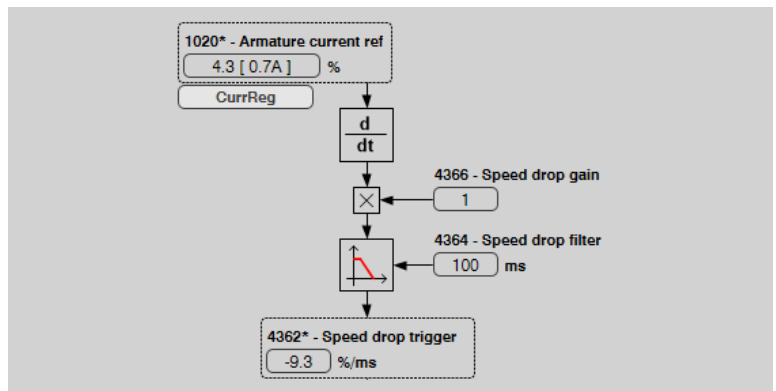


Figure 7-103: Speed drop gain diagram for the Speed Drop function

4364 Speed drop filter	Time constant with which the derivative of the armature current reference is filtered, expressed in [ms]
4366 Speed drop gain	Gain applied to the armature current reference derivative, useful for amplifying the signal in the event of subsequent high filtering via a Speed drop filter
4368 Speed drop trig thr	Threshold on the derivative of the current reference Speed drop trigger beyond which the compensation cycle is activated, expressed in [%/ms]
4370 Speed drop speed thr	Motor speed threshold above which the compensation cycle is activated, expressed in [rpm]
4372 Speed drop curr thr	Motor current threshold below which the compensation cycle is activated, expressed as a percentage of the motor's rated armature current.
4374 Speed drop comp pos	Speed compensation, expressed as a percentage of the IPA 1870- Speed reference , which is added to the reference itself when the function is activated upon arrival of the bar (load pick-up).
4376 Speed drop comp neg	Speed compensation, expressed as a percentage of the IPA 1870- Speed reference , which is subtracted from the reference itself when the function is activated at the bar output (load release).
4378 Speed drop time pos	Duration of compensation during load acceptance, expressed in [s]

4380	Speed drop time neg	Duration of compensation during load release, expressed in [s]
4382	Speed drop ramp time	Duration of the ramp used for the gradual removal of compensation after the Speed drop comp pos and/or Speed drop comp neg times have elapsed, expressed in [s]. The duration is the same for both load pick-up and load release. If set to 0, compensation is removed instantly, without a ramp.
4384	Speed drop idle time	Function inhibition time after compensation removal, expressed in [s], useful for preventing a new cycle from being immediately triggered following current variations induced by the removal of compensation itself.
4386	Speed drop ref	Value of the current speed compensation, which is added to the speed reference chain. The Speed reference value used to calculate the compensation is sampled at the moment the function is activated.

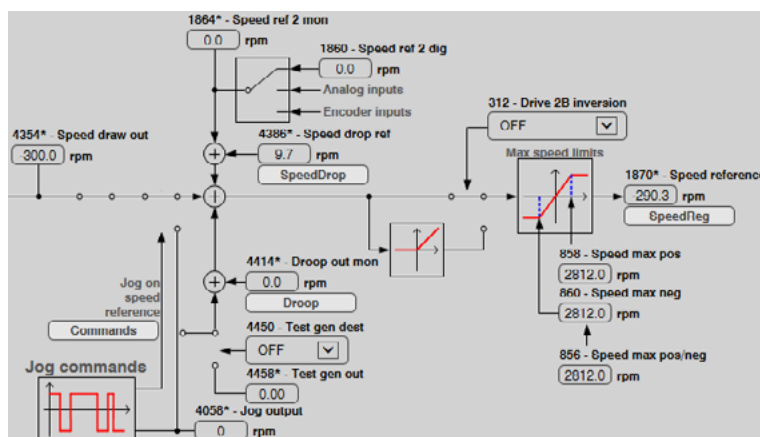


Figure 7-104: Speed drop ref diagram for the Speed Drop function

4388	Speed drop state	Monitoring the status of the function during the various phases of a complete compensation cycle. The Speed drop state parameter can have five possible states, as shown in the diagram, with reference to positive compensation (load). • Init (0): the function is disabled or the converter is disabled. In this case, Speed drop ref = 0.0 rpm. After enabling the function via Speed drop enable = ON (or the relevant digital input), when the converter is enabled, the status changes to Wait for thresholds • Wait for thresholds (1): compensation is still zero, but the speed reference and armature current begin to rise. If the motor speed (in absolute value) exceeds the Speed drop speed thr threshold and the current (in absolute value) is lower than the Speed drop curr thr threshold, the converter waits for the filtered derivative of the armature current reference Speed drop trigger to also exceed (in absolute value) the relative Speed drop trig thr threshold, assuming that this event indicates the need to trigger a compensation cycle. The converter then interprets the sign of Speed drop trigger and Speed reference to calculate the type of compensation to be performed (level and time): 1. If Speed drop trigger ≥ 0 and Speed reference ≥ 0, it is a load pickup: • Compensation level = Speed drop comp pos x (Speed reference / 100) • Compensation time = Speed drop time pos 2. If Speed drop trigger ≥ 0 and Speed reference < 0, it is a load release: • Compensation level = - Speed drop comp neg x (Speed reference / 100) • Compensation time = Speed drop time neg 3. If Speed drop trigger < 0 and Speed reference < 0, it is a load pick-up: • Compensation level = Speed drop comp pos x (Speed reference / 100) • Compensation time = Speed drop time pos 4. If Speed drop trigger < 0 and Speed reference ≥ 0, it is a load release: • Compensation level = - Speed drop comp neg x (Speed reference / 100) • Compensation time = Speed drop time neg
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The status then changes to **Compensation**

- **Compensation (2):** The speed reference is immediately increased by the newly calculated compensation level for the entire duration of the compensation time.

Throughout this phase, **Speed drop ref** = compensation level and when the compensation time expires, the status changes to **Ramp down**

- **Ramp down (3):** speed compensation is gradually removed via a linear ramp with a duration equal to the time set in IPA 4382-**Speed drop ramp time** and the status then changes to **Idle**

- **Idle (4):** compensation has been completely removed, however, to avoid triggering new compensation caused by current transients due to its removal, a time equal to IPA 4384-**Speed drop idle time** is waited for, during which the function is inhibited. At the end of the programmed time, the status returns to **Wait for thresholds**, making a new cycle possible

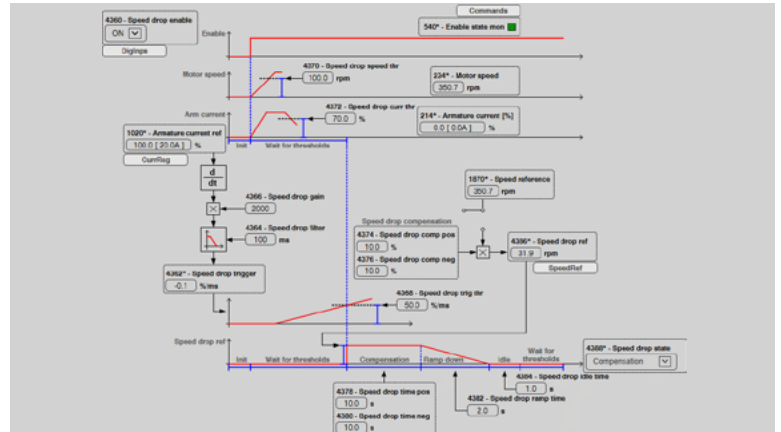


Figure 7-105: Speed drop state diagram for the Speed Drop function

7.18.9 Overload

The **overload** control function allows the drive to deliver a current higher than its rated armature current for a limited time. It is used to provide the motor with a higher starting torque or to allow current peaks in machines with cyclic load profiles. This function also protects the drive from thermal overload.

The operation of the overload function is defined by the following parameters in the **FUNCTIONS\OVERLOAD** menu:

IPA	DESCRIPTION
4300 Overload mode	Allows you to set the overload type using six possible selections: 0 None: Overload is disabled, so the drive can only deliver 100% of its rated current continuously. In this mode, all current references and limits have a maximum value of 100% (corresponding to the motor's rated armature current). 1 I2t Drive: the converter delivers up to 150% of its rated current (IPA 300-Drive arm current), allowing an overload of 60 s at 150% of the derated drive current. The I2t algorithm is defined based on this operating condition. With this operating mode, the drive current can reach up to 150% of the nominal current for a duration shorter than 60 seconds. Current limits are controlled by an I2t algorithm based on the charging and discharging of the Drive I2t accum accumulator, which triggers the Drive overload alarm when the critical value of 100% is reached. The alarm is set to Warning by default and therefore does not cause the converter to shut down immediately, but only lowers the current limits to the rated RMS current of the drive. To reset the alarm, Drive I2t accum must be completely discharged by lowering the output current. In this mode, all current references and limits have a maximum value of 200%.

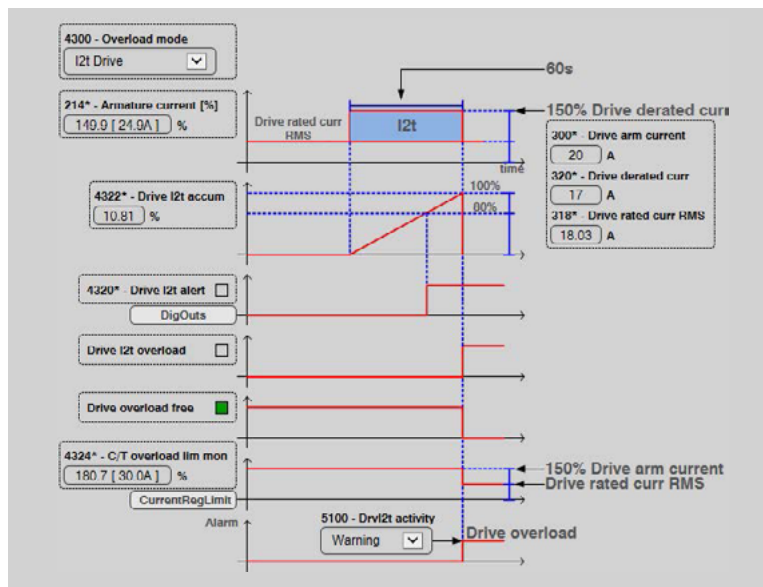


Figure 7-106: Logic diagram of the overload function when Overload mode = I2t Drive

2 I2t Drive and Motor: more restrictive conditions are added to **I2t Drive** mode to also ensure motor protection, allowing an overload for the **Motor I2t time** at the **Motor I2t current**. Current limits are controlled by an I2t algorithm based on the charging and discharging of the **Motor I2t accum** accumulator, which triggers the **Motor overload** alarm when the critical value of 100% is reached. The alarm is set to Warning by default and therefore does not cause the converter to shut down immediately. To reset the alarm, **Motor I2t accum** must be completely discharged by lowering the output current. All current references and limits have a maximum value of 200%.

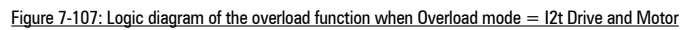


Figure 7-108: Logic diagram of the overload function when Overload mode = Current limited

NOTE!

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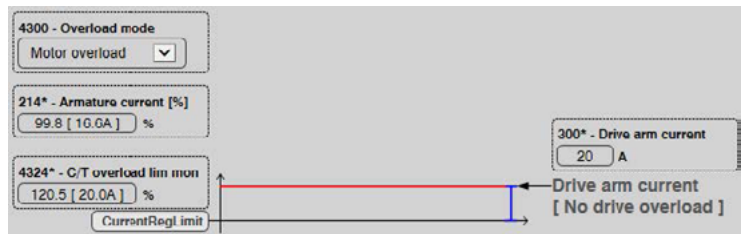


Figure 7-109: Logic diagram of the overload function when Overload mode = Current limited

5 I2t Motor: the converter delivers 100% of its rated current (IPA 300-Drive arm current) continuously, allowing an overload for the **Motor I2t time** at the **Motor I2t current**. Current limits are controlled by an I2t algorithm based on the charging and discharging of the **Motor I2t accum** accumulator, which triggers the **Motor overload** alarm when the critical value of 100% is reached. The alarm is set to Warning by default and therefore does not cause the converter to shut down immediately. To reset the alarm, **Motor I2t accum** must be completely discharged by lowering the output current. All current references and limits have a maximum value of 200%.

4302 Motor ventilation

Allows you to set the motor ventilation type when **Overload mode = I2t Drive and Motor** or **Overload mode = I2t Motor**. Two selections are possible:

1 Servo fan: the fan is independent of the motor and guarantees effective cooling at all speeds, without the need to apply a reduction factor to the motor's rated current based on the rotation speed, which can therefore be supplied continuously. In this mode, the **Motor I2t accum** only starts to increase above the motor's rated current, regardless of the motor speed.

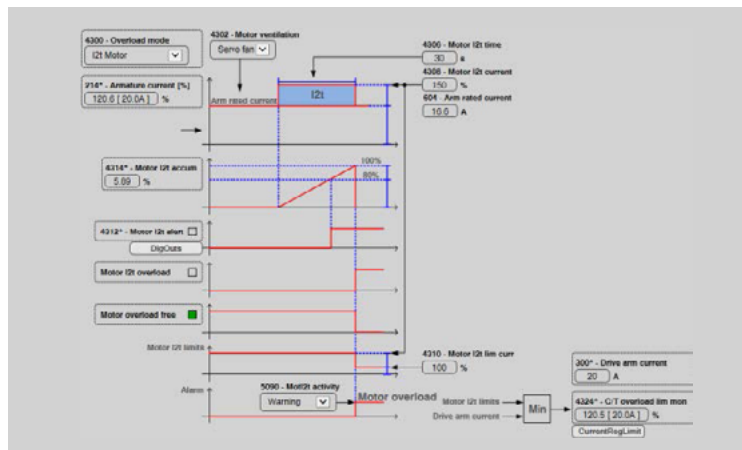


Figure 7-110: Logic diagram of the motor overload function when Motor ventilation = Servo fan

4320	Drive I2t alert	Monitor used to signal that the Drive I2t accum parameter has reached 80% and is available in the digital output selection lists. The signal returns to 0 when Drive I2t accum is completely discharged.
4322	Drive I2t accum	Monitor of the status of the drive's I2t accumulator, in the range 0-100%, which indicates how close the drive is to overload condition. If the Armature current [%] output current exceeds the rated RMS current of the drive, the accumulator starts to increase up to 100%, indicating the overload limit condition. The time to go from 0 to 100% is 60s if a current equal to 150% of the derated current of the drive is supplied. To discharge the accumulator, the output current must be brought below the rated RMS current of the drive.
4324	C/T overload lim mon	Monitor of the current limit imposed by the cascade overload function on the other limitation contributions. This parameter can be displayed in two units of measurement [%-A].

NOTE!

The actual current limits applied to the current regulator, defined by parameters IPA 1140-**C/T lim pos in use** and IPA 1142-**C/T lim neg in use**, result from the cascade of multiple contributing functions. The lowest value among them is always selected:

- Positive/negative torque limits defined by the user parameters IPA 1106-**C/T lim pos mon** and IPA 1110-**C/T lim neg mon**
- Torque limits derived from the reduction parameter IPA 1120-**C/T lim reduction**
- Torque limits imposed by the overload function, through IPA 4324-**C/T overload lim mon**
- Torque limits based on motor speed, via IPA 1172-**C/T speed lim in use**

Once overload is enabled using IPA 4003-**Overload mode**, it is necessary to increase the parameters IPA 1104-**C/T lim pos dig** and IPA 1108-**C/T lim neg dig** beyond 100% (up to 150%).

Otherwise, no overload current will be delivered, since these parameters also contribute to defining the actual current limits in use.

7.18.10 C/T Speed Limit

The torque current limits, which act at the input of the current regulator and refer only to the armature current, can also vary as a function of motor speed through a piecewise linear curve composed of six segments.

This curve is defined using the following parameters in the **FUNCTIONS|C/T SPEED LIMIT** menu:

IPA		DESCRIPTION
1150	C/T speed lim enable	Enables torque limits based on speed
1152	C/T speed lim 0	Torque current limit 0 for the torque/speed limit curve, in [%] relative to the motor's rated armature current
1154	C/T speed lim 1	Torque current limit 1 for the torque/speed limit curve, in [%] relative to the motor's rated armature current
1156	C/T speed lim 2	Torque current limit 2 for the torque/speed limit curve, in [%] relative to the motor's rated armature current
1158	C/T speed lim 3	Torque current limit 3 for the torque/speed limit curve, in [%] relative to the motor's rated armature current
1160	C/T speed lim 4	Torque current limit 4 for the torque/speed limit curve, in [%] relative to the motor's rated armature current
1162	C/T speed lim thr 0	Speed threshold 0 for the torque/speed limit curve, in [rpm]
1164	C/T speed lim thr 1	Speed threshold 1 for the torque/speed limit curve, in [rpm]
1166	C/T speed lim thr 2	Speed threshold 2 for the torque/speed limit curve, in [rpm]
1168	C/T speed lim thr 3	Speed threshold 3 for the torque/speed limit curve, in [rpm]
1170	C/T speed lim thr 4	Speed threshold 4 for the torque/speed limit curve, in [rpm]

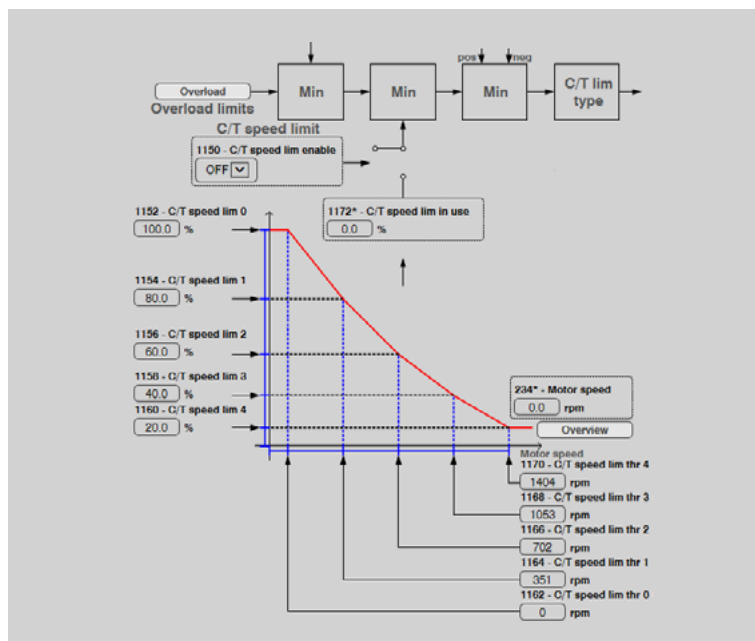


Figure 7-112: Logical diagram of current limit generation

The **C/T speed lim in use** value can therefore take on the following values depending on the motor speed:

- **C/T speed lim 0** is applied constantly for all speeds below **C/T speed lim thr 0**
- Linear interpolation between **C/T speed lim 0** and **C/T speed lim 1** for all speeds between **C/T speed lim thr 0** and **C/T speed lim thr 1**
- Linear interpolation between **C/T speed lim 1** and **C/T speed lim 2** for all speeds between **C/T speed lim thr 1** and **C/T speed lim thr 2**
- Linear interpolation between **C/T speed lim 2** and **C/T speed lim 3** for all speeds between **C/T speed lim thr 2** and **C/T speed lim thr 3**
- Linear interpolation between **C/T speed lim 3** and **C/T speed lim 4** for all speeds between **C/T speed lim thr 3** and **C/T speed lim thr 4**
- **C/T speed lim 4** is applied constantly for all speeds above **C/T speed lim thr 4**

The speed bands of the piecewise linear curve are reinitialized each time the parameter **IPA 602-Motor max speed** (in the **MOTOR DATA** menu, see [paragraph 7.9](#)) is modified, in order to define intervals of equal width equal to **IPA 602-Motor max speed / 4**.

However, they can later be adjusted as needed for specific application requirements.

NOTE!

It is the user's responsibility to configure contiguous and non-overlapping bands, both in speed and current.

NOTE!

The default maximum allowed value for all torque limits in the curve is 100%, but it can be increased up to 150% by enabling one of the available overload types via parameter **IPA 4300-Overload mode** in the **FUNCTIONS\OVERLOAD** menu (see [paragraph 6.18.8](#)).

NOTE!

The actual current/torque limits applied to the current regulator, defined by parameters **IPA 1140-C/T lim pos in use** and **IPA 1142-C/T lim neg in use** (see [Figure 7-45](#)), result from a cascade of contributions from several functions. The lowest value among them is always applied:

- Positive/negative torque limits defined by user parameters **IPA 1106-C/T lim pos mon** and **IPA 1110-C/T lim neg mon**
- Torque limits from the reduction parameter **IPA 1120-C/T lim reduction**
- Torque limits from the overload function, via **IPA 4324-C/T overload lim mon**
- Torque limits based on motor speed, via **IPA 1172-C/T speed lim in use**

Therefore, in order for the current/torque limits to effectively match those calculated by the function under consideration, the contribution **C/T speed lim in use** must have a lower value than all other limits in the cascade.

7.18.11 Brake control

The drive allows control of the opening and closing of a mechanical holding brake mounted on the motor shaft, via a digital output operated according to the run/stop status of the converter.

Brake control, which is useful in industrial hoisting applications, is managed through the following parameters in the **FUNCTIONS\BRAKE CONTROL** menu:

IPA		DESCRIPTION
4100	Brake control enable	Brake control enable parameter. If set to <i>OFF</i> , the Brake cmd mon digital output for brake control always assumes a low logic value.
4102	Fwd open C/T thr	Current threshold for opening the brake in the forward direction, expressed as a percentage of the motor armature current.
4104	Fwd open speed thr	Speed threshold for opening the brake in the forward direction, expressed in [rpm]
4106	Fwd open speed ref	Speed reference for opening the brake in the forward direction, expressed in [rpm]
4108	Fwd close speed thr	Speed threshold for closing the brake in the forward direction, expressed in [rpm]
4110	Rev open C/T thr	Current threshold for opening the brake in the reverse direction, expressed as a percentage of the motor armature current
4112	Rev open speed thr	Speed threshold for opening the brake in the reverse direction, expressed in [rpm]
4114	Rev open speed ref	Speed reference for brake opening in reverse direction, expressed in [rpm]
4116	Rev close speed thr	Speed threshold for brake closing in reverse direction, expressed in [rpm]
4134	Brake ramp acc time	Ramp acceleration time during brake opening phase, relative to full scale speed IPA 400- Full scale speed
4118	Brake pretorque dig	Level of torque injected at the moment the brake is released, expressed as a percentage of the motor's rated armature current
4120	Brake pretorque mon	Monitor of the level of torque injected at the moment the brake is released, which can also be assigned via programmable analogue inputs or fieldbus. The torque rises linearly from 0 to this value according to the ramp time defined by the Brake pretorque time parameter
4136	Brake pretorque time	Ramp time, expressed in ms, used for the gradual increase of the torque to be injected at the moment the brake is released, from 0 to 100% of the motor's rated armature current. If set to 0, the torque is applied instantly, without ramp
4122	Brake open delay	Brake release delay with respect to the relative threshold being exceeded, expressed in [ms]
4138	Brake ramp delay	Speed reference freeze time at the Fwd/Rev open speed ref value after completion of the pretorque phase, expressed in ms. This corresponds to the delay before returning to speed control with the normal ramp after the brake opening and pretorque phases. It also corresponds to the duration of the Wait for ramp state of parameter IPA 4148- Brake control state .
4124	Brake disable delay	Converter disable delay after brake closure during stopping, expressed in [ms]
4126	Brake fbk type	Enables brake feedback control, if available. Three selections are possible, depending on the type of feedback signal present: 0 None : the feedback signal is not available and the corresponding control is disabled 1 Normally closed : the feedback signal is at a high logic level when the brake is closed 2 Normally open : the feedback signal is at a low logic level when the brake is closed
4128	Brake fbk time	Maximum time allowed between sending the brake release command and receiving the feedback signal. If, at the end of the maximum time set, the feedback signal is not consistent with the command signal (depending on how Brake fbk type has been set), the converter signals the Brake fault alarm (see paragraph 7.20.8)
4130	Brake fbk mon	Brake feedback status monitor, available in the digital input selection lists
4132	Brake cmd mon	Brake open/close command monitor, available in the digital output selection lists
4148	Brake control state	Brake control function status monitor

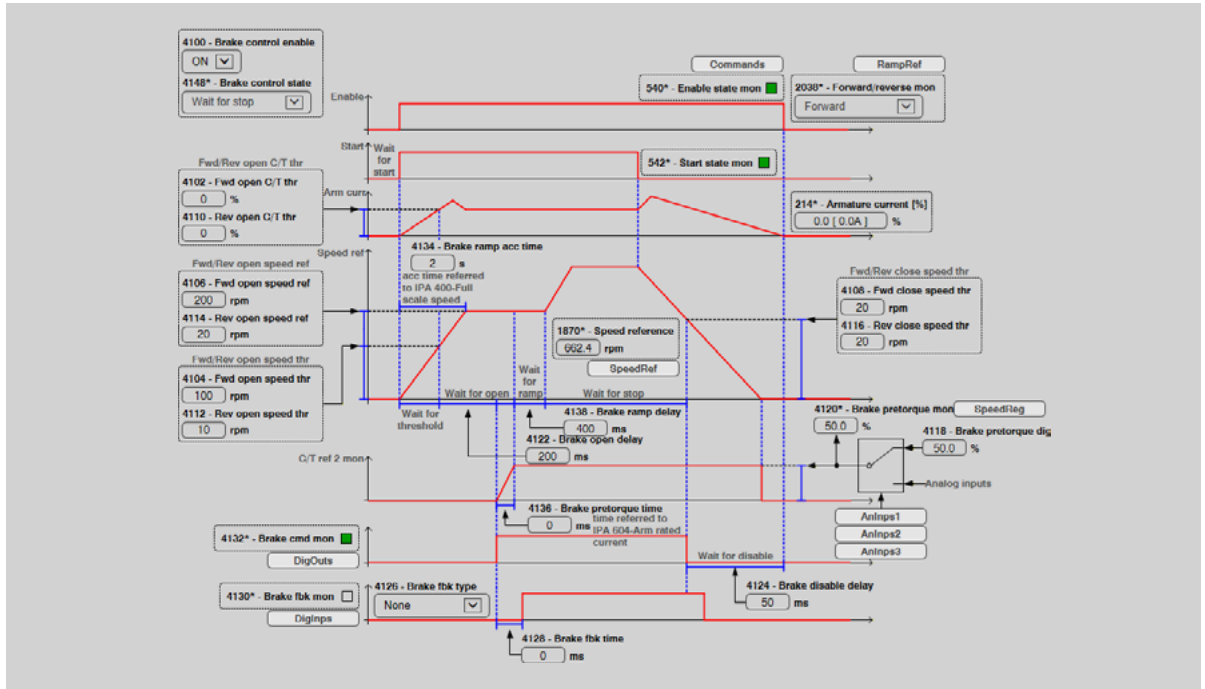


Figure 7-113: General diagram of the brake control function

The brake opening is conditioned on exceeding thresholds for both the speed reference and output current. Separate sets of parameters can be defined for the **Forward** and **Reverse** directions, and a delay time can be programmed for the brake opening command after these thresholds are exceeded.

The brake closing is conditioned only on exceeding a threshold on the speed reference, which can also be differentiated for the Forward and Reverse directions. A delay can be programmed for converter disable after the brake has closed.

The selection of the threshold set in use is based on the state of parameter IPA 2038-**Forward/reverse mon** (see [paragraph 7.10.1](#)).

The ramp reference during the brake opening phase is defined by IPA 4106 - **Fwd open speed ref** or IPA 4114-**Rev open speed ref**, and remains active until the pretorque phase following the brake opening command has been completed.

If Brake control enable is set to **ON**, the parameter IPA 4148-**Brake control state** displays the status of the brake control function, which is useful for monitoring the full sequence of brake opening and closing.

- Six operating states are possible, as shown in the diagram (see [Figure 7-103](#)), with reference to the **Forward** direction:
- **0 Wait for start:** the brake is closed, the converter is disabled, and it is waiting for a **Start** command, which may also come from a **Jog** command (see [paragraph 7.18.2](#)). After enabling, once the **Start** command is received, the state changes to **Wait for thresholds**
- **1 Wait for thresholds:** the brake is still closed, and the **ramp reference** is not the one normally set by the ramp reference chain, but is instead replaced by the parameter **Fwd open speed ref**. The acceleration ramp uses the dedicated time **Brake ramp acc time**. The **Speed reference** and **Armature current [%]** start to increase, and as soon as they reach their respective threshold **Fwd open speed thr** and **Fwd open C/T thr** the state changes to **Wait for open**
- **2 Wait for open:** the brake is still closed, but after the delay set by **Brake open delay** the brake opening command (**Brake cmd mon**) is issued. At the same time, the pre-torque value set by **Brake pretorque mon** is applied using **C/T reference 2** at the input of the current regulator (IPA 1910-**C/T ref 2 dig** = **Brake pretorque mon**) with the ramp time defined by **Brake pretorque time**. The state then changes to **Wait for ramp**.

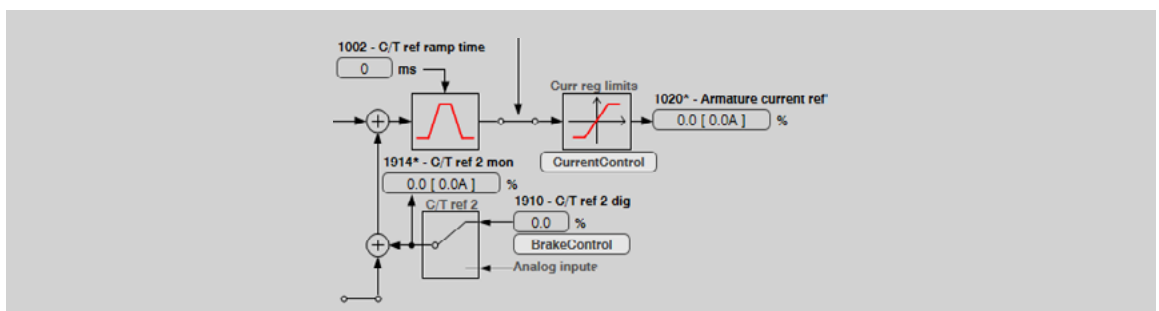


Figure 7-114: Logic diagram of the pretorque brake function

- **3 Wait for ramp:** After issuing the brake opening command and completing the pretorque phase, the speed reference can be further frozen at the *Fwd open speed ref* (or *Rev open speed ref*) value for the time set by the IPA 4138 - **Brake ramp delay** parameter.
- **4 Wait for stop:** the brake is open, and the drive resumes following the standard speed reference with standard ramp times. When the **Start** command is removed and the **speed reference** drops below the **Fwd close speed thr**, the brake closing command (**Brake cmd mon**) is issued, and the state changes to **Wait for disable**.
- **5 Wait for disable:** the brake is closed, and after the time defined by **Brake close delay**, the converter is disabled. The state returns to **Wait for start**, and the converter is ready for a new brake open/close cycle.

In all states of the brake open/close cycle, if the **Brake fbk type** parameter is set to *Normally open* or *Normally closed*, the converter performs a consistency check between the brake open/close command (**Brake cmd mon**) and the feedback signal (**Brake fbk mon**).

If the two signals differ for a period longer than the time set in parameter **Brake fbk time**, the **Brake fault** alarm is triggered.

The **Brake fbk mon** signal depends on the physical state of the digital input signal from which the feedback is received, and on the setting of the **Brake fbk type** parameter:

- If IPA 3000-**Digital input 1 dest** = **Brake fbk** and **Brake fbk type** = **Normally closed**
→ Then: **Brake fbk mon state** = **Digital input 1 mon state**
- If IPA 3000-**Digital input 1 dest** = **Brake fbk** and **Brake fbk type** = **Normally open**
→ Then: **Brake fbk mon state** = inverted state of **Digital input 1 mon**

7.18.12 Test generator

The **Test generator** function is a rectangular waveform generator with programmable frequency and amplitude, intended for debugging and/or commissioning purposes.

A typical use case is the manual tuning of the speed regulator ([see paragraph 5.2.10](#)).

The function is managed through the following parameters in the **FUNCTIONS\TEST GENERATOR** menu:

IPA	DESCRIPTION
4450 Test gen dest	Allows you to select the destination of the generated waveform to simulate certain reference signals for speed, current or field control. The following selections are possible: 0 OFF: function disabled 2 C/T ref: simulation of the armature current reference (see figure 7-35) 3 Field ref: simulation of the field current reference (see figure 7-47) 4 Ramp ref: ramp reference simulation (see figure 7-14) 5 Speed ref: speed reference simulation (see figure 7-15)
4452 Test gen frequency	Frequency in [Hz] of the waveform
4454 Test gen amplitude	Amplitude in [%] of the waveform
4456 Test gen offset	Offset in [%] of the waveform
4458 Test gen out	Instantaneous monitor of the waveform value, which takes the unit of measurement of the quantity selected with Test gen dest (respectively [%], [%], [rpm] or [rpm] for selections 2-3-4-5)

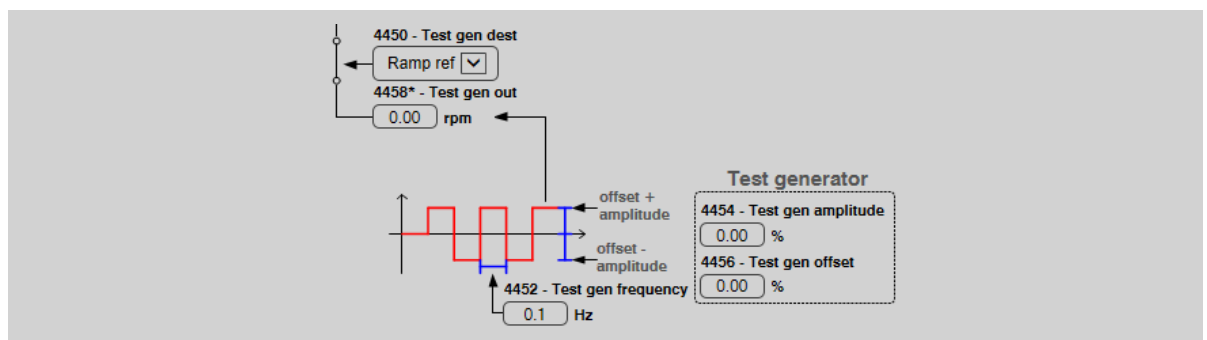


Figure 7-115: General diagram of the Test generator function

The **Test gen out** signal generated by the Test generator toggles instantly between the levels **Test gen offset + Test gen amplitude** and **Test gen offset – Test gen amplitude**, making it possible to generate negative levels as well.

In the case of **C/T ref** selection, the Test gen out signal is expressed as a percentage of parameter IPA 604-**Arm rated current** and is added into the armature current reference chain, summed with **C/T ref 1 mon + C/T ref 2 mon** ([see Figure 7-35](#)).

Both the amplitude and offset values are expressed as a percentage of the **Arm rated current**.

In the case of **Field ref** selection, the **Test gen out** signal is expressed as a percentage of parameter IPA 608-**Field rated current** and is added into the field current reference chain, summed with the output of the field current limiter (see Figure 7-47).

Both the amplitude and offset values are expressed as a percentage of the **Field rated current**.

In the case of **Ramp ref** selection, the **Test gen out** signal is expressed in rpm and is added into the ramp reference chain, summed with **Ramp ref 1 mon + Ramp ref 2 mon** or with the Multi speed values (see Figure 7-14). Amplitude and offset values are expressed as a percentage of parameter IPA 400-**Full scale speed**.

In the case of **Speed ref** selection, the **Test gen out** signal is expressed in rpm and is added into the speed reference chain, summed with **Speed ref 1 mon + Speed ref 2 mon** (see Figure 7-15). Amplitude and offset values are expressed as a percentage of parameter IPA 400-**Full scale speed**.

7.18.13 Signal adaptation

The **Link** function provides a sequence of operations that allows the value of a source parameter to be modified through a series of mathematical operations and then applied to a destination parameter.

The Link function is managed through the following parameters in the **FUNCTIONS\LINK 1 ... LINK 6** menu:

- **Link 1 source:** IPA of the source parameter for **Link 1**
- **Link 1 destination:** IPA of the destination parameter for **Link 1**
- **Link 1 mul gain:** Multiplication factor applied to the source of **Link 1**
- **Link 1 div gain:** Division factor applied to the source of **Link 1**
- **Link 1 input max:** Maximum limit applied to the source of **Link 1**
- **Link 1 input min:** Minimum limit applied to the source of **Link 1**
- **Link 1 input offset:** Offset added to the source of **Link 1**
- **Link 1 output offset:** Offset added to the destination of **Link 1**
- **Link 1 input abs:** Enables the absolute value function for the source of **Link 1**

The above list applies similarly to Link functions from 1 to 6.

Table 7-8: Parameters related to the configuration of the Link functions

Parameter	Link 1	Link 2	Link 3	Link 4	Link 5	Link 6
Link X source	IPA 4650	IPA 4670	IPA 4690	IPA 4710	IPA 4730	IPA 4750
Link X destination	IPA 4652	IPA 4672	IPA 4692	IPA 4712	IPA 4732	IPA 4752
Link X mul gain	IPA 4654	IPA 4674	IPA 4694	IPA 4714	IPA 4734	IPA 4754
Link X div gain	IPA 4656	IPA 4676	IPA 4696	IPA 4716	IPA 4736	IPA 4756
Link X input max	IPA 4658	IPA 4678	IPA 4698	IPA 4718	IPA 4738	IPA 4758
Link X input min	IPA 4660	IPA 4680	IPA 4700	IPA 4720	IPA 4740	IPA 4760
Link X input offset	IPA 4662	IPA 4682	IPA 4702	IPA 4722	IPA 4742	IPA 4762
Link X output offset	IPA 4664	IPA 4684	IPA 4704	IPA 4724	IPA 4744	IPA 4764
Link X input abs	IPA 4666	IPA 4686	IPA 4706	IPA 4726	IPA 4746	IPA 4766

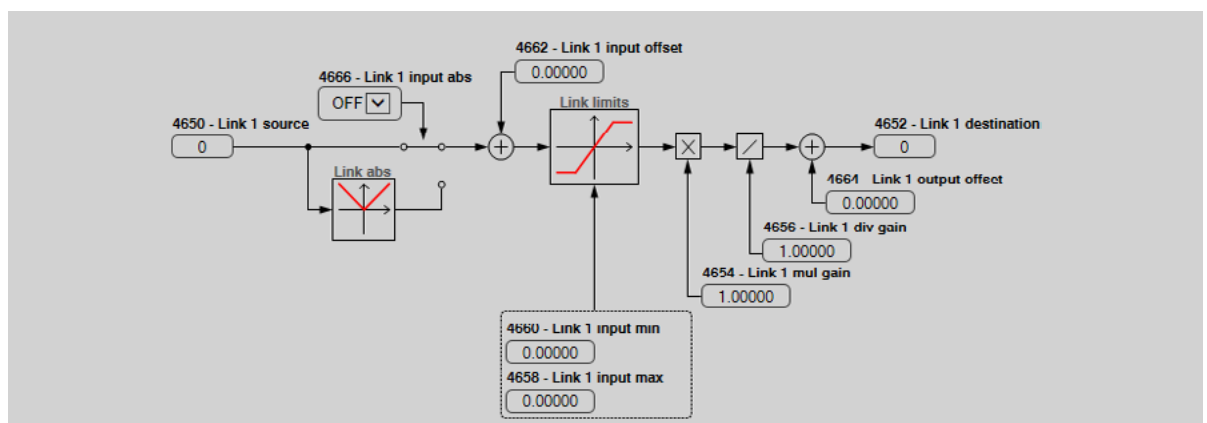


Figure 7-116: Operating diagram of a Link channel

The source parameter is acquired and then processed through the following operations in sequence:

- Application of the absolute value (only if enabled)
- Application of an input offset
- Limitation between a minimum and a maximum value

- Multiplication
- Division
- Application of an output offset

The resulting value after the last operation is assigned to the destination parameter.

NOTE!

The destination parameter cannot be read-only, and command-type parameters are not allowed.

NOTE!

It is the user's responsibility to configure operations that are meaningful within their specific application and that do not cause malfunctions or unexpected results.

NOTE!

The Link function is not executed within a cyclic control task with a fixed period. Therefore, it is recommended to use it only for parameter adaptation and connection involving simple logical or mathematical operations, and not for critical control or regulation functions.

7.18.14 PAD parameters

The **PADs** are general-purpose variables used for data exchange between the drive's system software, applications developed using the **WEG_DriveLogic** tool, and/or a connected fieldbus system ([see section 7.19.2](#)).

These variables can be accessed through the following parameters in the **FUNCTIONS\PAD PARAMETERS** menu:

IPA	DESCRIPTION
4500 Pad 0	General-purpose variable 0 in floating point
4502 Pad 1	General-purpose variable 1 in floating point
4504 Pad 2	General-purpose variable 2 in floating point
4506 Pad 3	General-purpose variable 3 in floating point
4508 Pad 4	General-purpose variable 4 in floating point
4510 Pad 5	General-purpose variable 5 in floating point
4512 Pad 6	General-purpose variable 6 in floating point
4514 Pad 7	General-purpose variable 7 in floating point
4516 Pad 8	General-purpose variable 8 to 16 bits with sign
4518 Pad 9	General-purpose variable 9 to 16 bits with sign
4520 Pad 10	General-purpose variable 10 to 16 bits with sign
4522 Pad 11	General-purpose variable 11 to 16 bits with sign
4524 Pad 12	General-purpose variable 12 to 16 bits with sign
4526 Pad 13	General-purpose variable 13 to 16 bits with sign
4528 Pad 14	General-purpose variable 14 to 16 bits with sign
4530 Pad 15	General-purpose variable 15 to 16 bits with sign
4550 Bitword Pad A	General-purpose 16-bit unsigned bitword A
4552 Pad A bit 0	Bit 0 of Bitword Pad A
4554 Pad A bit 1	Bit 1 of Bitword Pad A
4556 Pad A bit 2	Bit 2 of Bitword Pad A
4558 Pad A bit 3	Bit 3 of Bitword Pad A
4560 Pad A bit 4	Bit 4 of Bitword Pad A
4562 Pad A bit 5	Bit 5 of Bitword Pad A
4564 Pad A bit 6	Bit 6 of Bitword Pad A
4566 Pad A bit 7	Bit 7 of Bitword Pad A
4568 Pad A bit 8	Bit 8 of Bitword Pad A
4570 Pad A bit 9	Bit 9 of Bitword Pad A
4572 Pad A bit 10	Bit 10 of Bitword Pad A
4574 Pad A bit 11	Bit 11 of Bitword Pad A
4576 Pad A bit 12	Bit 12 of Bitword Pad A
4578 Pad A bit 13	Bit 13 of Bitword Pad A
4580 Pad A bit 14	Bit 14 of Bitword Pad A

4582	Pad A bit 15	Bit 15 of Bitword Pad A
4600	Bitword Pad B	General-purpose 16-bit unsigned bitword B
4602	Pad B bit 0	Bit 0 of Bitword Pad B
4604	Pad B bit 1	Bit 1 of Bitword Pad B
4606	Pad B bit 2	Bit 2 of Bitword Pad B
4608	Pad B bit 3	Bit 3 of Bitword Pad B
4610	Pad B bit 4	Bit 4 of Bitword Pad B
4612	Pad B bit 5	Bit 5 of Bitword Pad B
4614	Pad B bit 6	Bit 6 of Bitword Pad B
4616	Pad B bit 7	Bit 7 of Bitword Pad B
4618	Pad B bit 8	Bit 8 of Bitword Pad B
4620	Pad B bit 9	Bit 9 of Bitword Pad B
4622	Pad B bit 10	Bit 10 of Bitword Pad B
4624	Pad B bit 11	Bit 11 of Bitword Pad B
4626	Pad B bit 12	Bit 12 of Bitword Pad B
4628	Pad B bit 13	Bit 13 of Bitword Pad B
4630	Pad B bit 14	Bit 14 of Bitword Pad B
4632	Pad B bit 15	Bit 15 of Bitword Pad B

Parameters **Pad 0**, **Pad 1**, **Pad 2**, **Pad 3**, **Pad 4**, **Pad 5**, **Pad 6** and **Pad 7** are floating-point variables and can be set via programmable analog inputs 1, 2, or 3 ([see section 7.17.3](#)).

Parameters **Pad 8**, **Pad 9**, **Pad 10**, **Pad 11**, **Pad 12**, **Pad 13**, **Pad 14** and **Pad 15** are 16-bit signed integers and can be assigned to programmable analog outputs 1, 2, 3, or 4 ([see section 7.17.4](#)).

The parameter **Bitword Pad A** is a 16-bit unsigned integer whose bits 0 to 15 are directly accessible for read/write operations through the corresponding dedicated parameters **Pad A bit 0 to Pad A bit 15** ([see figure 7-107](#)), which can be set via programmable digital inputs 1 to 8 ([see section 7.17.1](#)).

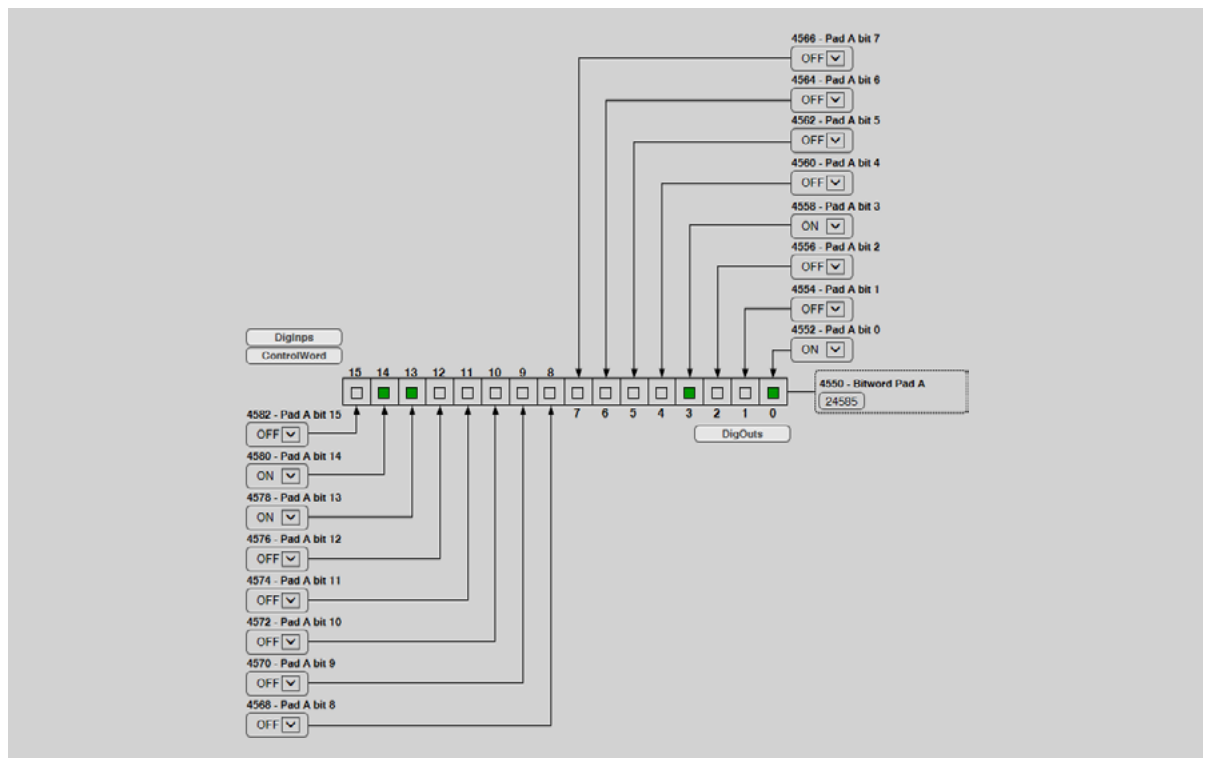


Figure 7-117: Configuration diagram of the Bitword Pad A variable

The parameter **Bitword Pad B** is a 16-bit unsigned integer whose bits 0 to 15 are directly accessible for read/write operations through the corresponding dedicated parameters **Pad B bit 0 to Pad B bit 15** ([see figure 7-108](#)), which can be set via programmable digital inputs 1 to 8 ([see section 7.17.1](#)).

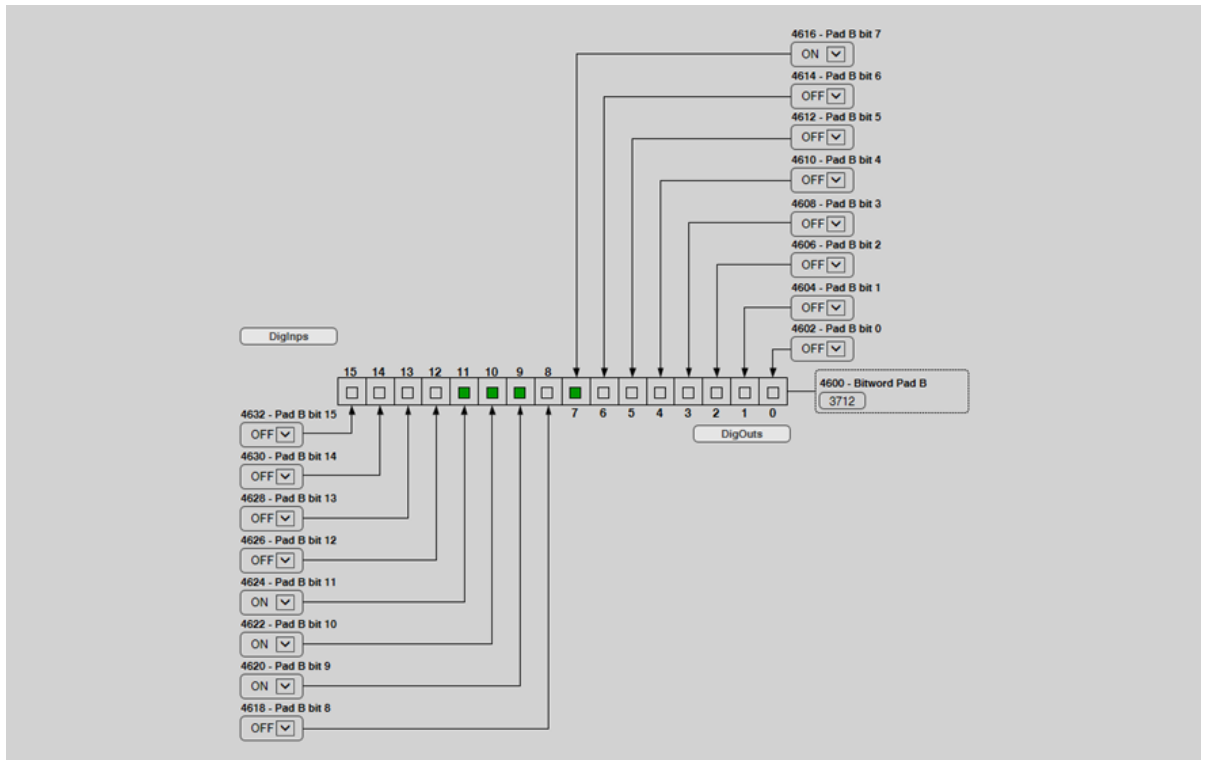


Figure 7-118: Configuration diagram of the Bitword Pad B variable

The individual bits of the **Bitword Pad A** and **Bitword Pad B** parameters can be assigned to programmable digital outputs 1, 2, 3, 4, 5, 6, 7, 8, R1, or R2 ([see section 7.17.2](#)), using the selections **Pad A bit** or **Pad B bit**. The assignment follows a predefined rule based on the bit position (example below refers to Pad A, and is analogous for Pad B):

- If IPA 3200-Digital output 1 sel = Pad A bit then Digital output 1 mon = status of Pad A bit 0
- If IPA 3202-Digital output 2 sel = Pad A bit then Digital output 2 mon = status of Pad A bit 1
- If IPA 3204-Digital output 3 sel = Pad A bit then Digital output 3 mon = status of Pad A bit 2
- If IPA 3206-Digital output 4 sel = Pad A bit then Digital output 4 mon = status of Pad A bit 3
- If IPA 3208-Digital output 5 sel = Pad A bit then Digital output 5 mon = status of Pad A bit 4
- If IPA 3210-Digital output 6 sel = Pad A bit then Digital output 6 mon = status of Pad A bit 5
- If IPA 3212-Digital output 7 sel = Pad A bit then Digital output 7 mon = status of Pad A bit 6
- If IPA 3214-Digital output 8 sel = Pad A bit then Digital output 8 mon = status of Pad A bit 7

7.19 Communication interface

The **COMMUNICATION** menu provides the parameters for configuring the converter's communication interfaces. Each function is managed through a dedicated submenu, described in detail below.

7.19.1 Network configuration

The drive's network communication can be configured using the following parameters in the **COMMUNICATION NETWORK CONFIG** menu:

IPA		DESCRIPTION
9562	IP address	Display of IP address in use
9564	IP netmask	Subnet IP address in use
9566	IP gateway	Gateway IP address in use
9604	IP assignment	IP address assignment. 0 DHCP: the drive's IP address is assigned by the network's DHCP server. If there is no DHCP server, the drive waits for about 3 minutes, then takes the static IP address configured via parameter (IPA 9556- IP address set , default = 169.254.10.10). Typical use case: drive connected to a network with multiple devices. 1 Static: the drive's IP address is assigned via the IPA 9556- IP address set parameter, default = 169.254.10.10. Typical use case: drive connected directly to the PC.

9556	IP address set	Network IP address settings
9558	IP netmask set	Subnet IP address setting
9560	IP gateway set	Gateway IP address setting
9200	Wi-Fi fw version	Indicates the FW version of the Wi-Fi Drive Link module connected to the drive
9202	Wi-Fi S/N	Indicates the serial number of the Wi-Fi Drive Link module connected to the drive
9204	Wi-Fi network name	Name of the Wi-Fi network generated by the Wi-Fi Drive Link module
9206	Wi-Fi network pwd	Password used to connect to the network generated by the Wi-Fi Drive Link module

7.19.2 Fieldbus configuration

The **R-TPD500** control board is equipped with an optional interface for standard fieldbus communication:

- **PROFIBUS** - EXP-PDP-TPD500
- **PROFINET** - EXP-ETH-PN-TPD500
- **EtherNet/IP** - EXP-ETH-IP-TPD500

Fieldbus-based communication, where the converter operates as a slave device, can be configured using the following parameters in the **COMMUNICATION\FIELDBUS CONFIG** menu:

IPA		DESCRIPTION
6000	Fieldbus enable	Parameter for enabling communication with the fieldbus. When set to <i>ON</i> , it activates the fieldbus communication card, thus establishing data exchange with the PLC.
6002	Fieldbus type	Monitor of the type of fieldbus module installed. The following displays are possible: 0 None: no fieldbus connected or module not recognised 137 PROFINET: PROFINET RT fieldbus 5 PROFIBUS: PROFIBUS DP V2 fieldbus 155 EtherNet/IP: EtherNet/IP fieldbus
6004	Fieldbus state	Monitor of the status of the installed field bus module. The following displays are possible: 0 Setup: the module is in setup mode 1 Init: the module is performing operations related to network initialisation 2 Wait process: the network is temporarily inactive or waiting for the PLC master 3 Idle: the network is waiting 4 Active: the fieldbus network is processing data correctly with no problems 5 Error: the network is in error 7 Exception: the module has generated an error exception from which it has not been possible to restore correct operation
6006	Fieldbus baudrate	Fieldbus baud rate selection. The following selections are possible: 0 Auto: communication speed negotiation is handled at the PLC master level 1 125k: network speed 125 kbps 2 250k: network speed 250 kbps 3 500k: network speed 500 kbps 4 1M: network speed 1 Mbps
6008	Fieldbus address	Fieldbus address if permitted by the protocol (PROFIBUS)
6010	Fieldbus IP address	Fieldbus IP address if permitted by the protocol (PROFINET, EtherNet/IP)
6012	Fieldbus IP netmask	Fieldbus netmask if permitted by the protocol (PROFINET, EtherNet/IP)
6014	Fieldbus DHCP enable	DHCP enable parameter if permitted by the protocol (PROFINET, EtherNet/IP)

7.19.3 Fieldbus - Master/Slave

Once an optional fieldbus communication interface is installed, it is possible to exchange up to sixteen parameters simultaneously from the master (PLC) to the slave (converter) in cyclic mode (commonly referred to as "process data" or PDO).

The **COMMUNICATION\FIELDBUS MS** menu allows the configuration of converter (slave) parameters to be assigned by the PLC (master) via cyclic fieldbus communication.

IPA		DESCRIPTION
6020	Fieldbus MS 1 ipa	Channel 1 configuration parameter from master to slave
6030	Fieldbus MS 2 ipa	Channel 2 configuration parameter from master to slave
6040	Fieldbus MS 3 ipa	Channel 3 configuration parameter from master to slave
6050	Fieldbus MS 4 ipa	Channel 4 configuration parameter from master to slave
6060	Fieldbus MS 5 ipa	Channel 5 configuration parameter from master to slave
6070	Fieldbus MS 6 ipa	Channel 6 configuration parameter from master to slave
6080	Fieldbus MS 7 ipa	Channel 7 configuration parameter from master to slave
6090	Fieldbus MS 8 ipa	Channel 8 configuration parameter from master to slave
6100	Fieldbus MS 9 ipa	Channel 9 configuration parameter from master to slave
6110	Fieldbus MS 10 ipa	Channel 10 configuration parameter from master to slave
6120	Fieldbus MS 11 ipa	Channel 11 configuration parameter from master to slave
6130	Fieldbus MS 12 ipa	Channel 12 configuration parameter from master to slave
6140	Fieldbus MS 13 ipa	Channel 13 configuration parameter from master to slave
6150	Fieldbus MS 14 ipa	Channel 14 configuration parameter from master to slave
6160	Fieldbus MS 15 ipa	Channel 15 configuration parameter from master to slave
6170	Fieldbus MS 16 ipa	Channel 16 configuration parameter from master to slave
6024	Fieldbus MS 1 div	Divider of the value received on channel 1 from master to slave
6034	Fieldbus MS 2 div	Divider of the value received on channel 2 from master to slave
6044	Fieldbus MS 3 div	Divider of the value received on channel 3 from master to slave
6054	Fieldbus MS 4 div	Divider of the value received on channel 4 from master to slave
6064	Fieldbus MS 5 div	Divider of the value received on channel 5 from master to slave
6074	Fieldbus MS 6 div	Divider of the value received on channel 6 from master to slave
6084	Fieldbus MS 7 div	Divider of the value received on channel 7 from master to slave
6094	Fieldbus MS 8 div	Divider of the value received on channel 8 from master to slave
6104	Fieldbus MS 9 div	Divider of the value received on channel 9 from master to slave
6114	Fieldbus MS 10 div	Divider of the value received on channel 10 from master to slave
6124	Fieldbus MS 11 div	Divider of the value received on channel 11 from master to slave
6134	Fieldbus MS 12 div	Divider of the value received on channel 12 from master to slave
6144	Fieldbus MS 13 div	Divider of the value received on channel 13 from master to slave
6154	Fieldbus MS 14 div	Divider of the value received on channel 14 from master to slave
6164	Fieldbus MS 15 div	Divider of the value received on channel 15 from master to slave
6174	Fieldbus MS 16 div	Divider of the value received on channel 16 from master to slave
6022	Fieldbus MS 1 mon	Monitor of the value received on channel 1 from master to slave
6032	Fieldbus MS 2 mon	Monitor of the value received on channel 2 from master to slave
6042	Fieldbus MS 3 mon	Monitor of the value received on channel 3 from master to slave
6052	Fieldbus MS 4 mon	Monitor of the value received on channel 4 from master to slave
6062	Fieldbus MS 5 mon	Monitor of the value received on channel 5 from master to slave
6072	Fieldbus MS 6 mon	Monitor of the value received on channel 6 from master to slave
6082	Fieldbus MS 7 mon	Monitor of the value received on channel 7 from master to slave
6092	Fieldbus MS 8 mon	Monitor of the value received on channel 8 from master to slave
6102	Fieldbus MS 9 mon	Monitor of the value received on channel 9 from master to slave
6112	Fieldbus MS 10 mon	Monitor of the value received on channel 10 from master to slave
6122	Fieldbus MS 11 mon	Monitor of the value received on channel 11 from master to slave
6132	Fieldbus MS 12 mon	Monitor of the value received on channel 12 from master to slave
6142	Fieldbus MS 13 mon	Monitor of the value received on channel 13 from master to slave
6152	Fieldbus MS 14 mon	Monitor of the value received on channel 14 from master to slave
6162	Fieldbus MS 15 mon	Monitor of the value received on channel 15 from master to slave
6172	Fieldbus MS 16 mon	Monitor of the value received on channel 16 from master to slave

Sixteen sets of configuration parameters are available: **Fieldbus MS 1...16 ipa**, **Fieldbus MS 1...16 div** and **Fieldbus MS 1...16 mon**, one for each data item that can be assigned to the converter via fieldbus communication.

Each **Fieldbus MS 1...16 ipa** parameter must contain the IPA of the parameter to be assigned, as shown in the following examples:

- To write **Ramp reference 1** (IPA 1800-**Ramp ref 1 dig**) via fieldbus, set **Fieldbus MS 1 ipa = 1800** (or any of the available channels).
- To write **Positive current limit** (IPA 1104-**C/T lim pos dig**) via fieldbus, set **Fieldbus MS 2 ipa = 1104** (or any of the available channels).
- To write the **Control word** (IPA 6450-**Control word dig**) via fieldbus, set **Fieldbus MS 3 ipa = 6450** (or any of the available channels).

For the parameters to be correctly assigned based on the values sent by the PLC, the fieldbus must be enabled by setting IPA 6000-**Fieldbus enable** = *ON*, and communication must be active and error-free, as indicated by IPA 6004 – **Fieldbus state** = *Active*.

In this case, the original values of the assigned parameters will be irreversibly overwritten.

The **Fieldbus MS 1...16 div** parameters are monitors of the division factors, which are automatically calculated by the drive each time a channel is configured via **Fieldbus MS 1...16 ipa**, based on the type and display format of the mapped parameter. Typical values include 1, 10, 100, and 1000, as shown in the following examples:

- If **Fieldbus MS 1 ipa = 1800**, then **Fieldbus MS 1 div = 10**, since IPA 1800-**Ramp ref 1 dig** is a floating-point value with one decimal place.
- If **Fieldbus MS 2 ipa = 900**, then **Fieldbus MS 2 div = 100**, since IPA 900-**Speed reg P** is a floating-point value with two decimal places.
- If **Fieldbus MS 3 ipa = 6450**, then **Fieldbus MS 3 div = 1**, since IPA 6450-**Control word dig** is an integer value.

The **Fieldbus MS 1...16 mon** parameters are 32-bit signed integer monitors that indicate the value which must be transmitted by the PLC to the master in order for the corresponding parameter to assume the correct value, as shown in the following examples:

- To write **Ramp reference 1** (IPA 1800-**Ramp ref 1 dig**) via fieldbus with a value of 500.5 rpm:
After setting **Fieldbus MS 1 ipa = 1800**, the drive sets **Fieldbus MS 1 div = 10**.
Therefore, the PLC must send **Fieldbus MS 1 mon = 5005** (500.5×10 , since $\text{div} = 10$).
- To write the **Speed regulator gain** (IPA 900-**Speed reg P**) via fieldbus with a value of 20.05%:
After setting **Fieldbus MS 2 ipa = 900**, the drive sets **Fieldbus MS 2 div = 100**.
Therefore, the PLC must send **Fieldbus MS 2 mon = 2005** (20.05×100 , since $\text{div} = 100$).
- To write the **Control word** (IPA 6450-**Control word dig**) via fieldbus with a value of 65535:
After setting **Fieldbus MS 3 ipa = 6450**, the drive sets **Fieldbus MS 3 div = 1**.
Therefore, the PLC must send **Fieldbus MS 3 mon = 65535** (65535×1 , since $\text{div} = 1$).

The PLC must therefore transmit on the bus a 32-bit signed integer value equal to the product of the desired value of the parameter to be written (in engineering units), as configured on each channel, and the corresponding division factor automatically calculated by the drive during channel configuration.

Even float-type parameters must be transmitted as 32-bit signed integers.

Value transmitted on the bus (channel n) = Value to be assigned to the parameter (channel n) × Division factor (channel n)

Many of the parameters that can be assigned via cyclic fieldbus communication can also be written via analog inputs. However, analog inputs have higher priority than the corresponding user parameters.

Therefore, for fieldbus writing to be effective, it is necessary to check that the parameter to be written is not already configured as the destination of an analog input—and if so, to remove that assignment. Refer to the following example:

- IPA 1800-**Ramp ref 1 dig** is the ramp reference 1 user value (manually assignable or assignable via fieldbus by setting IPA 6020-**Fieldbus MS 1 ipa** = 1800)
- IPA 1804-**Ramp ref 1 mon** is the monitor of ramp reference 1, corresponding to the actual value applied to the reference chain (see figure 6-14)
- If **An input 1 dest** is set to **Ramp ref 1**, then IPA 1800-**Ramp ref 1 dig** becomes ineffective, even if it is written via fieldbus. The actual reference value, as shown by IPA 1804-**Ramp ref 1 mon**, is controlled by the signal level of analog input 1, as highlighted in the selector of the following diagram:

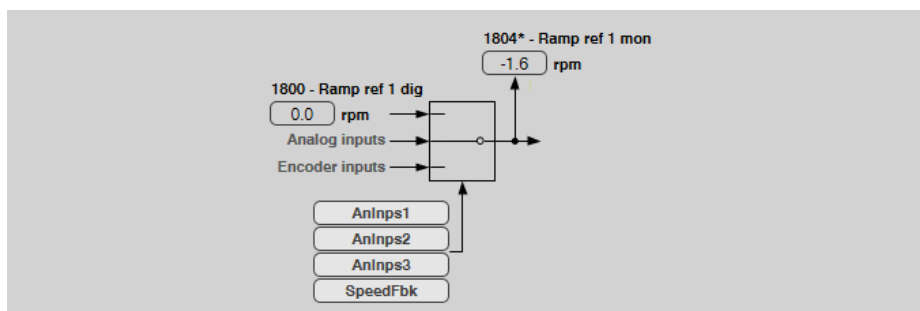


Figure 7-119: Operating logic when An input 1 dest = Ramp ref 1

NOTE!

- Therefore, if IPA 6020-**Fieldbus MS 1 ipa** = 1800, fieldbus writing - although functioning correctly - will be ineffective because:
- **Ramp ref 1 dig** = numerical value correctly received from fieldbus channel 1
- **Ramp ref 1 mon** = analog input 1 value (this is the value actually applied to the reference chain)
- Conversely, if IPA 3400-**An input 1 dest** is set to **OFF** or to any value other than **Ramp ref 1**, **Ramp ref 1 mon** follows **Ramp ref 1 dig**, as shown by the selector switching in the following diagram:

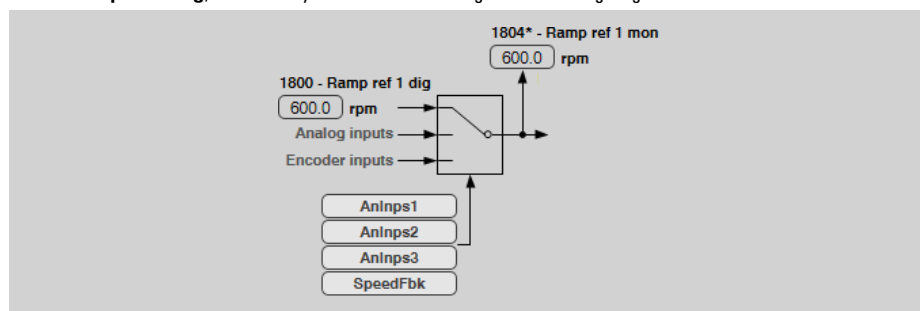


Figure 7-120: Operating logic when An input 1 dest ≠ Ramp ref 1

Therefore, if IPA 6020-**Fieldbus MS 1 ipa** = 1800 fieldbus writing is effective, and the result is:

- **Ramp ref 1 mon** = **Ramp ref 1 dig** = numerical value received from fieldbus channel 1

NOTE!

Not all parameters can be written via cyclic fieldbus communication. The drive accepts in the **Fieldbus MS 1...16 ipa** configuration channels only writable parameters that, by their function, are suitable for this type of communication. These typically include ramp and speed references, current references, current limits, control words, digital enable/start commands, regulator gains, and PAD variables used in **WEG_DriveLogic** applications.

All other parameters related to system configuration - such as motor nameplate data or other parameters set once during commissioning - are not considered process data. However, they can still be exchanged over the fieldbus using acyclic communication (refer to the Fieldbus manuals for details).

7.19.4 Fieldbus - Slave/Master

Once an optional fieldbus communication interface is installed, it is possible to exchange up to sixteen parameters simultaneously from the slave (converter) to the master (PLC) in cyclic mode (commonly referred to as "process data" or PDO).

The **COMMUNICATION\FIELDBUS SM** menu allows the configuration of converter (slave) parameters to be transmitted to the PLC (master) via cyclic fieldbus communication.

IPA	DESCRIPTION
6220 Fieldbus SM 1 ipa	Channel 1 configuration parameter from slave to master
6230 Fieldbus SM 2 ipa	Channel 2 configuration parameter from slave to master
6240 Fieldbus SM 3 ipa	Channel 3 configuration parameter from slave to master
6250 Fieldbus SM 4 ipa	Channel 4 configuration parameter from slave to master
6260 Fieldbus SM 5 ipa	Channel 5 configuration parameter from slave to master
6270 Fieldbus SM 6 ipa	Channel 6 configuration parameter from slave to master
6280 Fieldbus SM 7 ipa	Channel 7 configuration parameter from slave to master
6290 Fieldbus SM 8 ipa	Channel 8 configuration parameter from slave to master
6300 Fieldbus SM 9 ipa	Channel 9 configuration parameter from slave to master
6310 Fieldbus SM 10 ipa	Channel 10 configuration parameter from slave to master
6320 Fieldbus SM 11 ipa	Channel 11 configuration parameter from slave to master
6330 Fieldbus SM 12 ipa	Channel 12 configuration parameter from slave to master
6340 Fieldbus SM 13 ipa	Channel 13 configuration parameter from slave to master
6350 Fieldbus SM 14 ipa	Channel 14 configuration parameter from slave to master
6360 Fieldbus SM 15 ipa	Channel 15 configuration parameter from slave to master
6370 Fieldbus SM 16 ipa	Channel 16 configuration parameter from slave to master
6222 Fieldbus SM 1 mul	Multiplier of the value sent on channel 1 from slave to master
6232 Fieldbus SM 2 mul	Multiplier of the value sent on channel 2 from slave to master
6242 Fieldbus SM 3 mul	Multiplier of the value sent on channel 3 from slave to master
6252 Fieldbus SM 4 mul	Multiplier of the value sent on channel 4 from slave to master
6262 Fieldbus SM 5 mul	Multiplier of the value sent on channel 5 from slave to master
6272 Fieldbus SM 6 mul	Multiplier of the value sent on channel 6 from slave to master
6282 Fieldbus SM 7 mul	Multiplier of the value sent on channel 7 from slave to master
6292 Fieldbus SM 8 mul	Multiplier of the value sent on channel 8 from slave to master
6302 Fieldbus SM 9 mul	Multiplier of the value sent on channel 9 from slave to master
6312 Fieldbus SM 10 mul	Multiplier of the value sent on channel 10 from slave to master
6322 Fieldbus SM 11 mul	Multiplier of the value sent on channel 11 from slave to master
6332 Fieldbus SM 12 mul	Multiplier of the value sent on channel 12 from slave to master
6342 Fieldbus SM 13 mul	Multiplier of the value sent on channel 13 from slave to master
6352 Fieldbus SM 14 mul	Multiplier of the value sent on channel 14 from slave to master
6362 Fieldbus SM 15 mul	Multiplier of the value sent on channel 15 from slave to master
6372 Fieldbus SM 16 mul	Multiplier of the value sent on channel 16 from slave to master

Sixteen sets of configuration parameters are available: **Fieldbus SM 1...16 ipa** and **Fieldbus SM 1...16 mul**, one for each data item that can be transmitted to the PLC via fieldbus communication.

Each **Fieldbus SM 1...16 ipa** parameter must be set to the IPA of the parameter to be transmitted, as shown in the following examples:

- To transmit **Armature current** (IPA 222-**Armature current [A]**) via fieldbus, set **Fieldbus SM 1 ipa = 222** (or any other available channel).
- To transmit the current **Speed regulator proportional gain** (IPA 908-**Speed reg P in use**) via fieldbus, set **Fieldbus SM 2 ipa = 908** (or any other available channel).
- To transmit the **Status word** (IPA 6432-**Status word mon**) via fieldbus, set **Fieldbus SM 3 ipa = 6432** (or any other available channel).

For the parameters to be correctly transmitted in line with the actual values on the slave, the fieldbus must be enabled by setting IPA 6000-**Fieldbus enable** = **ON**, and communication must be active and error-free, as indicated by IPA 6004 - **Fieldbus state** = **Active**.

The **Fieldbus SM 1...16 mul** parameters are monitors of the multiplication factors, which are automatically calculated by the drive each time a channel is configured via **Fieldbus SM 1...16 ipa**, based on the type and display format of the mapped parameter. Typical values include 1, 10, 100, and 1000, as shown in the following examples:

- If **Fieldbus SM 1 ipa = 222**, then **Fieldbus SM 1 mul = 10**, since IPA 222-**Armature current [A]** is a float with one decimal place.
- If **Fieldbus SM 2 ipa = 908**, then **Fieldbus SM 2 mul = 100**, since IPA 908-**Speed reg P in use** is a float with two decimal places.
- If **Fieldbus SM 3 ipa = 6432**, then **Fieldbus SM 3 mul = 1**, since IPA 6432-**Status word mon** is an integer.

The converter transmits on the bus a 32-bit signed integer value equal to the product of the parameter value to be transmitted (in engineering units), as configured on each channel, and the corresponding multiplication factor automatically calculated by the drive during channel configuration.
Even float-type parameters are therefore transmitted as 32-bit signed integers.

Value transmitted on the bus (channel n) = Parameter value (channel n) × Multiplication factor (channel n).

The PLC must then independently perform the division between the value received on a given channel and the corresponding channel's multiplication factor before using it within its program.

NOTE!

Not all parameters can be transmitted via cyclic fieldbus communication. The drive accepts in the **Fieldbus SM 1...16 ipa** configuration channels only those parameters that, by their function, are suitable for this type of transmission. These typically include monitors of control-related physical quantities, ramp and speed reference monitors, current reference monitors, current limit monitors, status words, monitors of enable/start commands, and PAD variables used in **WEG_DriveLogic** applications.
All other parameters related to system configuration - such as motor nameplate data or parameters that are typically set only once during commissioning - are not considered process data. However, they can still be exchanged via fieldbus using acyclic communication (refer to the Fieldbus manuals for details).

7.19.5 Status Word

The **Status word** is a fully programmable word used for communication from the converter to the fieldbus, where each bit corresponds to specific information about the drive status.

In a typical configuration, the status word must be assigned to one of the sixteen communication channels **Fieldbus SM 1 ipa ... Fieldbus SM 16 ipa** in the **COMMUNICATION\FIELDBUS SM** menu ([see section 7.19.4](#)).

The status word is managed through the following parameters in the **COMMUNICATION\STATUS WORD** menu.

IPA		DESCRIPTION
6400	Status word 0 sel	Selection of bit 0 of the status word
6402	Status word 1 sel	Selection of bit 1 of the status word
6404	Status word 2 sel	Selection of bit 2 of the status word
6406	Status word 3 sel	Selection of bit 3 of the status word
6408	Status word 4 sel	Selection of bit 4 of the status word
6410	Status word 5 sel	Selection of bit 5 of the status word
6412	Status word 6 sel	Selection of bit 6 of the status word
6414	Status word 7 sel	Selection of bit 7 of the status word
6416	Status word 8 sel	Selection of bit 8 of the status word
6418	Status word 9 sel	Selection of bit 9 of the status word
6420	Status word 10 sel	Selection of bit 10 of the status word
6422	Status word 11 sel	Selection of bit 11 of the status word
6424	Status word 12 sel	Selection of bit 12 of the status word
6426	Status word 13 sel	Selection of bit 13 of the status word
6428	Status word 14 sel	Selection of bit 14 of the status word
6430	Status word 15 sel	Selection of bit 15 of the status word
6432	Status word mon	Status word monitor, in hexadecimal format

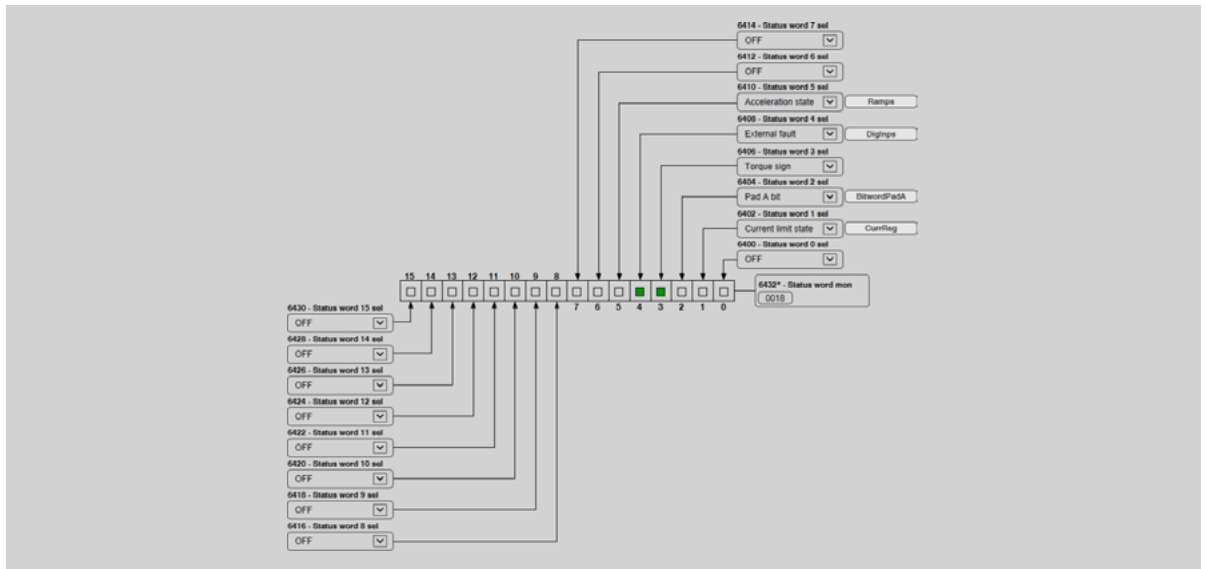


Figure 7-121: Configuration diagram for the Status word bit variable

Each bit (0...15) of the status word can be controlled by the following drive states:

- 0 **OFF**: bit set to 0 (logic low)
- 100 **ON**: bit set to 1 (logic high)
- 1 **Speed 0 thr**: zero speed detection
- 2 **Speed threshold**: speed within programmable thresholds
- 3 **Speed set**: speed reached within a programmable band
- 4 **Current limit state**: drive at current limit
- 5 **Drive ready**: drive in Ready state
- 6 **Motor overload free**: motor overload condition cleared
- 8 **Ramp +**: ramping up
- 9 **Ramp -**: ramping down
- 10 **Speed limited**: speed limitation active
- 11 **Undervoltage**: **Undervoltage** alarm active
- 12 **Overvoltage**: **Overvoltage** alarm active
- 13 **Heatsink**: **Heatsink** alarm active
- 14 **Overcurrent**: **Overcurrent** alarm active
- 15 **Motor overtemp**: **Motor overtemperature** alarm active
- 16 **External fault**: **External fault** alarm active
- 17 **Failure supply**: **Supply failure** alarm active
- 18 **Pad A bit**: state of **Bitword Pad A** bit n-1 on digital output n
- 19 **Pad B bit**: state of **Bitword Pad B** bit n-1 on digital output n
- 20 **Control word bit**: state of **Control word mon** bit n-1 on digital output n
- 21 **Torque sign**: sign of output torque
- 23 **Trip contactor**: shutdown completed after delayed stop
- 24 **Field loss**: **Field loss** alarm active
- 25 **Speed fbk loss**: **Speed feedback** loss alarm active
- 26 **Bus loss**: **Fieldbus loss** alarm active
- 30 **Enc 1 state ok**: **Encoder 1** in valid state
- 31 **Enc 2 state ok**: **Encoder 2** in valid state
- 35 **Enable seq err**: **Enable seq err** alarm active
- 42 **Drive ok**: no alarms active on the drive
- 49 **An inp 1 cmp match**: analog input 1 comparator match reached
- 50 **Enable state mon**: drive enable state active
- 51 **Start state mon**: drive start state active
- 52 **FastStop state mon**: fast stop state active
- 60 **Acceleration state**: acceleration ramp active
- 61 **Deceleration state**: deceleration ramp active
- 62 **Brake cmd mon**: mechanical brake open command
- 63 **Brake fault**: **Brake fault** alarm active
- 65 **Motor I2t alert**: motor overload warning at 80%
- 66 **Drive I2t alert**: drive overload warning at 80%
- 67 **Drive overload free**: drive overload condition cleared
- 68 **Motor I2t overload**: **Motor overload** alarm active
- 69 **Drive I2t overload**: **Drive overload** alarm active
- 70 **Arm curr threshold**: armature current threshold exceeded
- 71 **Overspeed**: **Overspeed** alarm active
- 72 **Delta freq err**: **Delta frequency** error alarm active

- 76 **Drv ready to start:** drive ready to start
77 **Remote control:** Remote control mode active
80 **Firing:** armature circuit in firing (commutation) state
81 **Cont current:** output current in continuous conduction mode
82 **Sustained curr:** Sustained current alarm active

NOTE!

The digital outputs associated with alarm states remain meaningful even if the corresponding alarm is set to be ignored. For example, if IPA 5070-**EF activity** = **Ignore**, it is still possible to monitor the status of the alarm by assigning IPA 6400-**Status word 0 sel** to **External fault**).

7.19.6 Control Word

The **Control word** is a fully programmable word used for communication from the fieldbus to the converter, where each bit corresponds to a command for controlling the drive.

In a typical configuration, the control word must be assigned to one of the sixteen communication channels **Fieldbus MS 1 ipa ... Fieldbus MS 16 ipa** in the **COMMUNICATION\FIELDBUS MS** menu ([see section 7.19.3](#)).

The control word is managed through the following parameters in the **COMMUNICATION\CONTROL WORD** menu.

IPA	DESCRIPTION
6450 Control word dig	Direct parameter on which to set the control word
6452 Control word sel	Control word source selector. In default conditions, it is equal to Control word dig, but other selections are also possible: 0 OFF: all bits of the control word are set to 0 1 Control word dig: the Control word dig parameter is used as the control word 2 Pad 8: IPA 4516- Pad 8 is used as the control word 3 Pad 9: IPA 4518- Pad 9 is used as the control word 4 Pad 10: IPA 4520- Pad 10 is used as the control word 5 Pad 11: IPA 4522- Pad 11 is used as the control word 6 Pad 12: IPA 4524- Pad 12 is used as the control word 7 Pad 13: IPA 4526- Pad 13 is used as the control word 8 Pad 14: IPA 4528- Pad 14 is used as the control word 9 Pad 15: IPA 4530- Pad 15 is used as the control word 10 Bitword Pad A: IPA 4550- Bitword Pad A is used as the control word 11 Bitword Pad B: IPA 4600- Bitword Pad B is used as the control word
6454 Control word 0 dest	Selection of bit 0 function of the control word
6456 Control word 1 dest	Selection of bit 1 function of the control word
6458 Control word 2 dest	Selection of bit 2 function of the control word
6460 Control word 3 dest	Selection of bit 3 function of the control word
6462 Control word 4 dest	Selection of bit 4 function of the control word
6464 Control word 5 dest	Selection of bit 5 function of the control word
6466 Control word 6 dest	Selection of bit 6 function of the control word
6468 Control word 7 dest	Selection of bit 7 function of the control word
6470 Control word 8 dest	Selection of bit 8 function of the control word
6472 Control word 9 dest	Selection of bit 9 function of the control word
6474 Control word 10 dest	Selection of bit 10 function of the control word
6476 Control word 11 dest	Selection of bit 11 function of the control word
6478 Control word 12 dest	Selection of bit 12 function of the control word
6480 Control word 13 dest	Selection of bit 13 function of the control word
6482 Control word 14 dest	Selection of bit 14 function of the control word
6484 Control word 15 dest	Selection of bit 15 function of the control word
6486 Control word mon	Control word status monitor. Based on the value of the Control word sel parameter, the following value is obtained: • If Control word sel = OFF, then Control word mon = 0 • If Control word sel = Control word dig, then Control word mon = Control word dig • If Control word sel = Pad 8, then Control word mon = Pad 8 (same for Pad 9...Pad 15) • If Control word sel = Bitword Pad A, then Control word mon = Bitword Pad A • If Control word sel = Bitword Pad B, then Control word mon = Bitword Pad B

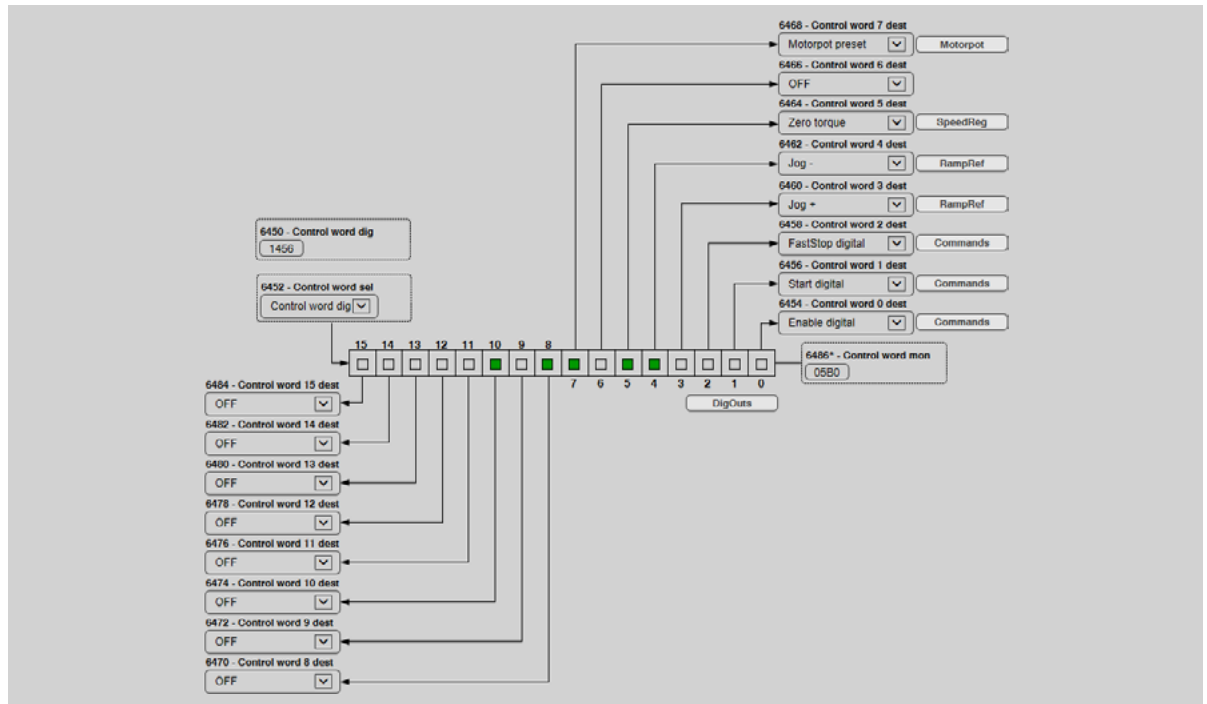


Figure 7-122: Configuration diagram of the Control word bit variable

For each bit (0...15) of the control word, the following functions (destinations) can be selected:

- 0 OFF: destination disabled, the input does not control any function
- 1 **Motorpot preset**: motor potentiometer preset command
- 2 **Motorpot up**: motor potentiometer increase command
- 3 **Motorpot down**: motor potentiometer decrease command
- 4 **Motorpot invert**: motor potentiometer inversion command
- 5 **Jog +**: jog + command
- 6 **Jog -**: jog – command
- 7 **Alarm reset**: alarm reset command (active if the alarm has cleared)
- 8 **C/T lim reduct cmd**: torque limit reduction command
- 10 **Ramp out = 0**: command to zero ramp output
- 11 **Ramp in = 0**: command to zero ramp input
- 12 **Ramp freeze**: ramp freeze command
- 13 **Speed reg lock**: disconnect speed regulator output from current regulator
- 14 **Speed reg lock I**: lock integral part of speed regulator
- 15 **Speed autocapture**: enable speed flying capture
- 16 **An input 1 sign +**: select positive sign for analog input 1
- 17 **An input 1 sign -**: select negative sign for analog input 1
- 18 **An input 2 sign +**: select positive sign for analog input 2
- 19 **An input 2 sign -**: select negative sign for analog input 2
- 20 **An input 3 sign +**: select positive sign for analog input 3
- 21 **An input 3 sign -**: select negative sign for analog input 3
- 22 **Zero torque**: zero torque command
- 23 **Multi speed sel 0**: bit 0 for multi-speed selection (speeds 1 to 7)
- 24 **Multi speed sel 1**: bit 1 for multi-speed selection (speeds 1 to 7)
- 25 **Multi speed sel 2**: bit 2 for multi-speed selection (speeds 1 to 7)
- 26 **Multi ramp sel 0**: bit 0 for multi-ramp selection (ramps 1 to 4)
- 27 **Multi ramp sel 1**: bit 1 for multi-ramp selection (ramps 1 to 4)
- 28 **Field loss ext**: external **Field loss** alarm signal
- 29 **Speed reg enable**: enable PI speed regulator
- 30 **Field reg enable**: enable field current regulator
- 31 **Field weak**: enable field weakening
- 32 **Field weak spd-0**: enable field weakening at zero speed
- 33 **PAD A bit 0**: force state (0/1) of Bitword Pad A bit 0
- 34 **PAD A bit 1**: force state (0/1) of Bitword Pad A bit 1
- 35 **PAD A bit 2**: force state (0/1) of Bitword Pad A bit 2
- 36 **PAD A bit 3**: force state (0/1) of Bitword Pad A bit 3
- 37 **PAD A bit 4**: force state (0/1) of Bitword Pad A bit 4
- 38 **PAD A bit 5**: force state (0/1) of Bitword Pad A bit 5
- 39 **PAD A bit 6**: force state (0/1) of Bitword Pad A bit 6
- 40 **PAD A bit 7**: force state (0/1) of Bitword Pad A bit 7
- 41 **PAD A bit 8**: force state (0/1) of Bitword Pad A bit 8
- 42 **PAD A bit 9**: force state (0/1) of Bitword Pad A bit 9

- 43 **PAD A bit 10**: force state (0/1) of Bitword Pad A bit 10
 44 **PAD A bit 11**: force state (0/1) of Bitword Pad A bit 11
 45 **PAD A bit 12**: force state (0/1) of Bitword Pad A bit 12
 46 **PAD A bit 13**: force state (0/1) of Bitword Pad A bit 13
 47 **PAD A bit 14**: force state (0/1) of Bitword Pad A bit 14
 48 **PAD A bit 15**: force state (0/1) of Bitword Pad A bit 15
 68 **Forward**: forward direction command
 69 **Reverse**: reverse direction command
 70 **An input 1 enable**: enable analog input 1
 71 **An input 2 enable**: enable analog input 2
 72 **An input 3 enable**: enable analog input 3
 73 **Droop enable**: enable droop function
 74 **Enable digital**: enable command in **Digital** mode (only valid if IPA 502-**Control mode** = Remote)
 75 **Start digital**: start command in **Digital** mode (only valid if IPA 502-**Control mode** = Remote)
 76 **FastStop digital**: fast stop command in **Digital** mode (only valid if IPA 502-**Control mode** = Remote)
 84 **Brake fbk**: mechanical brake feedback
 86 **Adapt sel 1**: bit 0 for adaptive speed set selection
 87 **Adapt sel 2**: bit 1 for adaptive speed set selection
 88 **Wired FC enable**: enable field control via FC unit with standard I/Os
 89 **Wired FC inv seq**: field control active during inversion sequence
 90 **Wired FC active brg**: current active bridge (positive or negative) of the FC unit
 95 **Speed drop enable**: **Speed drop** function enable command

NOTE!

It is not possible to control the same function simultaneously via digital inputs and the control word.
 For example, if **Digital input 1 dest** = **Zero torque** and **Control word 0 dest** = **Zero torque**, then **Digital input 1 dest** will automatically be set to **OFF** (and vice versa).

NOTE!

For some of the selectable functions in the control word bit destination list, there is also a corresponding ON/OFF user parameter. In such cases, the following general rule applies:

- IPA 2018-**Ramp in** = **0** is the command to zero the ramp input, located in the **RAMPS** menu ([see section 7.11](#))
- IPA 2020-**Ramp in** = **0 mon** is the actual status of the command, also in the **RAMPS** menu
- IPA 6454-**Control word 0 dest** is set to **Ramp in** = **0**
- In this case, the parameter **Ramp in** = **0** becomes ineffective, and the actual status of the function - monitored by **Ramp in** = **0 mon**, is controlled by bit 0 of the control word.

The control word therefore has higher priority than the corresponding user parameters of assignable commands (the same rule also applies to digital inputs).

7.19.7 RS485

The **R-TPD500** control board is also equipped with an interface for connecting the converter to a communication network based on the standard **Modbus-RTU protocol** operating over an **RS485 serial line**. This enables point-to-point communication between the converter and a PC using the **WEG_DriveLabs** configuration tool, which operates as the Modbus-RTU master.

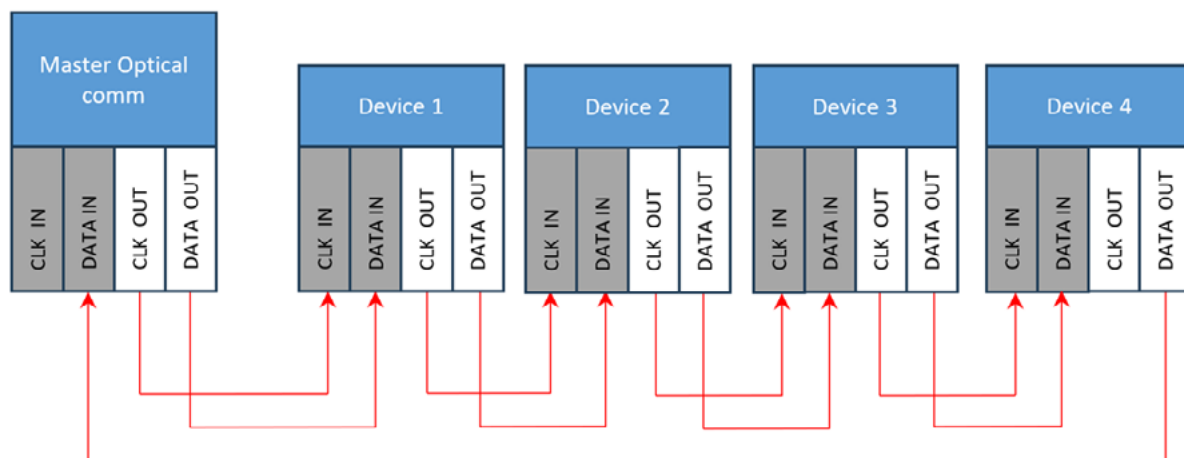
The **RS485 serial communication** based on the Modbus-RTU protocol, with the converter operating as a slave, can be configured using the following parameters in the **COMMUNICATION\RS485** menu:

IPA	DESCRIPTION
5900 Serial address	Allows you to set the address to which the converter responds when connected via RS485 serial line with Modbus-RTU protocol
5902 Serial baudrate	Allows you to set the serial communication speed. Five selections are available, expressed in bits per second: 0 9600 bps 1 19200 bps 2 38400 bps 3 57600 bps 4 115200 bps
5904 Serial frame	Allows you to set the frame format for serial communication. There are six options available: 0 8-N-1 : 8 data bits, no parity bit, 1 stop bit 1 8-E-1 : 8 data bits, even parity, 1 stop bit 2 8-O-1 : 8 data bits, odd parity, 1 stop bit 3 8-N-2 : 8 data bits, no parity bit, 2 stop bits 4 8-E-2 : 8 data bits, even parity, 2 stop bits 5 8-O-2 : 8 data bits, odd parity, 2 stop bits

7.19.8 Optical Fiber

Once the optional optical fiber communication interface is installed, it is possible to interconnect from 2 to up to 5 drives together with the following topology.

Table 7-9: Optical fiber communication



The **COMMUNICATION\OPTICAL FIBER** menu allows to configure the network assigning the behaviour (role) of the drive in the network.

IPA	DESCRIPTION
5300 Optic mode	Selection of the behaviour of the drive in the network. 0 OFF: the fiber optic card is turned off and no communication is available. If the drive is inside a network, the whole network will stop working. 1 Master: the device is the master of the network, only one master device can exist in a network. The master shall be a TPD500 or a TPD500-CU; a TPD500-FC cannot be the master. 2 Bypass: this mode allows to keep a not used device wired to the network without interrupting the communication; the device is thus transparent to the network. 3 Device 1: the device takes the role of slave device 1, this means that the first packet of the data frame is dedicated to it. Only one Device 1 can exist in a network. 4 Device 2: the device takes the role of slave device 2, this means that the second packet of the data frame is dedicated to it. Only one Device 2 can exist in a network. 5 Device 3: the device takes the role of slave device 3, this means that the third packet of the data frame is dedicated to it. Only one Device 3 can exist in a network. 6 Device 4: the device takes the role of slave device 4, this means that the fourth packet of the data frame is dedicated to it. Only one Device 4 can exist in a network.
5302 Optic device 1	Selection of the behaviour of the drive set as Device 1 in the network. This parameter is valid only if the drive is set as Master with parameter IPA 5300-Optic mode 0 None: No Device 1 assigned in the network 1 FC: The Device 1 drive is a TPD500-FC
5304 Optic device 2	Selection of the behaviour of the drive set as Device 2 in the network. This parameter is valid only if the drive is set as Master with parameter IPA 5300-Optic mode 0 None: No Device 2 assigned in the network 1 FC: The Device 2 drive is a TPD500-FC
5306 Optic device 3	Selection of the behaviour of the drive set as Device 3 in the network. This parameter is valid only if the drive is set as Master with parameter IPA 5300-Optic mode 0 None: No Device 3 assigned in the network 1 FC: The Device 3 drive is a TPD500-FC
5308 Optic device 4	Selection of the behaviour of the drive set as Device 4 in the network. This parameter is valid only if the drive is set as Master with parameter IPA 5300-Optic mode 0 None: No Device 4 assigned in the network 1 FC: The Device 4 drive is a TPD500-FC

7.20 Alarm configuration

The drive includes a diagnostic system designed to manage various alarm signals in a flexible way. The **ALARM CONFIG** menu provides the parameters for alarm management. Each alarm is handled through a dedicated submenu that allows individual configuration. These submenus are described in detail below.

The status of each alarm can also be assigned to a programmable digital output ([see section 7.17.2](#)).

All alarm menus share a similar structure based on the following generic settings (which may not always be available, depending on the type of alarm):

- **Alarm activity:** defines the type of drive response when the alarm is triggered. Up to six types of activity may be available, although in some cases the user cannot select the alarm reaction type:

0 Ignore: no alarm message is displayed on the keypad and the drive takes no action.

However, any digital output assigned to the alarm is still activated and requires a RESET after the alarm clears to be deactivated.

1 Warning: an alarm message is displayed on the keypad ([see section 6.1.2.10](#)), but the drive takes no action.

2 Disable: an alarm message is displayed on the keypad, and the drive is immediately disabled, causing the motor to coast to stop.

3 Fast stop: an alarm message is displayed on the keypad, and the drive is stopped using the **Fast stop ramp** ([see section 7.2.4](#)). Once zero speed is reached, the drive is disabled.

4 Stop: an alarm message is displayed on the keypad, and the drive is stopped using the currently active deceleration ramp. Once zero speed is reached, the drive is disabled.

5 C/T lim stop: an alarm message is displayed on the keypad, and the drive is stopped by disabling ramp control and braking at the torque limits. Once zero speed is reached, the drive is disabled.

Some alarms cannot be ignored and will necessarily disable the drive. In other cases, a controlled stop cannot be performed. However, signaling via digital output is always possible (if configured).

The following table lists the possible actions for each type of alarm indication.

Table 7-10: Configurable drive responses to alarm events

ALARM	IGNORE	WARNING	DISABLE	FAST STOP	STOP	C/T LIM STOP
FAILURE SUPPLY			X			
UNDERVOLTAGE			X			
OVERVOLTAGE	X	X	X			
OVERSPEED	X	X	X	X	X	X
HEATSINK			X	X	X	X
MOTOR OVERTEMP	X	X	X	X	X	X
EXTERNAL FAULT	X	X	X	X	X	X
BRAKE FAULT	X	X	X	X	X	X
MOTOR I2T	X	X	X	X	X	X
DRIVE I2T	X	X	X	X	X	X
OVERCURRENT	X	X	X			
FIELD LOSS			X			
DELTA FREQ ERR	X	X	X			
SPEED FBK LOSS	X	X	X			
BUS LOSS	X	X	X	X	X	X
ENABLE SEQ ERR	X		X			
SUSTAINED CURR	X		X			
OPTIC ERROR	X	X	X	X	X	X

The following additional settings may also be available for alarms:

- **Alarm holdoff:** for certain alarms, it is possible to set a delay time between the occurrence of the alarm condition and its actual signaling. This helps to avoid undesired alarms caused by brief or fast transients. An alarm is effectively triggered and managed only if, after its initial detection, the condition remains active continuously for a duration equal to or greater than the configured holdoff time. If the alarm condition remains active for a shorter time than the holdoff time, the drive ignores it.
- **Alarm restart time:** for certain alarms, automatic restart is possible without user intervention.
- The restart time defines the time window within which the alarm condition must clear in order to allow automatic re-enabling of the converter. This is only valid if the corresponding **Alarm latch** parameter is set to **OFF**.
- **Alarm latch:** when set to **OFF**, it allows automatic restart without user intervention. When set to **ON**, restart is only possible - after the alarm condition has cleared - following a manual user action (pressing the **RST** key on the keypad or issuing the Alarm reset command via a programmed digital input). The latch setting also affects the

behaviour of the digital output associated with the alarm status:

- If set to **OFF**, the output automatically returns to logic low once the alarm clears.
- If set to **ON**, the output returns to logic low only after the alarm clears and the user performs a manual reset (via the keypad or digital input).
- **OK Relay open**: for certain alarms, it is possible to configure the opening of a relay-type digital output (e.g., IPA 3216-Relay 1 sel = Drive ok) when the alarm is triggered, if the corresponding **OK Relay open** parameter is set to **ON**.
- **Alarm threshold**: for certain alarms based on comparison with a physical quantity (such as voltage, current, or speed), it is possible to set a programmable trigger threshold.

7.20.1 Failure supply

The **Failure supply** alarm indicates an anomaly in the power supply voltage, typically caused by a fault in the internal regulation circuit voltages. The alarm is also triggered if, while the converter is enabled, the voltage at terminals **U2 / V2** is lost ([see section 5.2](#)).

The parameters for managing the Failure supply alarm are available in the **ALARM CONFIG\FAILURE SUPPLY** menu.

IPA	DESCRIPTION
5000 FS latch	Defines the restart mode after the alarm has been triggered. If set to OFF , restarting occurs automatically and the digital output Failure supply automatically returns to the low logic level, while if set to ON , restarting also requires user intervention (pressing the RST button on the keypad or executing the Alarm reset command programmed on the digital inputs), which also causes the digital output Failure supply to return to the low logic level.
5002 FS OK relay open	Parameter to enable the command to open a digital relay output in the event of an alarm (e.g. IPA 3216-Relay 1 sel = Drive ok)

The alarm activity is not user-programmable.

7.20.2 Undervoltage

The **Undervoltage** alarm indicates a mains undervoltage condition when the converter is enabled. In this case, the drive is immediately disabled.

The parameters for managing the Undervoltage alarm are available in the **ALARM CONFIG\UNDervoltage** menu.

IPA	DESCRIPTION
5010 UV holdoff	Alarm holdoff time
5012 UV restart time	Alarm restart time. If the alarm returns within the restart time and UV latch = OFF , the drive attempts automatic restart
5014 UV latch	Alarm restart enable parameter. If UV latch = OFF , if the voltage returns within the UV restart time , the converter performs an automatic restart. To avoid speed oscillations when the voltage returns to normal, you can enable the motor speed fly capture function using parameter IPA 838 - Speed auto capture (see section 7.13.1)
5016 UV OK relay open	Parameter to enable the command to open a digital relay output in the event of an alarm (e.g. IPA 3216-Relay 1 sel = Drive ok)
5018 UV threshold	Voltage threshold, expressed in [V], for alarm activation

The alarm activity is not user-programmable.

7.20.3 Overvoltage

The **Overvoltage** alarm indicates an armature overvoltage condition when the converter is enabled. The alarm is triggered when the voltage reaches 120% of the motor's nominal armature voltage.

The parameters for managing the Overvoltage alarm are available in the **ALARM CONFIG\OVERVOLTAGE** menu.

IPA	DESCRIPTION
5020 OV activity	Defines the behaviour of the drive when an alarm occurs. Three selections are possible: 0 Ignore : the alarm is ignored 1 Warning : the alarm is only signalled, without any action 2 Disable : the drive is immediately disabled

5022	OV holdoff	Alarm holdoff time. If the condition persists for less than this time, the alarm is ignored
5024	OV restart time	Alarm restart time. If the alarm returns within the restart time and OV latch = OFF , the drive attempts automatic restart.
5026	OV latch	Alarm restart enable parameter. If OV latch = OFF , if the armature voltage drops within the OV restart time , the converter automatically restarts. To avoid speed oscillations when the voltage returns to normal, it is possible to enable the motor speed fly-by capture function using parameter IPA 838 - Speed auto capture (see paragraph 7.13.1).
5028	OV OK relay open	Parameter to enable the command to open a digital relay output in the event of an alarm (e.g. IPA 3216-Relay 1 sel = Drive ok)

7.20.4 Overspeed

The **Overspeed** alarm indicates a motor overspeed condition when the converter is enabled. The alarm is triggered when the speed exceeds the threshold set in parameter IPA 5040-**OS threshold**.

The parameters for managing the Overspeed alarm are available in the **ALARM CONFIG\OVERSPEED** menu.

IPA	DESCRIPTION
5030 OS activity	Defines the behaviour of the drive when an alarm occurs. All possible selections are allowed: 0 Ignore : the alarm is ignored 1 Warning : the alarm is only signalled, without any action 2 Disable : the drive is immediately disabled 3 Fast stop : the drive executes the Fast stop ramp and then disables itself 4 Stop : the drive executes the normal ramp and then disables itself 5 C/T lim stop : the drive stops at the torque limits and then disables itself
5032 OS holdoff	Alarm holdoff time. If the condition persists for less than this time, the alarm is ignored
5034 OS restart time	Alarm restart time. If the alarm returns within the restart time and OS latch = OFF , the drive attempts automatic restart.
5038 OS OK relay open	Parameter to enable the command to open a digital relay output in the event of an alarm (e.g. IPA 3216-Relay 1 sel = Drive ok)
5040 OS threshold	Threshold, expressed in rpm, for alarm activation. It is initialised at 120% of the IPA 400-Full scale speed

7.20.5 Heatsink

The **Heatsink** alarm indicates an overtemperature condition on the heatsink.

The parameters for managing the Heatsink alarm are available in the **ALARM CONFIG\HEATSINK** menu.

IPA	DESCRIPTION
5050 HS activity	Defines the behaviour of the drive when an alarm occurs. Only selections that involve direct action on the drive are permitted, and the alarm cannot be ignored: 2 Disable : the drive is immediately disabled 3 Fast stop : the drive executes the Fast stop ramp and then disables itself 4 Stop : the drive executes the normal ramp and then disables 5 C/T lim stop : the drive stops at the torque limits and then disables
5052 HS OK relay open	Parameter to enable the command to open a digital relay output in the event of an alarm (e.g. IPA 3216-Relay 1 sel = Drive ok)

7.20.6 Motor overtemp

The **Motor overtemp** alarm indicates a motor overtemperature condition, detected via a thermistor connected to terminals **78–79** on the **R-TPD500** control board (see section 4.4.2).

The parameters for managing the **Motor overtemp** alarm are available in the **ALARM CONFIG\MOTOR OVERTEMP** menu.

IPA	DESCRIPTION
5060 MotOT activity	Defines the behaviour of the drive when an alarm occurs. All possible selections are permitted: 0 Ignore: the alarm is ignored 1 Warning: the alarm is only signalled, without any action 2 Disable: the drive is immediately disabled 3 Fast stop: the drive executes the Fast stop ramp and then disables itself 4 Stop: the drive executes the normal ramp and then disables itself 5 C/T lim stop: the drive stops at the torque limits and then disables itself
5062 MotOT OK relay open	Parameter to enable the command to open a digital relay output in the event of an alarm (e.g. IPA 3216-Relay 1 sel = Drive ok)

7.20.7 External fault

The **External fault alarm** indicates an external fault condition communicated to the drive by the absence of voltage at terminal **15** of the **R-TPD500** control board ([see section 4.4.2](#)).

The parameters for managing the External fault alarm are available in the **ALARM CONFIG\EXTERNAL FAULT** menu.

IPA	DESCRIPTION
5070 EF activity	Defines the behaviour of the drive when an alarm occurs. All possible selections are permitted: 0 Ignore: the alarm is ignored 1 Warning: the alarm is only signalled, without any action 2 Disable: the drive is immediately disabled 3 Fast stop: the drive executes the Fast stop ramp and then disables itself 4 Stop: the drive executes the normal ramp and then disables itself 5 C/T lim stop: the drive stops at the torque limits and then disables itself
5072 EF holdoff	Alarm holdoff time. If the condition persists for less than this time, the alarm is ignored
5074 EF restart time	Alarm restart time. If the alarm returns within the restart time and EF latch = OFF , the drive attempts automatic restart
5076 EF latch	Alarm restart enable parameter. If EF latch = OFF , if the voltage at terminal 15 returns within the EF restart time , the converter automatically restarts
5078 EF OK relay open	Parameter to enable the command to open a digital relay output in the event of an alarm (e.g. IPA 3216-Relay 1 sel = Drive ok)

7.20.8 Brake fault

The **Brake fault** alarm indicates a mismatch condition between the brake open/close command and its corresponding feedback signal ([see section 7.18.10](#)).

The parameters for managing the **Brake fault** alarm are available in the **ALARM CONFIG\BRAKE FAULT** menu.

IPA	DESCRIPTION
5080 BF activity	Defines the behaviour of the drive when an alarm occurs. All possible selections are permitted: 0 Ignore: the alarm is ignored 1 Warning: the alarm is only signalled, without any action 2 Disable: the drive is immediately disabled 3 Fast stop: the drive executes the Fast stop ramp and then disables itself 4 Stop: the drive executes the normal ramp and then disables itself 5 C/T lim stop: the drive stops at the torque limits and then disables itself
5082 BF OK relay open	Parameter to enable the command to open a digital relay output in the event of an alarm (e.g. IPA 3216-Relay 1 sel = Drive ok)

7.20.9 Motor I2t

The **Motor overload** alarm indicates a motor overload condition when parameter IPA 4314-**Motor I²t accum** reaches 100% ([see section 7.18.8](#)).

The parameters for managing the Motor overload alarm are available in the **ALARM CONFIG\MOTOR I2T** menu.

IPA	DESCRIPTION
5090 MotI2t activity	Defines the behaviour of the drive when an alarm occurs. All possible selections are permitted: 0 Ignore: the alarm is ignored 1 Warning: the alarm is only signalled, without any action 2 Disable: the drive is immediately disabled 3 Fast stop: the drive executes the Fast stop ramp and then disables itself 4 Stop: the drive executes the normal ramp and then disables itself 5 C/T lim stop: the drive stops at the torque limits and then disables itself
5092 MotI2t latch	Defines the restart mode after the alarm has been triggered. If set to OFF , restart occurs automatically after the IPA 4314- Motor I²t accum accumulator has been completely discharged (see paragraph 6.18.8) and the Motor I2t overload digital output automatically returns to the low logic level. while if set to ON , restarting also requires user intervention (pressing the RST button on the keypad or executing the Alarm reset command programmed on the digital inputs), which also causes the Motor I2t overload digital output to return to the low logic level.
5094 MotI2t OK relay open	Parameter to enable the command to open a digital relay output in the event of an alarm (e.g. IPA 3216- Relay 1 sel = Drive ok)

7.20.10 Drive I2t

The **Drive overload** alarm indicates a motor overload condition when parameter IPA 4322-**Drive I²t accum** reaches 100% ([see section 7.18.8](#)).

The parameters for managing the Drive overload alarm are available in the **ALARM CONFIG\DRIVE I2T** menu.

IPA	DESCRIPTION
5100 DrvI2t activity	Defines the behaviour of the drive when an alarm occurs. All possible selections are allowed: 0 Ignore: the alarm is ignored 1 Warning: the alarm is only signalled, without any action 2 Disable: the drive is immediately disabled 3 Fast stop: the drive executes the Fast stop ramp and then disables itself 4 Stop: the drive executes the normal ramp and then disables itself 5 C/T lim stop: the drive stops at the torque limits and then disables itself
5104 DrvI2t OK relay open	Parameter to enable the command to open a digital relay output in the event of an alarm (e.g. IPA 3216- Relay 1 sel = Drive ok)

7.20.11 Overcurrent

The **Overcurrent** alarm indicates a motor overcurrent condition when the converter is enabled. The alarm is triggered when the armature current exceeds the threshold set in parameter IPA 5120-**OC threshold**.

The parameters for managing the Overcurrent alarm are available in the **ALARM CONFIG\OVERCURRENT** menu.

IPA	DESCRIPTION
5110 OC activity	Defines the behaviour of the drive when an alarm occurs. All possible selections are permitted: 0 Ignore: the alarm is ignored 1 Warning: the alarm is only signalled, without any action 2 Disable: the drive is immediately disabled
5112 OC holdoff	Alarm holdoff time. If the condition persists for less than this time, the alarm is ignored
5114 OC restart time	Alarm restart time. If the alarm returns within the restart time and OC latch = OFF , the drive attempts automatic restart
5116 OC latch	Alarm restart enable parameter. If OC latch = OFF , if the speed drops within the OC restart time , the converter automatically restarts.

5118	OC OK relay open	Parameter to enable the command to open a digital relay output in the event of an alarm (e.g. IPA 3216- Relay 1 sel = Drive ok)
5120	OC threshold	Alarm threshold, expressed as a percentage of the motor's rated armature current. It is initialised at 180%

7.20.12 Field Loss

The Field loss alarm indicates that the motor field current is too low when the converter is enabled.

The alarm appears in one of the following cases:

- the field is regulated directly by the drive and the field current falls below the threshold set at 50% of the minimum field current, set in parameter IPA 1354-**Field min dig**
- the field is regulated directly by the drive and the field current does not reach the reference within two seconds in a two-quadrant converter with IPA 312-**Drive 2B inversion** set to FC (2B+E) or Field contactors, when field inversion has not been successful
- the **TPD500-FC** external field regulator is unable to supply the required field current

The parameters for managing the Field loss alarm are available in the **ALARM CONFIG\FIELD LOSS** menu.

IPA	DESCRIPTION
5132	FL holdoff
	Alarm holdoff time. If the condition persists for less than this time, the alarm is ignored
5134	FL restart time
	Alarm restart time. If the alarm returns within the restart time and FL latch = OFF , the drive attempts automatic restart
5136	FL latch
	Alarm restart enable parameter. If FL latch = OFF , if the speed drops within the FL restart time , the converter automatically restarts
5138	FL OK relay open
	Parameter to enable the command to open a digital relay output in the event of an alarm (e.g. IPA 3216- Relay 1 sel = Drive ok)

The alarm activity cannot be programmed by the user.

7.20.13 Delta Frequency

The **Delta frequency** alarm indicates that the converter's three-phase supply frequency deviates too much from the nominal value detected at power-up.

The alarm threshold is defined as a programmable percentage of the three-phase supply frequency (50 Hz / 60 Hz), which is automatically calculated at startup and monitored in parameter IPA 202-**Mains frequency** (see section 6.3).

The parameters for managing the **Delta frequency** alarm are available in the **ALARM CONFIG\DELTA FREQUENCY** menu.

IPA	DESCRIPTION
5030	DF activity
	Defines the behaviour of the drive when an alarm occurs. All possible selections are permitted: 0 Ignore: the alarm is ignored 1 Warning: the alarm is only signalled, without any action 2 Disable: the drive is immediately disabled 3 Fast stop: the drive executes the Fast stop ramp and then disables itself 4 Stop: the drive executes the normal ramp and then disables itself 5 C/T lim stop: the drive stops at the torque limits and then disables itself
5032	DC holdoff
	Alarm holdoff time. If the condition persists for less than this time, the alarm is ignored
5034	DF restart time
	Alarm restart time. If the alarm returns within the restart time and DF latch = OFF , the drive attempts automatic restart.
5036	DF latch
	Alarm restart enable parameter. If DF latch = OFF , if the speed drops within the DF restart time , the converter automatically restarts.
5038	DF OK relay open
	Parameter to enable the command to open a digital relay output in the event of an alarm (e.g. IPA 3216- Relay 1 sel = Drive ok)
5040	DF threshold
	Threshold, expressed as a percentage of the mains frequency value calculated at start-up, for alarm activation

7.20.14 Speed Feedback Loss

The **Speed feedback loss** alarm indicates a missing or inconsistent motor speed feedback signal, based on encoder or tachometer feedback (e.g., due to a fault, wiring issue, or incorrect configuration - [see section 7.12.1](#)), when the converter is enabled.

The parameters for managing the Speed feedback loss alarm are available in the **ALARM CONFIG\SPEED FBK LOSS** menu.

IPA	DESCRIPTION
5160 SFL activity	Defines the behaviour of the drive when an alarm occurs. All possible selections are allowed: 0 Ignore: the alarm is ignored 1 Warning: the alarm is only signalled, without any action 2 Disable: the drive is immediately disabled
5162 SFL holdoff	Alarm holdoff time. If the condition persists for less than this time, the alarm is ignored
5164 SFL code	Hexadecimal code indicating the sensor identified as faulty. Combinations of the following values are possible: 0x2: error on Encoder 1 0x4: error on Encoder 2 0x8: error on Tachometer
5168 OC OK relay open	Parameter to enable the command to open a digital relay output in the event of an alarm (e.g. IPA 3216-Relay 1 sel = Drive ok)

By using parameter IPA 656-**Speed fbk bypass** ([see section 7.18.8](#)), it is possible to enable automatic fallback to armature feedback in case of a fault or failure in the encoder or tachometer feedback, without losing motor control or stopping the drive as a result of the Speed fbk loss alarm.

To use the feedback bypass function, the SFL activity parameter must be set to Ignore or Warning, in order to prevent the drive from being disabled when a fault condition is detected.

7.20.15 Bus Loss

The **Bus loss** alarm indicates a communication fault with the fieldbus.

The alarm is triggered when parameter IPA 6004-**Fieldbus state** ([see section 7.19.2](#)) is different from Active while the converter is enabled.

The parameters for managing the **Bus loss** alarm are available in the **ALARM CONFIG\BUS LOSS** menu.

IPA	DESCRIPTION
5170 BLoss activity	Defines the behaviour of the drive when an alarm occurs. All possible selections are allowed: 0 Ignore: the alarm is ignored 1 Warning: the alarm is only signalled, without any action 2 Disable: the drive is immediately disabled 3 Fast stop: the drive executes the Fast stop ramp and then disables itself 4 Stop: the drive executes the normal ramp and then disables itself 5 C/T lim stop: the drive stops at the torque limits and then disables itself
5172 BLoss holdoff	Alarm holdoff time. If the condition persists for less than this time, the alarm is ignored
5174 Bloss restart time	Alarm restart time. If the alarm returns within the restart time and BLoss latch = OFF , the drive attempts automatic restart
5176 BLoss latch	Alarm restart enable parameter. If BLoss latch = OFF , if the speed drops within the BLoss restart time , the converter performs an automatic restart
5178 BLoss OK relay open	Parameter to enable the command to open a digital relay output in the event of an alarm (e.g. IPA 3216-Relay 1 sel = Drive ok)

7.20.16 Enable Sequence Error

The **Enable sequence** error alarm indicates an error in the converter enable sequence.

The alarm is typically triggered when the converter is powered on and the enable terminal ([see section 7.2.1](#)) is already at a logic high level, in order to prevent the converter from starting without an explicit user command.

The parameters for managing the Enable sequence error alarm are available in the **ALARM CONFIG\ENABLE SEQ ERR** menu.

IPA	DESCRIPTION
5200 EnSEQ activity	Defines the behaviour of the drive when an alarm occurs. Only the following selections are permitted: 0 Ignore : the alarm is ignored 2 Disable : the drive is immediately disabled
5206 EnSEQ latch	Defines the restart mode after an alarm has been triggered. If set to <i>OFF</i> , restart is possible by lowering and raising the enable terminal, while if set to <i>ON</i> , user intervention is also required for restart (pressing the RST button on the keypad or executing the Alarm reset command programmed on the digital inputs).
5208 EnSEQ OK relay open	Parameter to enable the command to open a digital relay output in the event of an alarm (e.g. IPA 3216-Relay 1 sel = Drive ok)

The correct enable sequence to avoid triggering the **Enable seq err** alarm is described in the following steps, depending on the selected command mode ([see section 7.2](#)):

- If IPA 500-**Main commands = Terminals**
 1. Power up the control board.
 2. System hardware/software initialization: this takes a few seconds during which the keypad displays the message "Wait for loading...". At this stage, the enable terminal (12) can be in any logic state.
 3. At the end of the initialization, the enable terminal (12) must be at logic low and remain in this state for at least 1 second; otherwise, the Enable seq err alarm will be triggered.
 4. After 1 second, the enable terminal (12) can be set to logic high, enabling the drive.
- If IPA 500-**Main commands = Digital**
 1. Power up the control board.
 2. System hardware/software initialization: this takes a few seconds during which the keypad displays the message "Wait for loading...". At this stage, the enable terminal (12) can be in any logic state.
 3. At the end of the initialization, parameter IPA 520-**Enable digital** cmd must be *OFF* and remain in this state for at least 1 second. Otherwise, if the enable terminal (12) is at logic high and **Enable digital cmd = ON**, the **Enable seq err** alarm will be triggered.
 4. After 1 second, Enable digital cmd can be set to *ON* (accepted only if the enable terminal is also at logic high), thus enabling the drive.

After the **Enable seq err** alarm is triggered, a new start attempt can be made by resetting the alarm using the following steps:

- If IPA 5206-**EnSEQ latch = ON**
 1. Set the enable terminal (12) to logic low.
 2. Reset the alarm by either pressing the RST key on the keypad or executing the **Alarm reset** command assigned to a digital input.
 3. Perform a new enable sequence.
- If IPA 5206-**EnSEQ latch = OFF**
 1. Set the enable terminal (12) to logic low: in this case, the alarm is automatically reset without user intervention.
 2. Perform a new enable sequence.

7.20.17 Sustained current

The **Sustained current** alarm indicates that the converter was unable to bring the armature current to zero within a configurable time limit, following a bridge change command or a disable command.

The parameters for managing the Sustained current alarm are available in the **ALARM CONFIG\SUSTAINED CURR** menu.

IPA	DESCRIPTION
5220 SC activity	Defines the behaviour of the drive in the event of an alarm. Only the following selections are permitted: 0 Ignore : the alarm is ignored 2 Disable : the drive is immediately disabled
5226 SC holdoff	Alarm holdoff time. If the armature current condition remains non-zero for less than this time, the alarm is ignored
5228 SC OK relay open	Parameter to enable the open command of a digital relay output in the event of an alarm (e.g. IPA 3216-Relay 1 sel = Drive ok)

7.20.18 SCR TEST

The drive provides two test functions to check the integrity of the power bridge.

The **SCR short** test detects any short-circuited SCRs before enabling the thyristor bridge, thus avoiding any current peaks; when the **SCR short** function is enabled, the test is performed each time the drive is enabled, introducing a delay of approximately 2 seconds before the actual regulation starts. During this phase, the **EN** LED on the keypad flashes very rapidly.

The detection of an anomaly by the SCR short test causes the **SCR short** alarm to be activated (if enabled) and the pair of thyristors in short circuit is indicated in red in the **DIAGRAMS MENU/FUNCTIONS/SCR TEST** diagram of the **WEG_DriveLabs** configurator, in accordance with the value of parameter IPA 5236-**SCR short code**.

The **SCR open** test identifies the presence of an open thyristor or the failure of its gate signal connection during normal drive operation.

The detection of an anomaly by the SCR open test causes the **SCR open** alarm to be activated (if enabled) and the open thyristor is indicated in white in the **DIAGRAMS MENU/FUNCTIONS/SCR TEST** diagram of the **WEG_DriveLabs** configurator, in accordance with the value of the IPA 5234-**SCR open code** parameter.

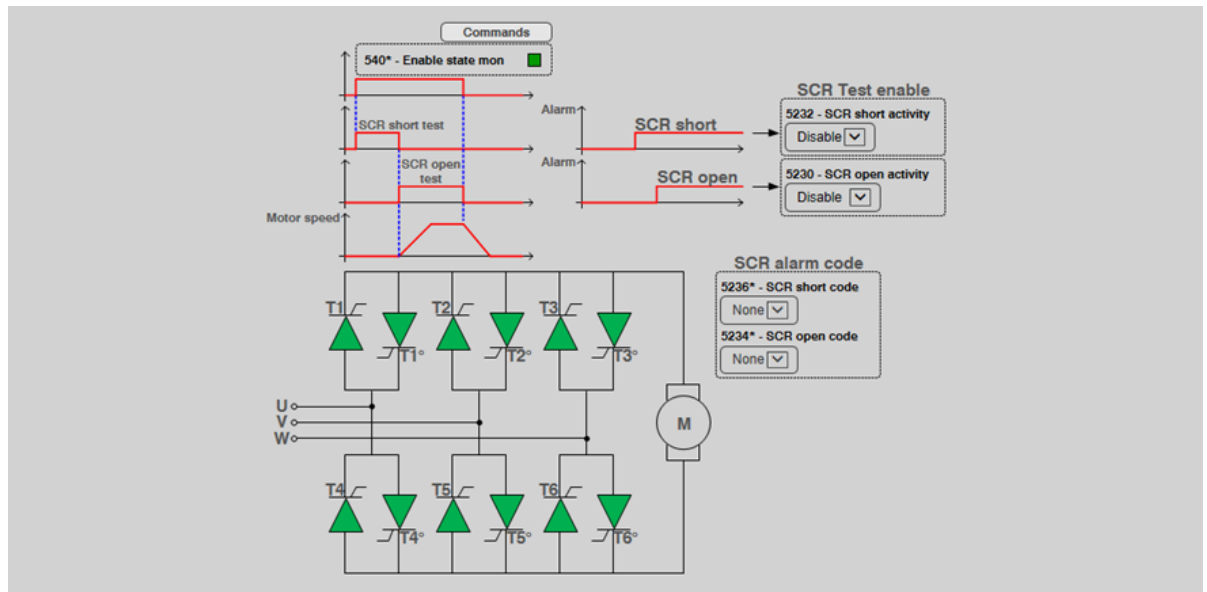


Figure 7-123: Operation in the case of a 4B converter

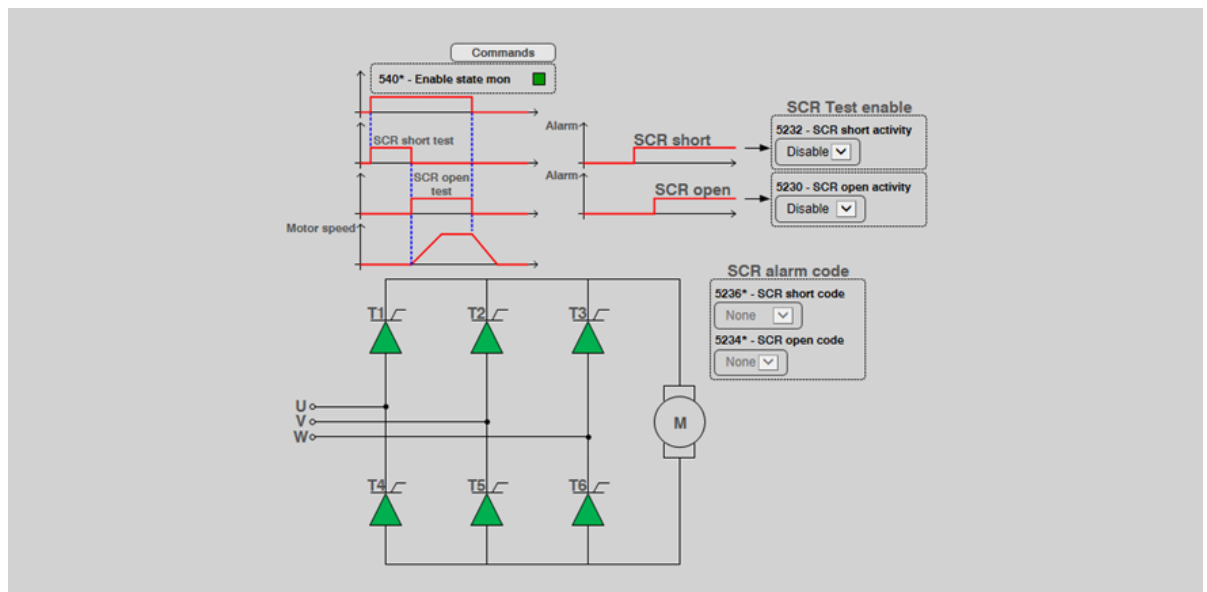


Figure 7-124: Operation in the case of a 2B converter

The operation of the tests is defined by the following parameters in the **ALARM CONFIG\SCR TEST** menu:

IPA	DESCRIPTION
5230 SCR open activity	Enables the SCR open test and defines the behaviour of the drive when the corresponding alarm is triggered. The following selections are available: 0 Ignore: the test is not performed and the alarm is ignored 1 Warning: the test is performed and the alarm is only signalled, without any action 2 Disable: the test is performed and the drive is immediately disabled
5232 SCR short activity	Enables the SCR short test and defines the behaviour of the drive when the corresponding alarm is triggered. Only the following selections are permitted: 0 Ignore: the test is not performed and the alarm is ignored 2 Disable: the test is performed and the drive is immediately enabled
5234 SCR open code	Alphanumeric code indicating which SCR has been detected as open. The following values are possible (see figure 7-125 for 4B converters or figure 7-126 for 2B converters, both referring to the case where SCR open code = T2): 0 None: no SCR detected as open 1 T1: SCR T1 detected as open 2 T2: SCR T2 detected as open 3 T3: SCR T3 detected as open 4 T4: SCR T4 detected as open 5 T5: SCR T5 detected as open 6 T6: SCR T6 detected as open 11 T1°: SCR T1° detected open (only in case 4B) 12 T2°: SCR T2° detected open (only in case 4B) 13 T3°: SCR T3° detected open (only in case 4B) 14 T4°: SCR T4° detected open (only in case 4B) 15 T5°: SCR T5° detected open (only in case 4B) 16 T6°: SCR T6° detected open (only in case 4B)

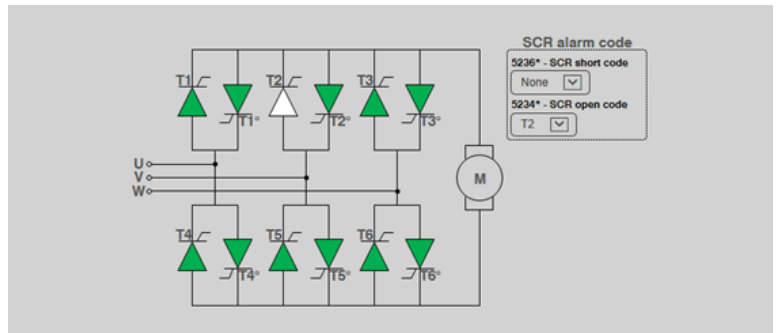


Figure 7-125: Operation in the case of a 4B converter

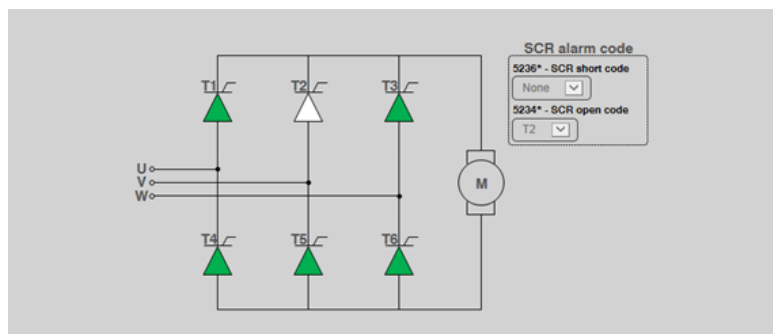


Figure 7-126: Operation in the case of a 2B converter

5236 SCR short code

Alphanumeric code indicating which SCR has been detected in short circuit.

The following values are possible (see figure 7-127 for 4B converters or figure 7-128 for 2B converters, both referring to the case where **SCR short code** = T6):

- 0 None:** no SCR detected in short circuit
- 1 T1:** SCR T1 detected short-circuited (only in case 2B)
- 2 T2:** SCR T2 detected short-circuited (only in case 2B)
- 3 T3:** SCR T3 detected short-circuited (only in case 2B)
- 4 T4:** SCR T4 detected short-circuited (only in case 2B)
- 5 T5:** SCR T5 detected short-circuited (only in case 2B)
- 6 T6:** SCR T6 detected short-circuited (only in case 2B)
- 11 T1/T1°:** SCR T1 or SCR T1° detected in short circuit (only in case 4B)
- 12 T2/T2°:** SCR T2 or SCR T2° detected in short circuit (only in case 4B)
- 13 T3/T3°:** SCR T3 or SCR T3° detected in short circuit (only in case 4B)
- 14 T4/T4°:** SCR T4 or SCR T4° detected in short circuit (only in case 4B)
- 15 T5/T5°:** SCR T5 or SCR T5° detected in short circuit (only in case 4B)
- 16 T6/T6°:** SCR T6 or SCR T6° detected in short circuit (only in case 4B)

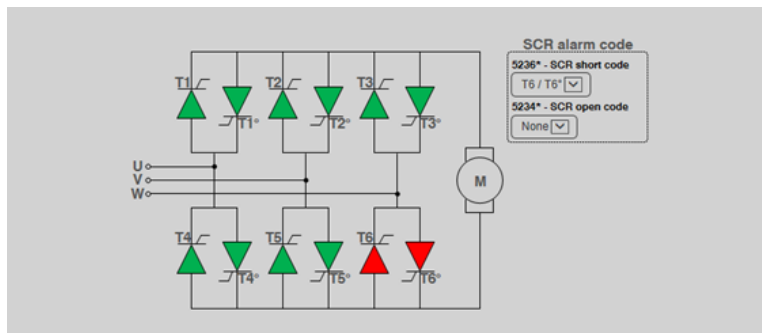


Figure 7-127: Operation in the case of a 4B converter

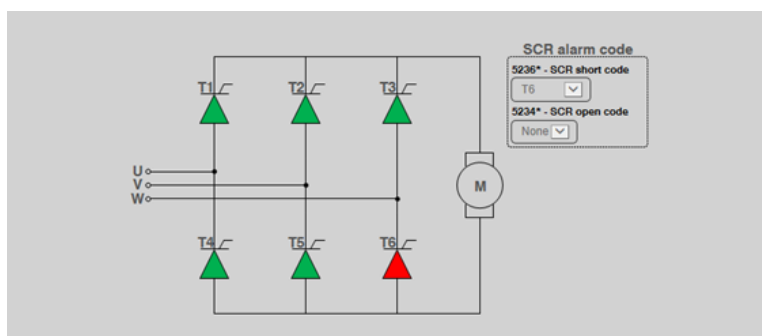


Figure 7-128: Operation in the case of a 2B converter

5238 SCR open threshold

Allows you to configure the sensitivity of the open SCR detection algorithm, so that a higher percentage value corresponds to an increase in the sensitivity of the algorithm.

This percentage represents the maximum accepted ratio between the value measured in an SCR branch and the average system current.

NOTE!

The SCR short test, if enabled, is performed each time the converter is enabled, therefore in all the following cases:

- Normal enable starting from a stopped or already rotating motor.
- First enable when the drive is switched on, if the control terminals are already at a high logic level and the **Enable seq err** alarm is disabled.
- Enable with fly-by function enabled via parameter IPA 838-**Speed auto capture**.
- Automatic restart after an alarm has been reset.
- Enabling following the start of the current regulator's **autotuning** procedure.

7.20.19 OPTIC ERROR

The optic error alarm indicates a communication fault on the optical fiber connection.
The parameters for managing the Optic error alarm are available in the **ALARM CONFIG/OPTIC ERROR** menu.

IPA	DESCRIPTION
5190 Optic error activity	Defines the behaviour of the drive when an alarm occurs. All possible selections are allowed: 0 Ignore : the alarm is ignored 1 Warning : the alarm is only signalled, without any action 2 Disable : the drive is immediately disabled 3 Fast stop : the drive executes the Fast stop ramp and then disables itself 4 Stop : the drive executes the normal ramp and then disables itself 5 C/T lim stop : the drive stops at the torque limits and then disables itself

7.21 Alarm logging

The alarms that occur on the drive are stored in the internal non-volatile memory.

Up to 30 alarms can be stored in a FIFO (First-In, First-Out) buffer.

The alarm history can be viewed from the keypad by accessing the **ALARM LOG** menu, or in **WEG_DriveLabs** by clicking the triangular **Alarm Log** icon.

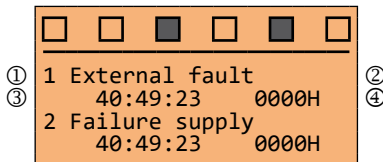
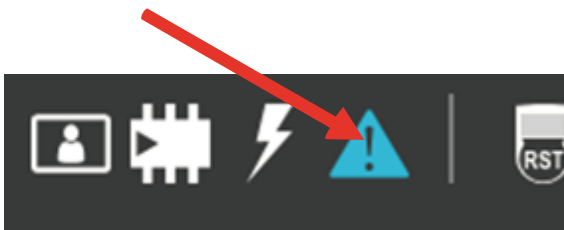
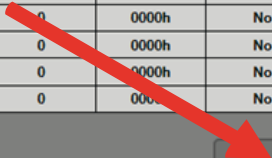


Figure 7-129: Alarm Log - Keypad

Keypad	WEG_DriveLabs	
①	N°	Position in the alarm list, starting from the most recently stored alarm
-	Code	Alarm identification code
④	SubCode	Provides additional information about the alarm, when available (see Chapter 7 – FUNCTION PARAMETERS for further details)
②	Description	Alarm description
③	Time	Drive operating time at which the alarm occurred, expressed in hours:minutes:seconds (hh:mm:ss)
-	Speed [rpm]	Motor speed sampled at the instant the alarm occurred
-	Vout [rpm]	Armature voltage sampled at the instant the alarm occurred
-	Iout [%]	Armature current sampled at the instant the alarm occurred
-	Vmains [V]	AC supply voltage sampled at the instant the alarm occurred



ALARMS									
TPD500_1			Active Alarms						
N°	Code	SubCode	Description	Active	Time	Speed[rpm]	Vout[V]	Iout[%]	Vmains[V]
1	6	0000h	External fault	yes	40:49:23	0.0	0	0.0	0
2	1	0000h	Failure supply	yes	40:49:23	0.0	-1	0.0	0
3	48	0000h	Load def plc	no	40:49:17	0.0	0	0.0	0
4	0	0000h	No alarm	no	0:00:00	0.0	0	0.0	0
5	0	0000h	No alarm	no	0:00:00	0.0	0	0.0	0
6	0	0000h	No alarm	no	0:00:00	0.0	0	0.0	0
7	0	0000h	No alarm	no	0:00:00	0.0	0	0.0	0
8	0	0000h	No alarm	no	0:00:00	0.0	0	0.0	0
9	0	0000h	No alarm	no	0:00:00	0.0	0	0.0	0
10	0	0000h	No alarm	no	0:00:00	0.0	0	0.0	0



ALARMS									
TPD500_1			Alarms Log						
N°	Code	SubCode	Description	Time	Speed[rpm]	Vout[V]	Iout[%]	Vmains[V]	
1	6	0000h	External fault	40:49:23	0.0	0	0.0	0	
2	1	0000h	Failure supply	40:49:23	0.0	-1	0.0	0	
3	48	0000h	Load def plc	40:49:17	0.0	0	0.0	0	
4	6	0000h	External fault	40:49:23	0.0	0	0.0	0	
5	1	0000h	Failure supply	40:49:23	0.0	0	0.0	0	
6	48	0000h	Load def plc	40:49:17	0.0	0	0.0	0	
7	6	0000h	External fault	40:47:37	0.0	0	0.0	0	
8	1	0000h	Failure supply	40:47:37	0.0	0	0.0	0	

Figure 7-130: Alarm Log - WEG_DriveLabs

7.22 Recipe configuration

The **RECIPE CONFIG** menu provides configuration parameters for creating a fully customizable menu - accessible from both the keypad and **WEG_DriveLabs** - containing up to 24 parameters.

This feature allows grouping existing parameters of specific interest, even if located in different menus, to speed up access and navigation.

The menu created on the keypad is called **RECIPE**. By default, it is empty and can be accessed under the **RECIPE CONFIG** menu.

IPA	DESCRIPTION	
5500	Recipe config 1	IPA of the parameter to be entered in position 1 of the RECIPE menu
5502	Recipe config 2	IPA of the parameter to be entered in position 2 of the RECIPE menu
5504	Recipe config 3	IPA of the parameter to be entered in position 3 of the RECIPE menu
5506	Recipe config 4	IPA of the parameter to be entered in position 4 of the RECIPE menu
5508	Recipe config 5	IPA of the parameter to be entered in position 5 of the RECIPE menu
5510	Recipe config 6	IPA of the parameter to be entered in position 6 of the RECIPE menu
5512	Recipe config 7	IPA of the parameter to be entered in position 7 of the RECIPE menu
5514	Recipe config 8	IPA of the parameter to be entered in position 8 of the RECIPE menu
5516	Recipe config 9	IPA of the parameter to be entered in position 9 of the RECIPE menu
5518	Recipe config 10	IPA of the parameter to be entered in position 10 of the RECIPE menu
5520	Recipe config 11	IPA of the parameter to be entered in position 11 of the RECIPE menu
5522	Recipe config 12	IPA of the parameter to be entered in position 12 of the RECIPE menu
5524	Recipe config 13	IPA of the parameter to be entered in position 13 of the RECIPE menu
5526	Recipe config 14	IPA of the parameter to be entered in position 14 of the RECIPE menu
5528	Recipe config 15	IPA of the parameter to be entered in position 15 of the RECIPE menu

5530	Recipe config 16	IPA of the parameter to be entered in position 16 of the RECIPE menu
5532	Recipe config 17	IPA of the parameter to be entered in position 17 of the RECIPE menu
5534	Recipe config 18	IPA of the parameter to be entered in position 18 of the RECIPE menu
5536	Recipe config 19	IPA of the parameter to be entered in position 19 of the RECIPE menu
5538	Recipe config 20	IPA of the parameter to be entered in position 20 of the RECIPE menu
5540	Recipe config 21	IPA of the parameter to be entered in position 21 of the RECIPE menu
5542	Recipe config 22	IPA of the parameter to be entered in position 22 of the RECIPE menu
5544	Recipe config 23	IPA of the parameter to be entered in position 23 of the RECIPE menu
5546	Recipe config 24	IPA of the parameter to be entered in position 24 of the RECIPE menu
5548	Take recipe config	RECIPE menu creation command

In each configuration parameter, it is possible to set the IPA of any parameter in the drive, regardless of the original menu it belongs to. Any non-existent or hidden IPA will be rejected.

It is also possible to include parameters created through **WEG_DriveLogic** applications.

Once the configuration is complete, the custom menu must be generated by executing parameter IPA 5548-**Take recipe config**.

Duplicate parameters cannot be included in the **RECIPE** menu. If a duplicated parameter is configured, it will still be accepted, but the previously inserted instance will be removed from the menu.

To remove a parameter from the **RECIPE** menu, set the corresponding parameter in **RECIPE CONFIG** to 0, and then re-execute IPA 5548-**Take recipe config**.

To save the newly created custom menu permanently, execute IPA 460-**Save parameters** (from the **DRIVE CONFIG** menu). This allows access to the menu even after powering off and restarting the drive.

To completely clear the **RECIPE** menu, execute IPA 470-**Load default** (from the **DRIVE CONFIG** menu); all configuration parameters will be reset to 0.

A fully configurable custom menu can also be created in the **WEG_DriveLabs** configurator. In this case, two Toolbar commands are available to interact with the **RECIPE CONFIG** menu on the keypad.

- Download **recipe** command:

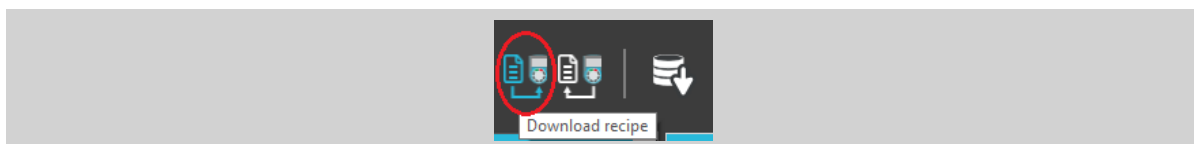


Figure 7-131: Icon for downloading the custom menu parameter list to the keypad

Allows downloading to the keypad a menu that has just been created in the configurator. Proceed with the following steps:

1. In the **RECIPES** node of the configurator's tree menu, launch the Add recipe command to create a new custom menu, or select an existing **RECIPE** node.

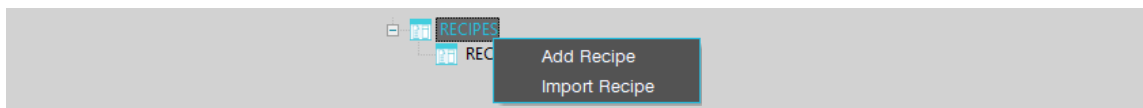


Figure 7-132: Creating a new custom menu

2. Assign a name to the newly created (and initially empty) menu node.

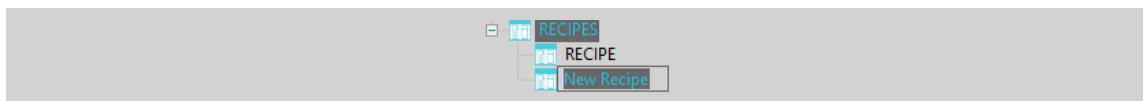


Figure 7-133: Custom menu name definition

3. Manually drag the desired parameters from the configurator menus into the newly created node.
4. Select the node and launch the Download recipe command.

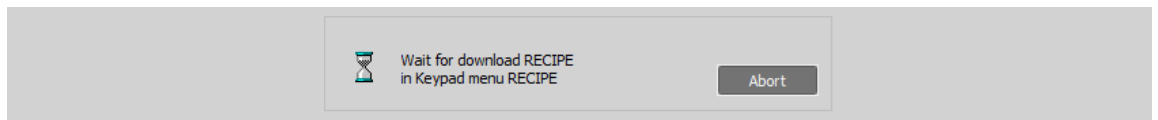


Figure 7-134: Waiting message while downloading custom parameters to the keypad

At the end of the download, the **Take recipe config** command is executed automatically, and the **RECIPE** menu on the keypad will contain the same parameters as the node.

Alternatively, the existing **RECIPES\RECIPE** node can be used, following the same steps.

Execute IPA 460-**Save parameters** if you want to save the menu permanently.

- **Upload recipe** command:

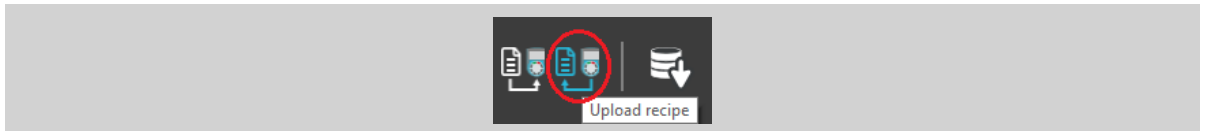


Figure 7-135: Icon for uploading the custom menu created on the keypad to the PC

Allows uploading a menu that was just created on the keypad to the configurator.

Proceed with the following steps:

1. In the **RECIPES** node of the configurator's tree menu, launch the **Add recipe** command to create a new custom menu, or select an existing **RECIPE** node.
2. Assign a name to the newly created menu node.
3. Select the node and launch the **Upload recipe** command.

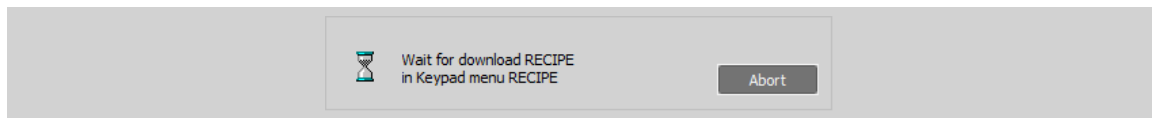


Figure 7-136: Message indicating the loading of custom parameters from the keypad

At the end of the upload, the created node will contain the same parameters as the **RECIPE** menu on the keypad. Alternatively, you can use the existing **RECIPES\RECIPE** node and repeat the same steps.

NOTE!

Downloading a custom menu only creates the same menu on the keypad; it does not modify the current values of the parameters in the menu being downloaded!

NOTE!

In **WEG_DriveLabs**, multiple recipes can be created and are viewable through the **RECIPES** node, while on the keypad, only one recipe is available, accessible through the **RECIPE** menu. This menu can be created directly on the keypad or downloaded from **WEG_DriveLabs**, as previously explained.

8. MAINTENANCE

8.1 Handling and care



Before performing any cleaning or maintenance operation, whether ordinary or extraordinary, always disconnect the device from the power supply.

TPD500 series drives must be installed exclusively in accordance with the mounting and installation instructions provided in this manual.

After commissioning, the device does not require any special care - only a few simple guidelines regarding cleaning and connection checks must be followed:

- For cleaning the device, use only dry cloths; the use of wet or damp cloths is strictly prohibited.
- To remove dust and foreign objects, a vacuum cleaner or compressed air (maximum 1 bar) may also be used.
- Two weeks after initial startup, check that all terminals and connection points are tightened according to the specified torque values. This operation should be repeated annually.

8.2 Repairs

It is strongly recommended that any repairs to the device be carried out exclusively by qualified personnel authorized by **WEG Automation Europe**. Please contact: technohelp@weg.net

If spare parts need to be ordered, keep the following points in mind. When ordering spare parts, do not simply indicate the device type. Also specify:

- The serial number, as shown on the nameplate;
- The type of control board and the system software version (these can be found on the EEPROM of the R-TPD500 control board).

When replacing boards, ensure that the configuration of switches and jumpers on the replacement board exactly matches that of the original components.

In particular, pay close attention to dip-switch S15 on the control board, as it defines the rated current of the device.

NOTE!

An incorrect configuration or improper adjustment of this dip-switch may cause damage to the equipment. Any faults or damage resulting from such actions shall not be the responsibility of the manufacturer.

8.3 Control board firmware update

The control board firmware update can be performed in one of the following two ways.

NOTE!

This procedure must be carried out when the drive is not running the motor or connected to a load.

NOTE!

After a firmware update, all parameters will be reset to their factory default values. Therefore, all parameters must be reconfigured for proper operation. It is recommended to save the parameters to a PC (using WEG_DriveLabs) or to a USB drive before starting the procedure.

Using the WEG_DriveLabs configuration software

- Connect to the TPD500 using **WEG_DriveLabs**
- Select the *Download Firmware* icon



- On the page that opens, two drop-down menus are available:
 - List of applications** compatible with the firmware detected on the connected drive, e.g., **PID_1.0.0** or **TW_1.0.0**. In this case, only the application is downloaded and updated, while the firmware remains unchanged.
 - Latest firmware** available for a full drive update, e.g., **TPD500_1.0.3**. In this case, the entire firmware on the control board is updated (any existing applications will need to be downloaded again afterward).

- Select the firmware to download directly, for example **TPD500_1.0.3**, without performing a manual search (*Browse* button).

The **FW File** and **FW Name** fields are automatically filled with the path and name of the selected file. You just need to click the **Download** button and wait for the process to complete, which consists of the following two steps.

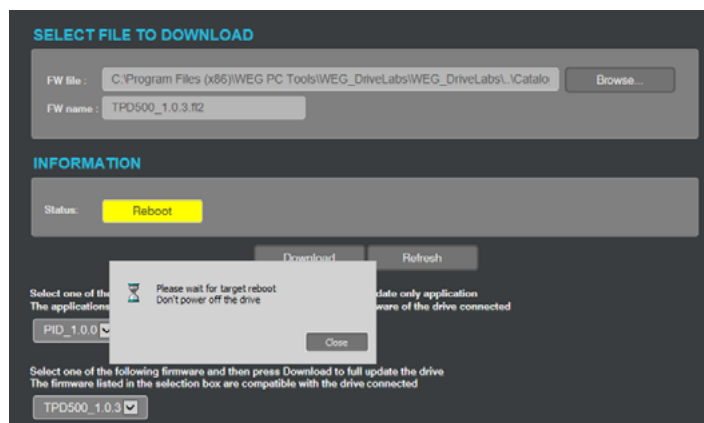
- In the first step, the file is transferred to the drive. The status changes from *Ready* to *Upgrade*.

During this step, you can press the **Cancel** button to abort the procedure.

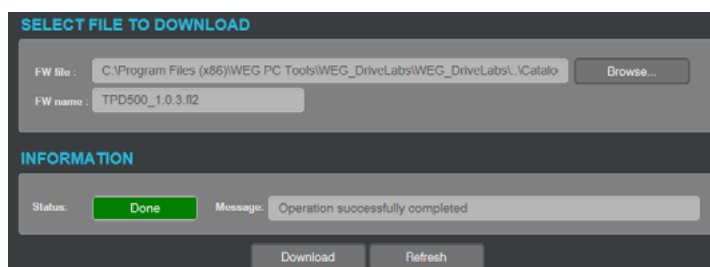
NOTE!

At this stage, the Upgrading Firmware progress bar may restart several times.

- Once the transfer is complete, the status changes to *Reboot*. The drive restarts and begins internal firmware programming, which may take several minutes. During this phase:
 - The message “*Don’t power off the drive*” is displayed, as it is crucial not to turn off the device power.
 - The progress percentage is shown only on the keypad, since **WEG_DriveLabs** is no longer in direct communication with the control board.
 - Pressing the Close button only closes the window; the procedure cannot be stopped at this point.



- When the internal programming is complete, the system restarts, and the status changes to *Done*, displaying the message “*Operation successfully completed*”.



After the restart, the system may require confirmation via the keypad (ESC button) to acknowledge that all parameters have been reset to their default values. To restore the drive to its previous settings before the download, use the parameter file saved to the PC or USB drive at the beginning of the procedure.

- Alternatively, to selecting from the drop-down menus, you can manually browse for the file to download (useful, for example, to program the drive with firmware versions older than the latest one shown in the menu) by clicking the Browse button. Select a file with the *.fl2* extension, located in a path depending on the firmware version, similar to the following: C:\Program Files (x86)\WEG PC Tools\WEG_DriveLabs\Catalog\TPD500\TPD500_1.x.3\PLC\1.0.3\Firmware\TPD500_1.0.3.fl2

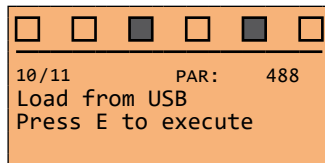


- At the end of the procedure, WEG_DriveLabs is disconnected because the new firmware on the control board is usually not compatible with the current TPD500 session used to perform the download. It is therefore recommended to close the tool and start a new session, either by automatic scan or by manually selecting the new firmware version.
- If the drive loses power during the internal programming phase, it will restart in Boot state (with error code 0020H displayed on the keypad). However, the download procedure can still be repeated by reconnecting with WEG_DriveLabs after performing an automatic scan.

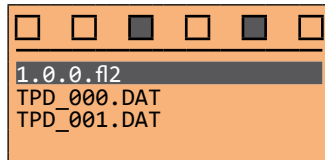


Using the keypad and the USB port

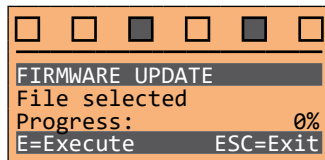
- Navigate using the keypad to the **DRIVE CONFIG** menu
- Scroll to parameter IPA 488—**Load from USB**



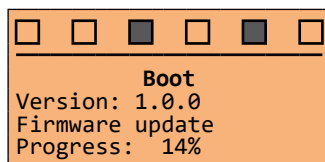
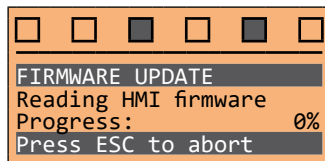
- Using the arrow keys, select the correct programming file (.fl2) and confirm with the **E** key



- Follow the instructions displayed on the keypad:
 - The procedure will copy the programming file into the drive, which will then restart and proceed with the update autonomously
 - The complete update may take a few minutes



The programming file may contain software components for HMI, DSP, and APP. The drive automatically updates the appropriate part of the code.



- At the end of the update, the drive restarts:
 - Normally, it is necessary to load the default parameters
 - Then save the parameters and perform a drive reset

9. FAULT INDICATIONS

9.1 Alarm indications

The following section lists and describes the possible alarms, their most common causes, and the recommended solutions.

If the proposed solutions do not resolve the current alarm, please contact the support service at: technohelp@weg.net

Table 9-1: Drive alarm list

CODE	ALARM	DESCRIPTION	
		PROBABLE CAUSES	POSSIBLE SOLUTIONS
1	Failure supply	The control board supply voltages are outside the allowed limits.	
		Wiring issue.	WARNING: Before removing the pluggable terminals, make sure the power supply is disconnected! Disconnect the pluggable terminals from the control board and issue a RESET command. If the alarm does not reappear, check the wiring for possible short circuits, such as between the shield and the conductor.
		Wiring issue on the TBO board.	Remove the terminal block of the optional TBO board (if installed) and issue another RESET command.
		Internal fault.	If the above actions do not resolve the issue, contact the support service.
2	Undervoltage	The three-phase supply voltage has dropped below the minimum threshold or one phase is missing.	
		IPA 5018– UV threshold parameter set too high.	Set IPA 5018– UV threshold correctly, according to the supply voltage used.
		Wiring issue, terminals not properly tightened.	Check and tighten the terminals of the contactor, inductor, filter, etc., if necessary.
		Line fuses tripped.	Restore the protection devices. If the issue recurs, investigate the cause. Refer to the troubleshooting section for Overcurrent .
		No voltage or low voltage at terminals U, V, W, or prolonged voltage sags. Mains dips or high distortion of the supply voltage.	Check the electrical connections.
3	Overvoltage	Overvoltage on the armature circuit.	
		IPA 606– Arm rated voltage parameter set too low.	Set the IPA 606– Arm rated voltage parameter correctly.
		The drive is not operating in field weakening mode, even though a speed has been set that requires it.	Reduce the speed limit via IPA 856– Speed max pos/neg , or enable field weakening through IPA 1304– Field reg mode , after properly tuning the regulators.
		The voltage and/or field regulator is not properly tuned.	Tune the regulators correctly.
4	Speed fbk loss	Speed measurement issue.	
		Incorrect speed sensor configuration.	Check the speed sensor parameter settings.
		Wiring issue.	Check the wiring and verify that the motor polarity and direction of rotation are correct.
		Faulty speed sensor.	Replace the sensor.
5	Heatsink	Heatsink temperature too high	
		Ambient temperature too high.	Improve environmental conditions or modify the duty cycle.
		Clogged heatsinks.	Perform maintenance.
		Device fan not working (for sizes ≥ 70 A).	Replace the fan.
6	External fault	External fault detected at terminal 15 (active low)	
		External fault signaling not used, and the connection between terminals 16 and 18 (reference potential) and/or 15 and 19 is missing.	Wire correctly.
		External fault signaling used, but no signal is present at terminal 15 (15...30 V with respect to terminal 16), or—if using an external power supply—the reference potentials have not been connected together.	Wire correctly.
8	Overcurrent	Overcurrent detected in the motor armature circuit	
		Short circuit at the drive output.	Check the power circuit wiring. Check the load integrity and impedance.
		Current regulator not optimized.	Run the auto-tuning procedure for the current regulator.
		IPA 5120– OC threshold parameter set too low.	Increase the threshold using the IPA 5120– OC threshold parameter.
9	Sustained Curr	The drive is unable to bring the armature current (terminals C-D) to zero.	
		Current sensing circuit fault.	Check the measured current using a clamp meter.
		SCR fault.	Contact the service team for support.

CODE	ALARM	DESCRIPTION	
		PROBABLE CAUSES	POSSIBLE SOLUTIONS
10	Power down	When the drive is enabled, the mains voltage is not present.	
		Wiring issue, terminals not properly tightened.	Check for the presence of armature voltage at terminals U, V, W.
		Line fuses tripped.	Check the proper operation of any contactor used to disconnect the three-phase supply, and verify the correct parameter settings for controlling the contactor in the DIGITAL OUTPUTS menu (typically using the "Drive ok" signal assigned to relay 1 or 2).
		No voltage or low voltage at terminals U, V, W.	
12	SCR open	An abnormal current has been detected in the commutation of an SCR.	
		SCR gate connection incorrect or missing.	Check wiring between FIR board and thyristor.
		SCR faulty (open).	Replace thyristor.
13	Overtemp motor	Motor overtemperature.	
		Broken wire or short circuit in the wiring between the motor's thermistor and terminals 78 and 79.	Check wiring integrity and impedance at terminals 78 and 79; repair if necessary.
		Missing 1 kΩ resistor in series with the contact connected to terminals 78 and 79.	Insert a resistor in series with the contact.
		The motor is not equipped with a thermistor, and no 1 kΩ resistor is present between terminals 78 and 79.	Insert a 1 kΩ resistor between terminals 78 and 79.
		The motor has external forced ventilation, but the fan is not working.	Replace the fan.
		Ambient temperature too high.	Improve environmental conditions, change the duty cycle, or enhance motor cooling.
		The motor has no external forced ventilation, and the load is too high at low speed.	Improve environmental conditions, change the duty cycle, or cool the motor using forced ventilation.
		The fan mounted on the motor shaft is not sufficient for this duty cycle.	
14	Bus loss	Communication issue on the bus.	
		Communication is not active and the enable command has been issued.	Check that the external controller is active.
		Wiring issue.	Check connections and the integrity of cables and connectors.
		EMC compatibility issues.	Take appropriate countermeasures.
		Internal fault.	Contact the support service.
15	OPTIC Alarm	Communication issue on the bus.	
		Communication is not active and the enable command has been issued.	Check that the external controller is active.
		Wiring issue.	Check connections and the integrity of cables and connectors.
		EMC compatibility issues.	Take appropriate countermeasures.
		Internal fault.	Contact the support service.
16	Field loss	Field current too low.	
		Field control circuit not powered.	Apply the correct voltage to terminals U1 and V1.
		Field not connected to the drive.	Check that the field circuit wires are not broken or disconnected.
		Field fuses have blown.	Restore the fuses; if the issue recurs, investigate the cause.
		If the field is controlled by an external -FC, the drive is disabled or in fault.	Set and wire the drives correctly for the selected configuration, and ensure the -FC is enabled.
		Field regulator not properly tuned.	Tune the field regulator.
		Incorrect parameter settings.	Set parameter IPA 5128– FL missing bypass to ON.
		The field current does not reach the reference within two seconds	Check the drive parameters, input voltage value and field regulator calibration
		If IPA 312– Drive 2B inversion = Field contactors incorrect wiring or parameters	Check the configuration of the digital outputs and, if contactor feedback is used, the digital inputs
		If IPA 312– Drive 2B inversion = Field contactors contactor fault	Check the wiring, closing and opening of the contactors
18	Enable seq err	The drive is switched on with terminal strip commands already set to a state that enables it immediately.	
		The drive is powered on, or a reset command is issued, while the ENABLE input is connected to 24 V and the device is configured for terminal strip control.	The IPA 5200– EnSEQ activity parameter can be set to Ignore.
19	Brake fault	Error in the brake opening or closing sequence.	
		Wiring issue in the brake feedback signals.	Refer to Chapter 7.18.10 – Brake control for proper configuration and use of the function.
		Incorrect parameter settings for the brake control function.	
		Signal sequencing error.	
20	Motor overload	Motor overload condition reached.	
		Motor I²t protection active. Incorrect parameter configuration and/or excessive duty cycle.	Refer to Chapter 7.20.9 – Motor I²t and verify that the configured parameters are correct. If everything is correctly set, it is necessary to wait for the accumulator IPA 4314– Motor I²t accum to discharge before resetting the alarm and re-enabling the drive.

CODE	ALARM	DESCRIPTION	
		PROBABLE CAUSES	POSSIBLE SOLUTIONS
21	Overspeed	Motor speed too high.	
		IPA 5040– OS threshold parameter set too low.	Set the IPA 5040– OS threshold parameter correctly.
		Speed measurement error.	Check that parameter IPA 650– Speed fbk sel is set consistently with the selected feedback source (Encoder 1, Encoder 2, Tacho, Armature). Verify the correct configuration of the speed sensor in use, including the encoder power supply.
			Check the wiring of the selected sensor.
22	Delta frequency	The frequency of the input three-phase supply deviates excessively from the value measured at first power-up.	
		Incorrect alarm parameter setting; IPA 5150– DF threshold is set too low.	Set the IPA 5150– DF threshold parameter correctly.
		System-related issues.	Ensure that the frequency of the three-phase supply remains stable and within the threshold limits throughout the operation of the drive.
23	Drive overload	Drive overload condition reached.	
		Drive I2t protection active. Incorrect parameter configuration and/or excessively demanding duty cycle.	You must wait for the IPA 4322– Drive I2t accum to discharge before resetting the alarm and subsequently enabling the drive. Refer to Chapter 7.20.10 – Drive I2t for more information.
24	SCR short	A short-circuited SCR has been detected.	
		Short circuit between one pole of the input network (U-V-W) and the output (C-D).	Check the U-V-W and C-D wiring.
		SCR faulty (short).	Replace the thyristor.

9.2 Other anomaly indications

The following section lists additional anomalies that may occur, along with their probable causes and possible solutions. If the proposed solutions do not resolve the issue, please contact the support service at: technohelp@weg.net

Table 9-2: List of possible drive anomalies

ANOMALY	PROBABLE CAUSES	POSSIBLE SOLUTIONS
Motor not rotating	Drive in alarm.	Remove the cause of the alarm and issue a RESET command.
	If the keypad is off, there may be no supply voltage at terminals U2 / V2, or an internal fuse may have blown.	Provide proper supply voltage to U2/V2. If necessary, replace the fuse.
	Unlock and/or Start commands are missing.	Send the appropriate Unlock and/or Start commands.
	The drive does not accept commands.	Check parameter IPA 500– Main commands and select the correct operating mode.
	Power supply protection devices have tripped.	Verify proper sizing of the protection devices and check the integrity of the SCRs.
	Ramp or speed reference not configured correctly.	Configure the ramp or speed reference properly.
	Negative reference with TPD500-... -2B-...	For bi-quadrant converters, the reference must be positive.
Incorrect motor rotation	Incorrect polarity of the reference signal.	Check the polarity.
	Motor incorrectly connected.	Connect the motor properly. Invert the armature or field conductors, and reverse the polarity of the speed sensor: swap the two encoder connections (A+ with A– or B+ with B–), or, if a tachogenerator is used, reverse its wiring.
The motor fails to reach its rated speed	The drive is at a speed limit.	Check parameters IPA 858– Speed max pos and IPA 860– Speed max neg .
	The drive is operating at current limits (ILim LED ON): • Motor is overloaded • Drive size is too small • Torque reduction is active • Field weakening is active	Reduce the load or torque demand; change the motor. Reduce the load or torque demand; increase the drive size. Check parameter IPA 1124– C/T lim reduct mon . Check parameters IPA 1312– Field weak mon and IPA 1342– Field current [%] . Check the settings of the CURR REG LIMIT block. If field weakening is active, check the field regulator settings.
	Incorrect speed measurement.	Check the speed feedback settings.
	A compensation is reducing the main reference.	Check the configuration.
	IPA 400– Full scale speed parameter set too low (if speed reference is from analog input).	Check the IPA 400– Full scale speed parameter.
	Speed reference error.	If the reference is assigned via terminal strip, check that parameter IPA 1870– Speed reference varies correctly from the minimum to the maximum value. If the reference comes from a potentiometer, verify that it is properly connected to 0V.
	Speed measurement error.	Ensure that parameter IPA 650– Speed fbk sel is set consistently with the selected feedback (Encoder 1, Encoder 2, Tacho, Armature). Check the correct configuration of the speed sensor in use, including encoder power supply.

ANOMALY	PROBABLE CAUSES	POSSIBLE SOLUTIONS
The motor accelerates too slowly	Ramp values and times not set correctly.	Set the ramp values and times correctly.
	The drive is operating at current limits (ILim LED ON):	Reduce the load or torque demand; replace the motor.
	• Motor is overloaded	Reduce the load or torque demand; increase the drive size.
	• Drive size is too small	Check parameter IPA 1124– C/T lim reduct mon .
	• Torque reduction is active	Check parameters IPA 1312– Field weak mon and IPA 1342– Field current [%] .
	• Field weakening is active	Check the settings of the CURR REG LIMIT block. If field weakening is active, check the field regulator settings.
The motor slows down but fails to stop	A minimum speed is set.	Set parameter IPA 850– Speed min pos/neg correctly.
	Noise on an analog input generates an unwanted speed or torque reference.	Set the parameters IPA 3400/3430/3460– An input 1/2/3 dest of unused analog inputs to OFF.
	Tachogenerator sensor offset present.	Remove the offset.
	Offset present on the analog input configured as speed or ramp reference.	Disconnect the cable from the used input. • If the motor stops, the issue is due to the resistance of the 0 V conductor cable. • If the motor continues to move, perform an analog input offset adjustment by setting parameters IPA 3406/3436/3466– An input 1/2/3 offset so that the motor remains stationary (i.e., the reference is zero).
The motor thermal protection is triggered	The motor is equipped with forced ventilation, but the fan is not working.	Replace the fan.
	Ambient temperature is too high.	Improve environmental conditions, change the duty cycle, and enhance motor cooling.
	The motor is not equipped with forced ventilation, and the load is too high at low speed.	Improve environmental conditions, change the duty cycle, and cool the motor using forced ventilation.
	The shaft-mounted fan is not sufficient for this duty cycle.	
	Motor thermal protection relay incorrectly set.	Adjust the motor thermal protection properly.
The motor is unable to supply maximum torque and power	The drive is operating at current limits (ILim LED ON):	Check parameter IPA 604– Arm rated current .
	• Incorrect configuration	Reduce the load or torque demand; replace the motor.
	• Motor is overloaded	Reduce the load or torque demand; increase the drive size.
	• Drive size is too small	Check parameter IPA 1124– C/T lim reduct mon .
	• Torque reduction is active	Check parameters IPA 1312– Field weak mon and IPA 1342– Field current [%] .
	• Field weakening is active	Check the settings of the CURR REG LIMIT block. If in field weakening mode, check the field regulator settings.
Non-linear speed behaviour during acceleration at maximum current	Speed regulator not properly tuned.	Proportionally reduce parameters IPA 900– Speed reg I and IPA 902– Speed reg P . If no improvement is observed, proceed with regulator optimization.
The speed oscillates	Speed regulator not properly tuned.	Check the tuning of the speed regulator.
	Armature or field voltage regulator not properly tuned.	If the operating point falls within the field weakening range, optimize the field regulator and, if necessary, the armature voltage regulator.
The drive does not react to the speed adaptive function	Speed adaptation not enabled.	Enable speed adaptation by setting parameter IPA 950– Adaptive gain enable to ON.
The motor potentiometer function is not being performed	Function not enabled.	Enable the motorpotentiometer function by setting parameter IPA 4000– Motorpot enable to ON.
	In terminal strip operation: Motorpot up and/or Motorpot down not assigned to digital inputs.	Assign Motorpot up and/or Motorpot down to digital inputs.
Jog operation does not work	A Start command is still active.	Disable the active Start command.
	Function not enabled.	Enable the Jog function by setting parameter IPA 4050– Jog enable to ON.
	In terminal strip operation: Jog + and/or Jog – not assigned to digital inputs.	Assign Jog + and/or Jog – to digital inputs.
Internal speed references do not work	Function not enabled.	Enable the multi-speed function by setting parameter IPA 4150– Multi speed enable to ON.
	In terminal strip operation: Multi speed sel 0 , Multi speed sel 1 and Multi speed sel 2 not assigned to digital inputs.	Assign Multi speed sel 0 , Multi speed sel 1 , and Multi speed sel 2 to digital inputs.
The multi-ramp function does not respond	Function not enabled.	Enable the multi-ramp function by setting parameter IPA 4200– Multi ramp enable to ON.
	In terminal strip operation: Multi Ramp sel 0 and Multi Ramp sel 1 not assigned to digital inputs.	Assign Multi Ramp sel 0 and Multi Ramp sel 1 to digital inputs.
Overload operation is not executed	Function not enabled.	Enable the overload function by setting parameter IPA 4300– Overload mode to I2t drive or I2t Drive and Motor.
		Increase the values of parameters IPA 1104– C/T lim pos dig and IPA 1108– C/T lim neg dig to 150%.

10. PARAMETER LIST

10.1 MENU STRUCTURE

The menu consists of a main menu with submenus and parameters. The structure is comparable to the organization of files and subfolders on a PC.

Main menu	It corresponds to the main menu of a PC (Main menu = Root).
Submenu	It corresponds to the submenus of a PC.
Parameter	It corresponds to the individual parameter.

NOTE!

Chapter 7 – FUNCTION PARAMETERS provides detailed information about menu functions and related parameters.

10.2 DESCRIPTION OF PARAMETERS AND FUNCTIONS – LEGEND

4 STARTUP WIZARD

4.1 SET DRIVE TYPE

0	1	2	3	4	5	6	7	8	9
Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
4.1.1	300	Drive arm current	A	UINT16	SDO	0	-	-	R

10 Rated current of the drive (armature circuit).

0	Menu and parameter indexing		
1	Index Parameter Address		
2	Parameter name		
3	Unit		
4	Parameter type	BIT	Boolean value, represented as 16 bits when accessed via Modbus
		ENUM	Selection list, represented as 16 bits via Modbus [1]
		FLOAT	Real, represented as 32 bits via Modbus
		INT16	Signed 16-bit integer, represented as 16 bits via Modbus
		INT32	Signed 32-bit integer, represented as 32 bits via Modbus
		UINT16	Unsigned 16-bit integer, represented as 16 bits via Modbus
		UINT32	Unsigned 32-bit integer, represented as 32 bits via Modbus
5	Fieldbus exchange mode	SDO	Acyclic exchange
		PDO	Cyclic/acyclic exchange
		CALC	Value calculated based on the drive size or dependent on other parameters
6	Default value	Numerical value	
7	Minimum value		
8	Maximum value		
9	Access	R	Read (reading) [2]
		W	Write (writing)
		Z	Parameter editable only when the drive is disabled
10	Parameter description		
[1]	The selection lists are provided in Chapter 7 – FUNCTION PARAMETERS of this manual.		
[2]	For read-only (R) parameters, the minimum and maximum values are not provided (–).		

1 MONITOR

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
1.1	200	Mains Voltage	V	FLOAT	PDO	0	-	-	R
		Mains voltage.							
1.2	202	Mains Frequency	Hz	FLOAT	PDO	0	-	-	R
		Network frequency.							
1.3	210	Armature voltage	V	FLOAT	PDO	0	-	-	R
		Armature voltage.							
1.4	214	Armature current [%]	%	FLOAT	PDO	0	-	-	R
		Armature current as a percentage of the motor's nominal armature current.							
1.5	222	Armature current [A]	A	FLOAT	PDO	0	-	-	R
		Armature current.							
1.6	216	Arm current filter	s	FLOAT	SDO	0.1	0.001	1	RW
		Time constant of the filter on the displayed armature current.							
1.7	1342	Field current [%]	%	FLOAT	PDO	0	-	-	R
		Field current as a percentage of the motor's rated field current.							
1.8	1344	Field current [A]	A	FLOAT	PDO	0	-	-	R
		Field current.							
1.9	220	Output power	kW	FLOAT	PDO	0	-	-	R
		Drive output power.							
1.10	234	Motor speed	rpm	FLOAT	PDO	0	-	-	R
		Motor rotation speed.							
1.11	236	Motor speed filter	s	FLOAT	SDO	0.1	0.001	1	RW
		Filter time constant on displayed motor speed.							
1.12	1020	Armature current ref	%	FLOAT	PDO	0	-	-	R
		Armature current reference as a percentage of the motor's rated armature current.							
1.13	1340	Field reference	%	FLOAT	PDO	0	-	-	R
		Flow reference as a percentage of the nominal motor flow.							
1.14	1338	Field current ref	%	FLOAT	PDO	0	-	-	R
		Field current reference as a percentage of the motor's rated field current.							
1.15	1820	Ramp reference	rpm	FLOAT	PDO	0	-	-	R
		Ramp reference at the input to the ramp function.							
1.16	2048	Ramp output	rpm	FLOAT	PDO	0	-	-	R
		Ramp function output.							
1.17	1870	Speed reference	rpm	FLOAT	PDO	0	-	-	R
		Overall reference speed input to the speed controller.							
1.18	3084	Enable input mon	-	UINT16	PDO	0	-	-	R
		Enable drive terminal status monitor (terminal 12).							
1.19	3094	Start input mon	-	UINT16	PDO	0	-	-	R
		Start terminal status monitor (terminal 13).							
1.20	3104	FastStop input mon	-	UINT16	PDO	0	-	-	R
		Fast stop terminal status monitor (terminal 14).							
1.21	3114	Ext fault input mon	-	UINT16	PDO	0	-	-	R
		External fault terminal status monitor (terminal 15).							
1.22	3196	Digital input mon	-	UINT16	PDO	0	-	-	R
		Overall monitor of the status of digital inputs.							
1.23	3296	Digital output mon	-	UINT16	PDO	0	-	-	R
		Overall monitor of the status of digital outputs.							
1.24	540	Enable state mon	-	UINT16	PDO	0	-	-	R

		Enable drive status monitor.							
1.25	542	Start state mon	-	UINT16	PDO	0	-	-	R
		Drive start status monitor.							
1.26	544	FastStop state mon	-	UINT16	PDO	0	-	-	R
		Fast stop status monitor for the drive.							
1.27	4770	First Alarm Code	-	UINT16	PDO	0	-	-	R
		Identification code of the first alarm that occurred.							

2 DRIVE INFO

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
2.1	172	Drive series	-	Enum	-	TPD500	-	-	R
		Product series identification string.							
2.2	174	Firmware version	-	UINT32	SDO	0	-	-	R
		Product firmware version.							
2.3	176	Firmware version DSP	-	UINT32	SDO	0	-	-	R
		Product control firmware version.							
2.4	182	Boot version	-	UINT32	-	0	-	-	R
		Product boot firmware version.							
2.5	180	Boot version DSP	-	UINT32	-	0	-	-	R
		Product control boot firmware version.							
2.6	184	Application name	-	STRING16	-	0	-	-	R
		String containing the name of any application loaded.							
2.7	194	Application type	-	UINT16	SDO	0	-	-	R
		Identification code of the application loaded, if any.							
2.8	192	Application version	-	UINT32	SDO	0	-	-	R
		Version of the application loaded, if any.							
2.9	490	Time drive power on	h.min	UINT32	PDO	0	-	-	R
		Drive power-on time.							
2.10	492	Time drive enable	h.min	UINT32	PDO	0	-	-	R
		Drive enable time.							
2.11	494	Number power on	-	UINT32	PDO	0	-	-	R
		Number of drive power-ons.							
2.12	440	Product S/N	-	UINT32	SDO	0	-	-	R
		Product serial number.							
2.13	444	Regulation S/N	-	UINT32	SDO	0	-	-	R
		Serial number of the R-TPD500 product regulation card.							
2.14	9600	MAC address	-	STRING16	-	0	-	-	R
		MAC address of the network card associated with the R-TPD500 product regulation card for Ethernet communication.							

3 DRIVE TYPE

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
3.1	300	Drive arm current	A	UINT16	SDO	0	-	-	R
		Nominal armature current of the drive.							
3.2	302	Drive size set	A	UINT16	SDO	4	4	20000	RWZ
		Nominal armature current setting of the drive (only in the case of Control Unit).							

3.3	304	Drive field current	A	FLOAT	SDO	CALC	0.5	150	RWZ
Nominal field current of the drive.									
3.4	306	Drive mains	-	Enum	SDO	500 V	-	-	R
Nominal armature supply voltage of the drive.									
3.5	308	Drive 2/4 quadrant	-	Enum	SDO	2B	-	-	R
Drive model (2B or 4B).									
3.6	312	Drive 2B+E enable	-	BIT	SDO	0	0	1	RWZ
Enable 2B + E configuration (external exciter).									

4 STARTUP WIZARD

4.1 Set DRIVE TYPE

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
4.1.1	300	Drive arm current	A	UINT16	SDO	0	-	-	R
Nominal armature current of the drive.									
4.1.2	302	Drive size set	A	UINT16	SDO	4	4	20000	RWZ
Drive armature current setting (only for Control Unit).									
4.1.3	304	Drive field current	A	FLOAT	SDO	CALC	0.5	150	RWZ
Nominal field current of the drive.									
4.1.4	312	Drive 2B inversion	deg	Enum	SDO	OFF	-	-	RWZ
Enabling 2B + E configuration (external exciter).									

4.2 Set DRIVE CONFIG

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
4.2.1	400	Full scale speed	rpm	UINT32	SDO	1500	10	6500	RWZ
Speed full scale.									
4.2.2	500	Main commands	-	Enum	SDO	Digital	0	1	RWZ
Drive command mode.									

4.3 Set MOTOR DATA

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
4.3.1	600	Motor rated speed	rpm	FLOAT	SDO	1500	10	6500	RW
Motor rated speed.									
4.3.2	602	Motor max speed	rpm	FLOAT	SDO	1500	10	6500	RW
Motor maximum speed.									
4.3.3	604	Arm rated current	A	FLOAT	SDO	CALC	0.1	CALC	RW
Rated armature current of the motor.									
4.3.4	606	Arm rated voltage	V	FLOAT	SDO	400	20	999	RW
Motor armature rated voltage.									
4.3.5	608	Field rated current	A	FLOAT	SDO	3.33	0	CALC	RW
Motor field rated current.									

4.4 Set SPEED FEEDBACK

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
4.4.1	650	Speed fbk sel	-	Enum	SDO	Encoder 2	0	3	RW
Selection of the type of feedback to be used for measuring or estimating the motor speed for speed control via a PI controller.									

4.5 Set ENCODER 1

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
4.5.1	702	Enc 1 pulses	ppr	UINT16	SDO	1024	150	16384	RWZ
Number of pulses per revolution of the digital encoder connected to connector XE1.									
4.5.2	704	Enc 1 supply enable	-	BIT	SDO	0	0	1	RW
Enables the generation of 5V power supply to encoder 1.									
4.5.3	706	Enc 1 input config	-	Enum	SDO	HTL	0	1	RW
Selection of encoder 1 signal type (TTL or HTL voltage level).									
4.5.4	708	Enc 1 Vdc supply	-	Enum	SDO	5.2V	0	3	RWZ
Allows you to adjust the power supply level of encoder 1 if the Enc 1 supply enable parameter is set to ON.									

4.6 Set ENCODER 2

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
4.6.1	752	Enc 2 pulses	ppr	UINT16	SDO	1024	150	16384	RWZ
Number of pulses per revolution of the digital encoder connected to the XE2 connector.									
4.6.2	754	Enc 2 supply enable	-	BIT	SDO	0	0	1	RW
Enables the generation of 5V power supply to encoder 2.									
4.6.3	756	Enc 2 input config	-	Enum	SDO	HTL	0	1	RW
Selection of encoder 2 signal type (TTL or HTL voltage level).									
4.6.4	758	Enc 2 Vdc supply	-	Enum	SDO	5.2V	0	3	RWZ
Allows you to adjust the power supply level of encoder 2 if the Enc 2 supply enable parameter is set to ON.									

4.7 Set TACHO

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
4.7.1	684	Tacho S4 switch sel	-	Enum	SDO	1100-0011 (90.7V)	0	4	RW
Configuration used for DIP switch S4 on the R-TPD500 control board.									
4.7.2	686	Tacho voltage scale	V/Krpm	FLOAT	SDO	60.0	1	4000	RW
Tachometer sensitivity rating.									

4.8 Set LIMITS

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
4.8.1	850	Speed min pos/neg	rpm	FLOAT	SDO	0	0	CALC	RW
Sets the minimum speed reference for both rotation directions (4B).									
4.8.2	856	Speed min pos	rpm	FLOAT	SDO	3000	0	CALC	RW
Sets the maximum speed reference for both directions of rotation (4B).									
4.8.3	1104	C/T lim pos dig	%	FLOAT	PDO	100	0	CALC	RW
Drive current limit for positive current direction, expressed as a percentage of the motor's rated armature current.									
4.8.5	1350	Field max dig	%	FLOAT	PDO	100	5	100	RW
Maximum flux as a percentage of the nominal flux (obtained at the nominal field current).									

4.8.6	1354	Field min dig	%	FLOAT	PDO	30	0	100	RW
Minimum flux as a percentage of the nominal flux (obtained at the nominal field current).									

4.9 Set REFERENCES

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
4.9.1	3400	An input 1 dest	-	Enum	SDO	Ramp ref 1	0	23	RW
Selection of the parameter whose value must be received from analogue input 1.									
4.9.2	1800	Ramp ref 1 dig	rpm	FLOAT	PDO	0	CALC	CALC	RW
Ramp reference 1.									

4.10 Exe CURR REG TUNE

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
4.10.1	1050	Curr reg autotune	-	BIT	-	0	0	0	RW
Command for executing a self-calibration cycle of the current regulator.									

4.11 Set FIELD CONTROL

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
4.11.1	1300	Field reg enable	-	BIT	PDO	1	0	1	RW
Field converter enable.									
4.11.2	1304	Field reg mode	-	Enum	SDO	Current control	0	4	RWZ
Field controller operating mode.									
4.11.3	1310	Field weak	-	BIT	PDO	0	0	1	RW
Enabling field weak.									
4.11.4	1314	Field weak speed-0	-	BIT	PDO	1	0	1	RW
Enabling field weak at zero speed.									

4.12 Exe SAVE PARAMETERS

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
4.13.1	460	Save parameters	-	BIT	PDO	0	0	1	RW
Command to save parameters to permanent memory.									

5 DRIVE CONFIG

Menu	IPA	Parameter name	Type	Def	Min	Max	Min	Max	Acc
5.1	400	Full scale speed	rpm	UINT32	SDO	1500	10	6500	RWZ
Speed full scale.									
5.2	470	Load default	-	BIT	SDO	0	0	1	RWZ
Command to reset the parameters to the factory default values, only possible if the converter is disabled.									
5.3	460	Save parameters	-	BIT	SDO	0	0	1	RW
Command to save the parameters to permanent memory.									
5.4	472	Drive reset	-	BIT	SDO	0	0	1	RWZ
Command to restart the software, only possible if the converter is disabled.									
5.5	466	Application enable	-	BIT	-	0	0	1	RWZ
Enables any application that may have been loaded.									
5.6	462	Access level	-	Enum	-	Expert	3	4	RW

		Access level setting.							
5.7	482	Display backlight	-	BIT	-	0	0	1	RW
		Enables permanent backlighting of the keypad display.							
5.8	484	Display startup	-	INT16	SD0	-1	-1	20000	RW
		Allows you to set what is automatically displayed on the keypad when the drive is turned on.							
5.9	486	Save to USB	-	BIT	-	0	0	1	RWZ
		Command to transfer the drive parameters to the memory connected to the USB port.							
5.10	488	Load from USB	-	BIT	-	0	0	1	RWZ
		Command to use the USB flash drive connected to the USB port to save or recover configuration parameters or to update the drive firmware.							
5.11	496	Wi-Fi safe removal	-	BIT	-	0	0	1	RWZ
		Command that removes power from the optional Wifi_DriveLink module.							

6 COMMANDS

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
6.1	500	Main commands	-	Enum	SD0	Digital	0	1	RWZ
		Drive command mode.							
6.2	502	Control mode	-	Enum	SD0	Local	0	1	RWZ
		Enabling fieldbus control mode (note: in standby).							
6.3	504	Stop mode	-	Enum	SD0	Stop&Speed 0	0	3	RWZ
		Drive disable management mode at stop or Fast stop.							
6.4	506	Speed 0 trip delay	ms	UINT16	SD0	0	0	40000	RW
		Drive disabling delay after stop and reaching speed 0.							
6.5	508	Trip contactor delay	ms	UINT16	SD0	0	0	40000	RW
		Delay on setting the Trip contactor output to control relay 2 after disabling.							
6.6	510	Jog stop control	-	BIT	SD0	0	0	1	RWZ
		Command to disable Stop mode when using the Jog function.							
6.7	520	Enable digital cmd	-	BIT	PDO	0	0	1	RW
		Enable command in Digital mode.							
6.8	522	Start digital cmd	-	BIT	PDO	0	0	1	RW
		Start command in Digital mode.							
6.9	524	FastStop digital cmd	-	BIT	PDO	0	0	1	RW
		Fast stop command in Digital mode.							

7 MOTOR DATA

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
7.1	600	Motor rated speed	rpm	FLOAT	SD0	1500	10	6500	RWZ
		Motor rated speed.							
7.2	602	Motor max speed	rpm	FLOAT	SD0	1500	10	6500	RWZ
		Motor maximum speed.							
7.3	604	Arm rated current	A	FLOAT	SD0	CALC	0.1	CALC	RWZ
		Nominal armature current of the motor.							
7.4	606	Arm rated voltage	V	FLOAT	SD0	400	20	999	RWZ
		Nominal armature voltage of the motor.							
7.5	608	Field rated current	A	FLOAT	SD0	3.33	0	CALC	RWZ
		Nominal field current of the motor.							

7.6	612	Motor EMF constant	V/rpm	FLOAT	SDO	0	0	100	RWZ
Electromotive force constant of the motor.									

8 REFERENCES

8.1 RAMP REF

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
8.1.1	1800	Ramp ref 1 dig	rpm	FLOAT	PDO	0	CALC	CALC	RW
Ramp reference 1.									
8.1.2	1804	Ramp ref 1 mon	rpm	FLOAT	PDO	0	-	-	R
Ramp reference monitor 1.									
8.1.3	1810	Ramp ref 2 dig	rpm	FLOAT	PDO	0	CALC	CALC	RW
Ramp reference 2.									
8.1.4	1814	Ramp ref 2 mon	rpm	FLOAT	PDO	0	-	-	R
Ramp reference monitor 2.									

8.2 SPEED REF

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
8.2.1	1850	Speed ref 1 dig	rpm	FLOAT	PDO	0	CALC	CALC	RW
Speed reference 1.									
8.2.2	1854	Speed ref 1 mon	rpm	FLOAT	PDO	0	-	-	R
Speed reference monitor 1.									
8.2.3	1860	Speed ref 2 dig	rpm	FLOAT	PDO	0	CALC	CALC	RW
Speed reference 2.									
8.2.4	1864	Speed ref 2 mon	rpm	FLOAT	PDO	0	-	-	R
Speed reference 2 monitor.									

8.3 TORQUE REF

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
8.3.1	1900	C/T ref 1 dig	%	FLOAT	PDO	0	CALC	CALC	RW
Armature current reference 1, expressed as a percentage of the motor's rated armature current.									
8.3.2	1904	C/T ref 1 mon	%	FLOAT	PDO	0	-	-	R
Armature current reference monitor 1.									
8.3.3	1910	C/T ref 2 dig	%	FLOAT	PDO	0	CALC	CALC	RW
Armature current reference 2, expressed as a percentage of the motor's rated armature current.									
8.3.4	1914	C/T ref 2 mon	%	FLOAT	PDO	0	-	-	R
Armature current reference 2 monitor.									

9 RAMPS

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
9.1	2000	Ramp enable	-	BIT	SDO	1	0	1	RWZ
Enables/disables ramp control of the speed reference.									
9.2	2002	Acc speed	rpm	UINT32	SDO	100	1	65535	RW
Standard ramp acceleration speed.									

9.3	2004	Acc time	s	UINT16	SDO	1	0	65535	RW
Standard ramp acceleration time.									
9.4	2006	Dec speed	rpm	UINT32	SDO	100	1	65535	RW
Standard ramp deceleration speed.									
9.5	2008	Dec time	s	UINT16	SDO	1	0	65535	RW
Standard ramp deceleration time.									
9.6	2010	Ramp shape	-	Enum	SDO	Linear	0	1	RWZ
Ramp type selector.									
9.7	2014	Acc time jerk	ms	FLOAT	SDO	300	20	15000	RW
Acceleration jerk time of ramp at S.									
9.8	2016	Dec time jerk	ms	FLOAT	SDO	300	20	15000	RW
Deceleration jerk time of the S ramp.									
9.9	2018	Ramp in = 0	-	BIT	PDO	0	0	1	RW
Immediate reset command for the ramp reference.									
9.10	2020	Ramp in = 0 mon	-	BIT	PDO	0	-	-	R
Monitor for immediate reset command of ramp reference.									
9.11	2022	Ramp out = 0	-	BIT	PDO	0	0	1	RW
Command for immediate reset of ramp output.									
9.12	2024	Ramp out = 0 mon	-	BIT	PDO	0	-	-	R
Monitor for the immediate reset command of the ramp output.									
9.13	2026	Ramp freeze	-	BIT	PDO	0	0	1	RW
Command to freeze the output value at the ramp, regardless of changes in the input reference.									
9.14	2028	Ramp freeze mon	-	BIT	PDO	0	-	-	R
Monitor for the immediate reset command of the ramp output.									
9.15	2030	Ramp +/- delay	ms	UINT16	SDO	100	0	65535	RW
Delay time on Ramp + and Ramp - signals for digital outputs.									
9.16	2032	FastStop speed	rpm	UINT32	SDO	1000	1	65535	RW
Fast stop ramp deceleration speed.									
9.17	2034	FastStop time	s	UINT16	SDO	1	0	65535	RW
Fast stop ramp deceleration time.									
9.18	2036	Forward/reverse	-	Enum	PDO	Forward	0	3	RW
Command to change the sign of the ramp reference.									
9.19	2038	Forward/reverse mon	-	Enum	PDO	Forward	-	-	R
Monitor for the command to change the sign of the ramp reference.									

10 SPEED FEEDBACK

10.1 CONFIG

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
10.1.1	650	Speed fbk sel	-	Enum	SDO	Encoder 2	0	3	RWZ
Selection of the type of feedback to be used for measuring or estimating the motor speed for speed control via PI regulator.									
10.1.2	654	Speed fbk error	%	UINT16	SDO	22	0	100	RW
Error threshold for the Speed fbk loss alarm caused by the comparison between the measured and estimated speed following the enabling of parameter IPA 658-Speed fbk control									
10.1.3	656	Speed fbk bypass	-	BIT	SDO	0	0	1	RW
Enables automatic switching to armature feedback in the event of a fault or failure of the encoder or tachometer feedback.									
10.1.4	658	Speed fbk control	-	BIT	SDO	1	0	1	RW

Armature voltage threshold, as a percentage of the motor rating, above which the speed sensor is checked after enabling parameter IPA
658-Speed fbk control

10.2 ENCODER 1

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
10.2.1	702	Enc 1 pulses	ppr	UINT16	SDO	1024	150	16384	RW
Number of pulses per revolution of the digital encoder connected to connector XE1.									
10.2.2	704	Enc 1 supply enable	-	BIT	SDO	0	0	1	RW
Enables the generation of the 5 V power supply for encoder 1.									
10.2.3	706	Enc 1 input config	-	Enum	SDO	HTL	0	1	RW
Selects the signal type of encoder 1 (TTL or HTL voltage level).									
10.2.4	708	Enc 1 Vdc supply	-	Enum	SDO	5.2V	0	3	RW
Allows the power supply level of encoder 1 to be adjusted if the Enc 1 supply enable parameter is set to ON.									
10.2.5	712	Enc 1 check	-	Enum	SDO	A-B	0	2	RW
Enables hardware consistency checking of channels A-B and/or Z of encoder 1 for the generation of the Speed fbk loss alarm.									
10.2.6	714	Enc 1 dest	-	Enum	SDO	OFF	0	4	RW
Allows the destination of encoder 1 (ramp or speed reference) to be set.									
10.2.7	716	Enc 1 speed	rpm	FLOAT	PDO	0	-	-	R
Speed measurement provided by encoder 1.									
10.2.8	728	Enc 1 error code	-	UINT16	PDO	0	-	-	R
Code indicating the type of error detected on encoder 1.									

10.3 ENCODER 2

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
10.3.1	752	Enc 2 pulses	ppr	UINT16	SDO	1024	150	16384	RW
Number of pulses per revolution of the digital encoder connected to connector XE2.									
10.3.2	754	Enc 2 supply enable	-	BIT	SDO	0	0	1	RW
Enables the generation of the 5 V power supply for encoder 2.									
10.3.3	756	Enc 2 input config	-	Enum	SDO	HTL	0	1	RW
Selects the signal type of encoder 2 (TTL or HTL voltage level).									
10.3.4	758	Enc 2 Vdc supply	-	Enum	SDO	5.2V	0	3	RW
Allows the power supply level of encoder 2 to be adjusted if the Enc 2 supply enable parameter is set to ON.									
10.3.5	762	Enc 2 check	-	Enum	SDO	A-B	0	2	RW
Enables hardware consistency checking of channels A-B and/or Z of encoder 2 for generating the Speed fbk loss alarm.									
10.3.6	764	Enc 2 dest	-	Enum	SDO	OFF	0	4	RWZ
Sets the destination of encoder 2 (ramp or speed reference).									
10.3.7	766	Enc 2 speed	rpm	FLOAT	PDO	0	-	-	R
Speed measurement provided by encoder 2.									
10.3.8	778	Enc 2 error code	-	UINT16	PDO	0	-	-	R
Code indicating the type of error detected on encoder 2.									

10.4 TACHO

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
10.4.1	682	Tacho filter	ms	FLOAT	SDO	6	0.0	1000.0	RW
Time constant of the filter on the speed measurement provided by the tachometer.									
10.4.2	684	Tacho S4 switch sel	-	Enum	SDO	1100-0011 (90.7V)	0	4	RW

Configuration used for DIP switch S4 on the R-TPD500 control board.									
10.4.3	686	Tacho voltage scale	V/krpm	FLOAT	SDO	60.0	1	4000	RW
Tachometer sensitivity setting.									
10.4.4	688	Tacho scale tuning	-	FLOAT	SDO	1.0	0.8	1.2	RW
Gain that allows finer tuning in cascade with Tacho voltage scale.									
10.4.5	690	Tacho offset	rpm	FLOAT	SDO	0.0	-20	20	RW
Offset that can be used to correct the speed measurement provided by the tachometer.									
10.4.6	696	Tacho speed	rpm	FLOAT	PDO	0	-	-	R
Speed measurement provided by the tachometer.									
10.4.7	698	Tacho sat error	-	UINT16	PDO	0	-	-	R
Monitor of the error signal generated by the tachometer, with generation of a Speed fbk loss alarm.									

11 SPEED CONTROL

11.1 SPEED REG

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
11.1.1	800	Speed reg enable	-	BIT	PDO	1	0	1	RW
Enabling the speed regulator.									
11.1.2	802	Speed reg enable mon	-	BIT	PDO	0	-	-	R
Monitoring the enable status of the IPA 800 speed regulator - Speed reg enable.									
11.1.3	804	Speed reg lock	-	BIT	PDO	0	0	1	RW
Command used to separate the speed controller output from the current controller during operation. When this occurs, the current reference is set to zero and the motor stops due to inertia.									
11.1.4	806	Speed reg lock mon	-	BIT	PDO	0	-	-	R
Monitor of the status of IPA 804-Speed reg lock.									
11.1.5	808	Speed reg lock I	-	BIT	PDO	0	0	1	RW
Command to block the integral action of the speed regulator.									
11.1.6	810	Speed reg lock I mon	-	BIT	PDO	0	-	-	R
Monitor of the command to block the integral action of the IPA 808-Speed reg lock I speed regulator.									
11.1.7	838	Speed auto capture	-	BIT	PDO	0	0	1	RW
Enabling the fly-in function for a motor that is already rotating.									
11.1.8	848	Speed reg output	%	FLOAT	PDO	0	-	-	R
Monitor of the speed regulator output, expressed as a percentage of the motor's rated armature current, which acts as a reference for the current regulator.									

11.2 SPEED REG LIMIT

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
11.2.1	850	Speed min pos/neg	rpm	FLOAT	SDO	0	0	CALC	RWZ
Sets the minimum speed reference for both rotation directions (4B).									
11.2.2	852	Speed min pos	rpm	FLOAT	PDO	0	0	8191	RWZ
Sets the minimum speed reference for the positive direction of rotation of the motor.									
11.2.3	854	Speed min neg	rpm	FLOAT	PDO	0	0	8191	RWZ
Sets the minimum speed reference for negative motor rotation (4B).									
11.2.4	856	Speed max pos/neg	rpm	FLOAT	SDO	3000	0	CALC	RWZ
Sets the maximum speed reference for both rotation directions (4B).									
11.2.5	858	Speed max pos	rpm	FLOAT	PDO	3000	0	8191	RWZ
Sets the maximum speed reference for the positive direction of rotation of the motor.									

11.2.6	860	Speed max neg	rpm	FLOAT	PDO	3000	0	8191	RWZ
Sets the maximum speed reference for the negative direction of rotation of the motor (4B).									

11.3 SPEED REG TUNE

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
11.3.1	900	Speed reg P	%	FLOAT	PDO	10	0	100	RW
Proportional gain Kp of the speed controller, expressed as a percentage of the base gain IPA 904-Speed reg P base.									
11.3.2	902	Speed reg I	%	FLOAT	PDO	1	0	100	RW
Integral gain Ki of the speed regulator, expressed as a percentage of the base gain IPA 906-Speed reg I base.									
11.3.3	904	Speed reg P base	A/rpm	FLOAT	-	CALC	0.001	CALC	RWZ
Proportional coefficient Kp base of the speed controller.									
11.3.4	906	Speed reg I base	-	FLOAT	-	CALC	0.001	CALC	RWZ
Integral coefficient Ki base of the speed controller.									
11.3.5	908	Speed reg P in use	%	FLOAT	PDO	0	-	-	R
Monitor of the proportional gain in use of the speed controller, expressed as a percentage of IPA 904-Speed reg P base.									
11.3.6	910	Speed reg I in use	%	FLOAT	PDO	0	-	-	R
Monitor of the integral gain in use of the speed regulator, expressed as a percentage of IPA 906-Speed reg I base.									
11.3.7	914	Speed reg P filter	ms	UINT16	SDO	0	0	1000	RW
Time constant of the low-pass filter applied to the proportional action of the PI speed regulator.									
11.3.8	920	Speed ref 0 level	rpm	UINT16	SDO	10	1	8191	RW
Speed used to define the intervention threshold for managing the speed controller gains at zero speed.									
11.3.9	922	Speed=0 P gain	%	FLOAT	PDO	1	0	100	RW
Proportional gain of the speed controller at zero speed, expressed as a percentage of IPA 904-Speed reg P base.									
11.3.10	924	Speed=0 I enable	-	BIT	PDO	0	0	1	RWZ
Enables the reset of the integral gain of the speed controller at zero speed.									
11.3.11	926	Speed=0 R enable	-	BIT	PDO	0	0	1	RWZ
Enabling the proportional gain of the speed controller at zero reference.									
11.3.12	928	Speed=0 P enable	-	BIT	PDO	0	0	1	RWZ
Enabling the gains of the speed controller at zero speed.									
11.3.13	930	Speed reg P bypass	%	FLOAT	PDO	1	0	100	RW
Proportional gain of the speed controller, expressed as a percentage of IPA 904-Speed reg P base, used in the speed feedback bypass condition.									
11.3.14	932	Speed reg I bypass	%	FLOAT	PDO	0.1	0	100	RW
Integral gain of the speed controller, expressed as a percentage of IPA 906-Speed reg I base, used in the speed feedback bypass condition.									

11.4 SPEED REG ADAPT

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
11.4.1	950	Adaptive gain enable	-	Enum	SDO	OFF	0	1	RWZ
Enables adaptive gains for the speed controller.									
11.4.2	952	Adaptive type sel	-	Enum	SDO	Motor speed	0	2	RWZ
Allows you to select the quantity relative to which the speed controller gains are varied.									
11.4.3	954	Adaptive ref dig	rpm	FLOAT	PDO	0	-8191	8191	RW
Input reference speed relative to which the adaptive gains of the speed controller are performed.									
11.4.4	956	Adaptive ref mon	rpm	FLOAT	PDO	0	-	-	R
Monitor of the reference speed with respect to which the adaptive gains of the speed controller are to be performed.									
11.4.5	958	Adaptive selector	-	UINT16	PDO	0	0	3	RW
Selection index of the set of adaptive PI gains of the speed controller.									

11.4.6	966	Adaptive sel mon	-	UINT16	PDO	0	-	-	R
Monitor selection index of the SET of adaptive PI gains of the speed controller.									
11.4.7	960	Adaptive speed 1	%	FLOAT	SDO	20.3	0	200	RW
Speed threshold for connecting SET 1-2 of the adaptive PI gains of the speed controller.									
11.4.8	962	Adaptive speed 2	%	FLOAT	SDO	40.7	0	200	RW
Speed threshold for connecting SET 2-3 of the adaptive PI gains of the speed controller.									
11.4.9	970	Adaptive joint 1	%	FLOAT	SDO	6.1	0	200	RW
Speed band width for connecting SET 1-2 of the adaptive PI gains of the speed controller.									
11.4.10	972	Adaptive joint 2	%	FLOAT	SDO	6.1	0	200	RW
Speed band width for connecting SET 2-3 of the adaptive PI gains of the speed controller.									
11.4.11	980	Adaptive P gain 1	%	FLOAT	SDO	10.00	0	100	RW
Proportional gain P of SET 1, expressed as a percentage of IPA 904-Speed reg P base.									
11.4.12	982	Adaptive I gain 1	%	FLOAT	SDO	1.00	0	100	RW
Integral gain I of SET 1, expressed as a percentage of IPA 906-Speed reg I base.									
11.4.13	984	Adaptive P gain 2	%	FLOAT	SDO	10.00	0	100	RW
Proportional P gain of SET 2, expressed as a percentage of IPA 904-Speed reg P base.									
11.4.14	986	Adaptive I gain 2	%	FLOAT	SDO	1.00	0	100	RW
Integral gain I of SET 2, expressed as a percentage of IPA 906-Speed reg I base.									
11.4.15	988	Adaptive P gain 3	%	FLOAT	SDO	10.00	0	100	RW
Proportional P gain of SET 3, expressed as a percentage of IPA 904-Speed reg P base.									
11.4.16	990	Adaptive I gain 3	%	FLOAT	SDO	1.00	0	100	RW
Integral gain I of SET 3, expressed as a percentage of IPA 906-Speed reg I base.									
11.4.17	992	Adaptive P gain 4	%	FLOAT	SDO	10.00	0	100	RW
Proportional gain P of SET 4, expressed as a percentage of IPA 904-Speed reg P base.									
11.4.18	994	Adaptive I gain 4	%	FLOAT	SDO	1.00	0	100	RW
Integral gain I of SET 4, expressed as a percentage of IPA 906-Speed reg I base.									
11.4.19	964	Adaptive set in use	-	Enum	PDO	None	-	-	R
Monitor of the adaptive PI gain SET in use.									
11.4.20	996	Adaptive P in use	%	FLOAT	PDO	0	-	-	R
Monitor of the adaptive proportional gain P in use.									
11.4.21	998	Adaptive I in use	%	FLOAT	PDO	0	-	-	R
Monitor of the adaptive integral gain I in use.									

11.5 SPEED REG FUNC

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
11.5.1	934	Speed reg func sel	-	Enum	SDO	None	0	2	RWZ
Enabling speed controller compensation functions (speed up or inertia compensation).									
11.5.2	936	Speed up gain	s/rpm	FLOAT	SDO	0	0	1000	RW
Gain of the Speed up function applied to the derivative of the IPA 234-Motor speed measurement.									
11.5.3	938	Speed up filter	ms	UINT16	SDO	0	0	1000	RW
Time constant of the low-pass filter of the Speed up function.									
11.5.4	940	Inertia comp filter	ms	UINT16	SDO	0	0	1000	RW
Time constant of the low-pass filter of the inertia compensation.									
11.5.5	942	Inertia	kgm ²	FLOAT	SDO	0.001	0.001	1000	RW
Inertia of the load on the motor shaft.									
11.5.6	944	Friction	Nm	FLOAT	SDO	0.001	0	100.00	RW
Friction of the load on the motor shaft.									

11.5.7	946	Torque constant	Nm/A	FLOAT	SDO	2.42	0.01	100.00	RW
Motor torque constant.									
11.5.8	948	Inertia comp mon	%	FLOAT	SDO	0	-	-	R
Monitor of the output produced by the inertia compensation function, expressed as a percentage of the motor's rated armature current.									

12 CURRENT CONTROL

12.1 CURR REG

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
12.1.1	1000	Curr reg mode	-	Enum	SDO	Predictive	0	1	RWZ
Selection of current regulator type (predictive or PI).									
12.1.2	1002	C/T ref ramp time	ms	UINT16	SDO	0	0	100	RW
Ramp time defining the di/dt of the current controller.									
12.1.3	1004	Zero torque	-	BIT	PDO	0	0	1	RW
Armature current reference reset command.									
12.1.4	1006	Zero torque mon	-	BIT	PDO	0	-	-	R
Armature current reference reset command monitor.									

12.2 CURR REG LIMIT

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
12.2.1	1104	C/T lim pos dig	%	FLOAT	PDO	100	0	CALC	RW
Drive current limit for positive current direction, expressed as a percentage of the motor's rated armature current.									
12.2.2	1106	C/T lim pos mon	%	FLOAT	PDO	0	-	-	R
Positive current limit monitor.									
12.2.3	1108	C/T lim neg dig	%	FLOAT	PDO	100	0	CALC	RW
Drive current limit for negative current direction, expressed as a percentage of the motor's rated armature current.									
12.2.4	1110	C/T lim neg mon	%	FLOAT	PDO	0	-	-	R
Negative current limit monitor.									
12.2.5	1112	C/T lim sym enable	-	Enum	SDO	ON	0	1	RWZ
Enabling of symmetrical current limits for both current directions.									
12.2.6	1120	C/T lim reduction	%	FLOAT	PDO	100	0	CALC	RW
Current limit with reduction active.									
12.2.7	1122	C/T lim reduct cmd	-	BIT	PDO	0	0	1	RW
Enabling current limit reduction.									
12.2.8	1124	C/T lim reduct mon	-	BIT	PDO	0	-	-	R
Monitor of the enable command for current limit reduction.									
12.2.9	1126	C/T lim type	-	Enum	SDO	Pos/neg	0	1	RWZ
Determines the operation of the drive at the current limits.									
12.2.10	1140	C/T lim pos in use	%	FLOAT	PDO	0	-	-	R
Monitor of the positive current limit actually in use, expressed as a percentage of the motor's rated armature current.									
12.2.11	1142	C/T lim neg in use	%	FLOAT	PDO	0	-	-	R
Monitor of the negative current limit actually in use, expressed as a percentage of the motor's rated armature current.									

12.3 CURR REG TUNE

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
12.3.1	1050	Curr reg autotune	-	BIT	-	0	0	0	RWZ
		Command for executing a current regulator self-tuning cycle.							
12.3.2	1052	Arm resistance	Ω	FLOAT	SDO	0.5	0	CALC	RW
		Motor armature resistance.							
12.3.3	1054	Arm inductance	mH	FLOAT	SDO	4.0	CALC	CALC	RW
		Motor armature inductance.							
12.3.4	1060	Compensation output	V	FLOAT	PDO	0	0	0	R
		Monitor useful for assessing whether the current regulator is correctly calibrated.							
12.3.5	1070	PI P1 gain	%	FLOAT	SDO	0.5	0	100	RW
		Proportional gain of the PI current controller, expressed as a percentage of the base value IPA 1080-PI P base, with current reference at zero.							
12.3.6	1072	PI I1 gain	%	FLOAT	SDO	30	0	100	RW
		Integral gain of the PI current controller, expressed as a percentage of the base value IPA 1082-PI I base, with current reference at zero.							
12.3.7	1074	PI P2 gain	%	FLOAT	SDO	0.3	0	100	RW
		Proportional gain of the PI current controller, expressed as a percentage of the base value IPA 1080-PI P base, with current reference greater than IPA 1078-PI P2 gain.							
12.3.8	1076	PI I2 gain	%	FLOAT	SDO	9.0	0	100	RW
		Integral gain of the PI current controller, expressed as a percentage of the base value IPA 1082-PI I base, with current reference greater than IPA 1078-PI curr thr.							
12.3.9	1078	PI curr thr	A	FLOAT	SDO	100	0	200	RW
		Threshold below which the proportional and integral gains vary linearly with the current from value 1 to value 2. Above this threshold, the values of IPA 1074-PI P2 gain and IPA 1076-PI I2 gain are maintained.							
12.3.10	1080	PI P base	deg/A	FLOAT	-	CALC	CALC	CALC	RWZ
		Base value of the proportional gain of the current controller.							
12.3.11	1082	PI I base	deg/Ams	FLOAT	-	CALC	CALC	CALC	RWZ
		Base value of the integral gain of the current controller.							

13 FIELD CONTROL

13.1 FIELD REG

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
13.1.1	1300	Field reg enable	-	BIT	PDO	1	0	1	RW
		Field converter enable.							
13.1.2	1302	Field reg enable mon	-	BIT	PDO	0	-	-	R
		Field converter enable command monitor.							
13.1.3	1304	Field reg mode	-	Enum	SDO	Current control	0	4	RW
		Field regulator operating mode.							
13.1.4	1310	Field weak	-	BIT	PDO	0	0	1	RW
		Field weak enable.							
13.1.5	1312	Field weak mon	-	BIT	PDO	0	-	-	R
		Field weak enable command monitor.							
13.1.6	1314	Field weak speed-0	-	BIT	PDO	1	0	1	RW
		Field weak enable at zero speed.							
13.1.7	1316	Field weak speed-0 mon	-	BIT	PDO	0	-	-	R
		Field weakening enable command monitor at zero speed.							

13.2 FIELD REG LIM

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
13.2.1	1350	Field max dig	%	FLOAT	PDO	100	5	100	RW
Maximum current in percent of the rated current (obtained at the rated field current).									
13.2.2	1352	Field max mon	%	FLOAT	PDO	0	-	-	R
Monitor of maximum flow as a percentage of nominal flow.									
13.2.3	1354	Field min dig	%	FLOAT	PDO	30	0	100	RW
Minimum flow as a percentage of nominal flow (obtained at nominal field current).									

13.3 FIELD REG TUNE

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
13.3.1	1320	Field curr reg P	%	FLOAT	SDO	15.00	0	100	RW
Proportional gain Kp of the field current controller, expressed as a percentage of IPA 1324-Field curr P base.									
13.3.2	1322	Field curr reg I	%	FLOAT	SDO	15.00	0	100	RW
Integral gain Ki of the field current controller, expressed as a percentage of IPA 1326-Field curr I base.									
13.3.3	1324	Field curr P base	-	FLOAT	-	100	1	1000	RWZ
Base proportional coefficient Kp of the field current controller.									
13.3.4	1326	Field curr I base	-	FLOAT	-	100	1	1000	RWZ
Integral coefficient Ki base of the field current controller.									
13.3.5	1450	Field curr const 40%	%	FLOAT	SDO	40	0	100	RWZ
Field current that leads to a flow equal to 40% of the nominal flow.									
13.3.6	1452	Field curr const 70%	%	FLOAT	SDO	70	0	100	RWZ
Field current that leads to a flow equal to 70% of the nominal flow.									
13.3.7	1454	Field curr const 90%	%	FLOAT	SDO	90	0	100	RWZ
Field current that leads to a flow equal to 90% of the nominal flow.									
13.3.8	1458	Field curve reset	-	BIT	SDO	0	0	1	RW
Command to reset the flow/field current curve.									

13.4 FIELD REG INV

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
13.4.1	1360	Field 2B inv mode	-	-	SDO	Normal	0	3	RWZ
To change the contactor-based reversal mode									
13.4.2	1362	Field 2B inv speed 0	-	BIT	SDO	0	0	1	RW
To allow field reversal only when IPA 826-Speed 0 thr is active									
13.4.3	1364	Field 2B curr thr	%	FLOAT	SDO	1	0	100	RW
Current threshold, expressed as a percentage of the nominal field current, below which both contactors open to let the inductor discharge through the resistor.									
13.4.4	1366	Field 2B wait time	ms	UINT16	SDO	400	0	2000	RW
Minimum interval required between the end of one reversal sequence and the start of the next.									
13.4.5	1368	Field 2B res time	ms	UINT16	SDO	800	0	2000	RW
To set how long the Field contactor + and Field contactor - remain open, allowing current to flow through the discharge resistor.									

14 VOLTAGE CONTROL

14.1 VOLT REG

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
14.1.1	1306	Volt control ref dig	%	FLOAT	PDO	100	0	100	RW
Armature voltage reference, expressed as a percentage of the motor's rated armature voltage.									
14.1.2	1308	Volt control ref mon	%	FLOAT	PDO	0	-	-	R
Armature voltage reference monitor.									
14.1.3	1448	Arm voltage filter	ms	UINT16	SDO	5	0	100.0	RW
Time constant of the low-pass filter applied to the voltage used by the armature voltage regulator.									

14.2 VOLT REG TUNE

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
14.2.1	1400	Voltage reg P	%	FLOAT	SDO	3	0	100	RW
Proportional gain Kp of the armature voltage regulator, expressed as a percentage of IPA1404-Voltage reg P base.									
14.2.2	1402	Voltage reg I	%	FLOAT	SDO	30	0	100	RW
Integral gain Ki of the armature voltage regulator, expressed as a percentage of IPA 1406-Voltage reg I base.									
14.2.3	1404	Voltage reg P base	-	FLOAT	-	100	1.0	1000	RWZ
Proportional coefficient Kp base of the armature voltage regulator.									
14.2.4	1406	Voltage reg I base	-	FLOAT	-	100	1.0	1000	RWZ
Integral coefficient Ki base of the armature voltage regulator.									

15 DIGITAL INPUTS

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
15.1	3000	Digital input 1 dest	-	Enum	SDO	OFF	0	90	RWZ
Selection of the function to be controlled via Digital input 1.									
15.2	3010	Digital input 2 dest	-	Enum	SDO	OFF	0	90	RWZ
Selection of the function to be controlled via Digital input 2.									
15.3	3020	Digital input 3 dest	-	Enum	SDO	OFF	0	90	RWZ
Selection of the function to be controlled via Digital input 3.									
15.4	3030	Digital input 4 dest	-	Enum	SDO	OFF	0	90	RWZ
Selection of the function to be controlled via Digital input 4.									
15.5	3040	Digital input 5 dest	-	Enum	SDO	OFF	0	90	RWZ
Selection of the function to be controlled via Digital input 5.									
15.6	3050	Digital input 6 dest	-	Enum	SDO	OFF	0	90	RWZ
Selection of the function to be controlled via Digital input 6.									
15.7	3060	Digital input 7 dest	-	Enum	SDO	OFF	0	90	RWZ
Selection of the function to be controlled via Digital input 7.									
15.8	3070	Digital input 8 dest	-	Enum	SDO	OFF	0	90	RWZ
Selection of the function to be controlled via Digital input 8.									
15.9	3002	Digital input 1 inv	-	BIT	SDO	0	0	1	RW
Enabling the polarity reversal of the Digital input 1 signal.									
15.10	3012	Digital input 2 inv	-	BIT	SDO	0	0	1	RW
Enabling the polarity reversal of the Digital input 2 signal.									
15.11	3022	Digital input 3 inv	-	BIT	SDO	0	0	1	RW

Enabling the polarity reversal of the Digital input 3 signal.									
15.12	3032	Digital input 4 inv	-	BIT	SD0	0	0	1	RW
Enabling the polarity reversal of the Digital input 4 signal.									
15.13	3042	Digital input 5 inv	-	BIT	SD0	0	0	1	RW
Enabling the polarity reversal of the Digital input 5 signal.									
15.14	3052	Digital input 6 inv	-	BIT	SD0	0	0	1	RW
Enabling the polarity reversal of the Digital input 6 signal.									
15.15	3062	Digital input 7 inv	-	BIT	SD0	0	0	1	RW
Enabling the polarity reversal of the Digital input 7 signal.									
15.16	3072	Digital input 8 inv	-	BIT	SD0	0	0	1	RW
Enabling the polarity reversal of the Digital input 8 signal.									
15.17	3004	Digital input 1 mon	-	UINT16	PD0	0	-	-	R
Monitor (0/1) of digital input 1 signal status.									
15.18	3014	Digital input 2 mon	-	UINT16	PD0	0	-	-	R
Monitor (0/1) of digital input 2 signal status.									
15.19	3024	Digital input 3 mon	-	UINT16	PD0	0	-	-	R
Monitor (0/1) of digital input 3 signal status.									
15.20	3034	Digital input 4 mon	-	UINT16	PD0	0	-	-	R
Monitor (0/1) of digital input 4 signal status.									
15.21	3044	Digital input 5 mon	-	UINT16	PD0	0	-	-	R
Monitor (0/1) of digital input 5 signal status.									
15.22	3054	Digital input 6 mon	-	UINT16	PD0	0	-	-	R
Monitor (0/1) of digital input 6 signal status.									
15.23	3064	Digital input 7 mon	-	UINT16	PD0	0	-	-	R
Monitor (0/1) of digital input 7 signal status.									
15.24	3074	Digital input 8 mon	-	UINT16	PD0	0	-	-	R
Monitor (0/1) of digital input 8 signal status.									

16 DIGITAL OUTPUTS

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
16.1	3200	Digital output 1 sel	-	Enum	SD0	Ramp +	0	82	RWZ
Select the function to be assigned to Digital output 1.									
16.2	3202	Digital output 2 sel	-	Enum	SD0	Ramp -	0	82	RWZ
Select the function to be assigned to Digital output 2.									
16.3	3204	Digital output 3 sel	-	Enum	SD0	Speed threshold	0	82	RWZ
Select the function to be assigned to Digital output 3.									
16.4	3206	Digital output 4 sel	-	Enum	SD0	Motor overload free	0	82	RWZ
Select the function to be assigned to Digital output 4.									
16.5	3208	Digital output 5 sel	-	Enum	SD0	Current limit state	0	82	RWZ
Select the function to be assigned to Digital output 5.									
16.6	3210	Digital output 6 sel	-	Enum	SD0	Overvoltage	0	82	RWZ
Select the function to be assigned to Digital output 6.									
16.7	3212	Digital output 7 sel	-	Enum	SD0	Undervoltage	0	82	RWZ
Select the function to be assigned to Digital output 7.									
16.8	3214	Digital output 8 sel	-	Enum	SD0	Overcurrent	0	82	RWZ
Select the function to be assigned to Digital output 8.									
16.9	3216	Relay 1 sel	-	Enum	SD0	Drive ok	0	82	RWZ

Selecting the function to be assigned to Relay 1.									
16.10	3218	Relay 2 sel	-	Enum	SD0	Trip contactor	0	82	RWZ
Selecting the function to be assigned to Relay 2.									
16.11	3220	Digital output 1 inv	-	BIT	SD0	0	0	1	RWZ
Enabling signal inversion Digital output 1.									
16.12	3222	Digital output 2 inv	-	BIT	SD0	0	0	1	RWZ
Enabling signal inversion Digital output 2.									
16.13	3224	Digital output 3 inv	-	BIT	SD0	0	0	1	RWZ
Enabling signal inversion Digital output 3.									
16.14	3226	Digital output 4 inv	-	BIT	SD0	0	0	1	RWZ
Enabling signal inversion Digital output 4.									
16.15	3228	Digital output 5 inv	-	BIT	SD0	0	0	1	RWZ
Enabling signal inversion Digital output 5.									
16.16	3230	Digital output 6 inv	-	BIT	SD0	0	0	1	RWZ
Enabling signal inversion Digital output 6.									
16.17	3232	Digital output 7 inv	-	BIT	SD0	0	0	1	RWZ
Enabling signal inversion Digital output 7.									
16.18	3234	Digital output 8 inv	-	BIT	SD0	0	0	1	RWZ
Enabling signal inversion Digital output 8.									
16.19	3236	Relay 1 inv	-	BIT	SD0	0	0	1	RWZ
Enabling signal inversion Relay 1.									
16.20	3238	Relay 2 inv	-	BIT	SD0	0	0	1	RWZ
Enabling signal inversion Relay 2.									
16.21	3240	Digital output 1 mon	-	UINT16	PDO	0	-	-	R
Monitor (0/1) of the status of signal Digital output 1.									
16.22	3242	Digital output 2 mon	-	UINT16	PDO	0	-	-	R
Monitor (0/1) of the status of signal Digital output 2.									
16.23	3244	Digital output 3 mon	-	UINT16	PDO	0	-	-	R
Monitor (0/1) of the status of signal Digital output 3.									
15.24	3246	Digital output 4 mon	-	UINT16	PDO	0	-	-	R
Monitor (0/1) of the status of signal Digital output 4.									
16.25	3248	Digital output 5 mon	-	UINT16	PDO	0	-	-	R
Monitor (0/1) of the status of signal Digital output 5.									
16.26	3250	Digital output 6 mon	-	UINT16	PDO	0	-	-	R
Monitor (0/1) of the status of signal Digital output 6.									
16.27	3252	Digital output 7 mon	-	UINT16	PDO	0	-	-	R
Monitor (0/1) of the status of signal Digital output 7.									
16.28	3254	Digital output 8 mon	-	UINT16	PDO	0	-	-	R
Monitor (0/1) of the status of signal Digital output 8.									
16.29	3256	Relay 1 mon	-	UINT16	PDO	0	-	-	R
Monitor (0/1) of the status of the Relay 1 signal.									
16.30	3258	Relay 2 mon	-	UINT16	PDO	0	-	-	R
Monitor (0/1) of the status of the Relay 2 signal.									

17 ANALOG INPUTS

17.1 ANALOG INPUT 1

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
17.1.1	3400	An input 1 dest	-	Enum	SDO	Ramp ref 1	0	28	RWZ
		Selection of the parameter whose value must be received from analogue input 1.							
17.1.2	3402	An input 1 type	-	Enum	SDO	-10V+10V	0	2	RWZ
		Selection of the input type (voltage or current).							
17.1.3	3404	An input 1 scale	-	FLOAT	SDO	1.0	-10.0	10.0	RW
		Scaling factor of analogue input 1.							
17.1.4	3406	An input 1 offset	cnt	INT16	PDO	0	-2048	2047	RW
		Allows compensation of a small offset on analogue signal 1.							
17.1.5	3408	An input 1 sign	-	Enum	PDO	Positive	0	1	RW
		Sign reversal command in the case of a unipolar input signal on analogue signal 1.							
17.1.6	3410	An input 1 sign mon	-	Enum	PDO	Positive	-	-	R
		Monitor of the sign reversal command of analogue signal 1.							
17.1.7	3412	An input 1 filter	ms	FLOAT	PDO	10.0	0.0	1000.0	RW
		Time constant of the low-pass filter applied to the measurement of analogue input signal 1.							
17.1.8	3414	An input 1 autotune	-	BIT	-	0	0	1	RW
		Command to perform automatic fine tuning of analogue input 1.							
17.1.9	3416	An input 1 tune val	-	FLOAT	SDO	1.0	-10.0	10.0	RW
		Gain acting in cascade with IPA 3404-An input 1 scale for fine calibration of analogue input 1.							
17.1.10	3418	An input 1 enable	-	BIT	PDO	1	0	1	RW
		Command to enable analogue input 1.							
17.1.11	3420	An input 1 en mon	-	BIT	PDO	1	-	-	R
		Analogue input 1 enable command monitor.							
17.1.12	3422	An input 1 cmp thr	-	FLOAT	SDO	CALC	-10000	10000	RW
		Analogue input 1 comparison function intervention threshold.							
17.1.13	3424	An input 1 cmp error	-	FLOAT	SDO	CALC	0	10000	RW
		Tolerance band for analogue input 1 comparison function.							
17.1.14	3426	An input 1 cmp delay	ms	UINT16	SDO	0	0	65000	RW
		Delay on the signal indicating that the analogue input 1 comparison level has been reached.							
17.1.15	3428	An input 1 mon	cnt	INT16	PDO	0	-	-	R
		Monitor in count of analogue input 1 signal, after A/D conversion, filtering and offset application.							

17.2 ANALOG INPUT 2

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
17.2.1	3430	An input 2 dest	-	Enum	SDO	OFF	0	28	RWZ
		Selection of the parameter whose value must be received from analogue input 2.							
17.2.2	3432	An input 2 type	-	Enum	SDO	-10V+10V	0	2	RWZ
		Selects the input type (voltage or current).							
17.2.3	3434	An input 2 scale	-	FLOAT	SDO	1.0	-10.0	10.0	RW
		Scaling factor for analogue input 2.							
17.2.4	3436	An input 2 offset	cnt	INT16	PDO	0	-2048	2047	RW
		Allows compensation of an offset contained in analogue signal 2.							
17.2.5	3438	An input 2 sign	-	Enum	PDO	Positive	0	1	RW
		Sign reversal command in the case of a unipolar input signal on analogue signal 2.							

17.2.6	3440	An input 2 sign mon	-	Enum	PDO	Positive	-	-	R
Monitor of the sign reversal command of analogue signal 2.									
17.2.7	3442	An input 2 filter	ms	FLOAT	SDO	10.0	0.0	1000.0	RW
Time constant of the low-pass filter applied to the measurement of analogue input signal 2.									
17.2.8	3444	An input 2 autotune	-	BIT	-	0	0	1	RW
Command to perform automatic fine tuning of analogue input 2.									
17.2.9	3446	An input 2 tune val	-	FLOAT	SDO	1.0	-10.0	10.0	RW
Gain acting in cascade with IPA 3404-An input 1 scale for fine calibration of analogue input 2.									
17.2.10	3448	An input 2 enable	-	BIT	PDO	1	0	1	RW
Command to enable analogue input 2.									
17.2.11	3450	An input 2 en mon	-	BIT	PDO	1	-	-	R
Analogue input 2 enable command monitor.									
17.2.12	3458	An input 2 mon	cnt	INT16	PDO	0	-	-	R
Monitor in count of analogue input 2 signal, after A/D conversion, filtering and offset application.									

17.3 ANALOG INPUT 3

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
17.3.1	3460	An input 3 dest	-	Enum	SDO	OFF	0	19	RWZ
Selection of the parameter whose value must be received from analogue input 3.									
17.3.2	3462	An input 3 type	-	Enum	SDO	-10V+10V	0	2	RWZ
Selects the input type (voltage or current).									
17.3.3	3464	An input 3 scale	-	FLOAT	SDO	1.0	-10.0	10.0	RW
Scaling factor for analogue input 3.									
17.3.4	3466	An input 3 offset	cnt	INT16	PDO	0	-2048	2047	RW
Allows compensation of an offset contained in analogue signal 3.									
17.3.5	3468	An input 3 sign	-	Enum	PDO	Positive	0	1	RW
Sign reversal command in the case of a unipolar input signal on analogue signal 3.									
17.3.6	3470	An input 3 sign mon	-	Enum	PDO	Positive	-	-	R
Monitor for the sign reversal command of analogue signal 3.									
17.3.7	3472	An input 3 filter	ms	FLOAT	SDO	10.0	0.0	1000.0	RW
Time constant of the low-pass filter applied to the measurement of analogue input signal 3.									
17.3.8	3474	An input 3 autotune	-	BIT	-	0	0	1	RW
Command to perform automatic fine tuning of analogue input 3.									
17.3.9	3476	An input 3 tune val	-	FLOAT	SDO	1.0	-10.0	10.0	RW
Gain acting in cascade with IPA 3404-An input 1 scale for fine calibration of analogue input 3.									
17.3.10	3478	An input 3 enable	-	BIT	PDO	1	0	1	RW
Command to enable analogue input 3.									
17.3.11	3480	An input 3 en mon	-	BIT	PDO	1	-	-	R
Analogue input 3 enable command monitor.									
17.3.12	3488	An input 3 mon	cnt	INT16	PDO	0	-	-	R
Monitor in count of analogue input 3 signal, after A/D conversion, filtering and offset application.									

18 ANALOG OUTPUTS

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
18.1	3500	An output 1 sel	-	Enum	SDO	Motor speed nofilt	0	96	RW
Selection of the variable to be assigned to Analog output 1.									
18.2	3502	An output 1 scale	-	FLOAT	SDO	1.0	-10.0	10.0	RW

Analogue output 1 scale factor.									
18.3	3504	An output 1 offset	cnt	INT16	SDO	0	-100	100	RW
Analogue output 1 offset compensation.									
18.4	3510	An output 2 sel	-	Enum	SDO	Arm curr nofilt	0	96	RW
Variable selection to be assigned to Analog output 2.									
18.5	3512	An output 2 scale	-	FLOAT	SDO	1.0	-10.0	10.0	RW
Analogue output 2 scale factor.									
18.6	3514	An output 2 offset	cnt	INT16	SDO	0	-100	100	RW
Analogue output 2 offset compensation.									
18.7	3520	An output 3 sel	-	Enum	SDO	Field current	0	96	RW
Variable selection to be assigned to Analog output 3.									
18.8	3522	An output 3 scale	-	FLOAT	SDO	1.0	-10.0	10.0	RW
Analogue output 3 scale factor.									
18.9	3524	An output 3 offset	cnt	INT16	SDO	0	-100	100	RW
Analogue output 3 offset compensation.									
18.10	3530	An output 4 sel	-	Enum	SDO	Armature voltage	0	96	RW
Selection of the variable to be assigned to Analog output 4.									
18.11	3532	An output 4 scale	-	FLOAT	SDO	1.0	-10.0	10.0	RW
Analogue output 4 scale factor.									
18.12	3534	An output 4 offset	cnt	INT16	SDO	0	-100	100	RW
Analogue output 4 offset compensation.									

19 FUNCTIONS

19.1 MOTORPOT

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
19.1.1	4000	Motorpot enable	-	BIT	SDO	0	0	1	RWZ
Motor potentiometer function enable.									
19.1.2	4002	Motorpot setpoint	rpm	INT16	-	0	0	0	R
Motor potentiometer output speed, which can be increased or decreased by applying the Up/Down commands.									
19.1.3	4004	Motorpot invert	-	BIT	PDO	0	0	1	RW
Motor potentiometer output inversion command.									
19.1.4	4006	Motorpot invert mon	-	BIT	PDO	0	0	0	R
Monitor of the motor potentiometer output reversal command.									
19.1.5	4008	Motorpot bottom lim	rpm	FLOAT	SDO	0	CALC	CALC	RW
Lower limit of the motor potentiometer output speed.									
19.1.6	4010	Motorpot top lim	rpm	FLOAT	SDO	1500	CALC	CALC	RW
Upper limit of the motor potentiometer output speed.									
19.1.7	4012	Motorpot acc time	s	UINT16	SDO	10	0	65535	RW
Acceleration time of the motor potentiometer ramp, between the lower limit and the upper limit.									
19.1.8	4014	Motorpot dec time	s	UINT16	SDO	10	0	65535	RW
Deceleration time of the motor potentiometer ramp, between the upper limit and the lower limit.									
19.1.9	4016	Motorpot mode	-	Enum	SDO	Ramp & Last Val	0	3	RW
Setting the motor potentiometer operating mode.									
19.1.10	4018	Motorpot powerOn cfg	-	Enum	SDO	Bottom lim	0	3	RW
Allows you to select the initial value of the Motorpot output when the drive is turned on.									
19.1.11	4020	Motorpot preset cfg	-	Enum	SDO	None	0	11	RW
Allows you to enable the preset command to act in various ways on the output speed of the Motorpot.									

19.1.12	4022	Motorpot out	rpm	FLOAT	PDO	0	-	-	R
Monitor of the motor potentiometer output, at the input of the ramp reference chain after the multispeed function and before the FWD/REV logic.									

19.2 JOG

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
19.2.1	4050	Jog enable	-	Enum	SDO	OFF	0	1	RWZ
Jog function enable.									
19.2.2	4052	Jog ref dig	rpm	FLOAT	PDO	0	0	8191	RW
Ramp or speed reference for the Jog function.									
19.2.3	4054	Jog ref mon	rpm	FLOAT	PDO	0	-	-	R
Monitor of the ramp or speed reference of the Jog function.									
19.2.4	4056	Jog selection	-	Enum	Enum	Speed input	0	1	RWZ
Allows you to select the action mode of the Jog function.									
19.2.5	4058	Jog output	rpm	INT16	PDO	0	-	-	R
Monitor of the output of the Jog function.									

19.3 MULTI SPEED

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
19.3.1	4150	Multi speed enable	-	Enum	SDO	OFF	0	1	RWZ
Multispeed function enabled.									
19.3.2	4152	Multi speed 1	rpm	FLOAT	PDO	0	-8191	8191	RW
Speed 1 can be used as ramp reference.									
19.3.3	4154	Multi speed 2	rpm	FLOAT	PDO	0	-8191	8191	RW
Speed 2 can be used as ramp reference.									
19.3.4	4156	Multi speed 3	rpm	FLOAT	PDO	0	-8191	8191	RW
Speed 3 can be used as ramp reference.									
19.3.5	4158	Multi speed 4	rpm	FLOAT	PDO	0	-8191	8191	RW
Speed 4 can be used as ramp reference.									
19.3.6	4160	Multi speed 5	rpm	FLOAT	PDO	0	-8191	8191	RW
Speed 5 can be used as ramp reference.									
19.3.7	4162	Multi speed 6	rpm	FLOAT	PDO	0	-8191	8191	RW
Speed 6 can be used as ramp reference.									
19.3.8	4164	Multi speed 7	rpm	FLOAT	PDO	0	-8191	8191	RW
Speed 7 can be used as ramp reference.									
19.3.9	4166	Multi speed sel	-	UINT16	PDO	0	0	7	RW
Desired speed selector.									
19.3.10	4168	Multi speed sel mon	-	UINT16	PDO	0	-	-	R
Desired speed selector monitor.									

19.4 MULTI RAMP

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
19.4.1	4200	Multi ramp enable	-	Enum	SDO	OFF	0	1	RWZ
Multi ramp function enable.									
19.4.2	4202	Multi ramp sel	-	UINT16	PDO	1	1	4	RW
Desired multi ramp set selector.									
19.4.3	4204	Multi ramp sel mon	-	UINT16	PDO	0	-	-	R

Monitor of the desired multi ramp set selector.								
19.4.4	4210	Acc speed 1	rpm	UINT32	SD0	100	1	65535 RW
Acceleration speed of linear ramp set 1.								
19.4.5	4220	Acc time 1	s	UINT16	SD0	1	0	65535 RW
Acceleration time of ramp set 1.								
19.4.6	4230	Acc time jerk 1	ms	FLOAT	SD0	300	20	15000 RW
Jerk time in acceleration of ramp S set 1.								
19.4.7	4240	Dec speed 1	rpm	UINT32	SD0	100	1	65535 RW
Linear ramp deceleration speed set 1.								
19.4.8	4250	Dec time 1	s	UINT16	SD0	1	0	65535 RW
Linear ramp deceleration time set 1.								
19.4.9	4260	Dec time jerk 1	ms	FLOAT	SD0	300	20	15000 RW
Jerk time during S ramp deceleration set 1.								
19.4.10	4212	Acc speed 2	rpm	UINT32	SD0	100	1	65535 RW
Acceleration speed of linear ramp set 2.								
19.4.11	4222	Acc time 2	s	UINT16	SD0	1	0	65535 RW
Acceleration time of ramp set 2.								
19.4.12	4232	Acc time jerk 2	ms	FLOAT	SD0	300	20	15000 RW
Jerk time during acceleration of S ramp set 2.								
19.4.13	4242	Dec speed 2	rpm	UINT32	SD0	100	1	65535 RW
Linear ramp deceleration speed set 2.								
19.4.14	4252	Dec time 2	s	UINT16	SD0	1	0	65535 RW
Linear ramp deceleration time set 2.								
19.4.15	4262	Dec time jerk 2	ms	FLOAT	SD0	300	20	15000 RW
Deceleration jerk time of ramp S set 2.								
19.4.16	4214	Acc speed 3	rpm	UINT32	SD0	100	1	65535 RW
Acceleration speed of linear ramp set 3.								
19.4.17	4224	Acc time 3	s	UINT16	SD0	1	0	65535 RW
Acceleration time of ramp set 3.								
19.4.18	4234	Acc time jerk 3	ms	FLOAT	SD0	300	20	15000 RW
Jerk time during acceleration of ramp S set 3.								
19.4.19	4244	Dec speed 3	rpm	UINT32	SD0	100	1	65535 RW
Linear ramp deceleration speed set 3.								
19.4.20	4254	Dec time 3	s	UINT16	SD0	1	0	65535 RW
Linear ramp deceleration time set 3.								
19.4.21	4264	Dec time jerk 3	ms	FLOAT	SD0	300	20	15000 RW
Jerk time during S ramp deceleration set 3.								
19.4.22	4216	Acc speed 4	rpm	UINT32	SD0	100	1	65535 RW
Acceleration speed of linear ramp set 4.								
19.4.23	4226	Acc time 4	s	UINT16	SD0	1	0	65535 RW
Acceleration time of ramp set 4.								
19.4.24	4236	Acc time jerk 4	ms	FLOAT	SD0	300	20	15000 RW
Jerk time during acceleration of ramp S set 4.								
19.4.25	4246	Dec speed 4	rpm	UINT32	SD0	100	1	65535 RW
Linear ramp deceleration speed set 4.								
19.4.26	4256	Dec time 4	s	UINT16	SD0	1	0	65535 RW
Linear ramp deceleration time set 4.								
19.4.27	4266	Dec time jerk 4	ms	FLOAT	SD0	300	20	15000 RW

19.5 THRESHOLDS

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
19.5.1	812	Speed 0 level	rpm	UINT16	SDO	10	1	8191	RW
		Speed threshold for Speed 0 thr signal.							
19.5.2	814	Speed 0 delay	ms	UINT16	SDO	100	0	65535	RW
		Time delay for Speed 0 thr signal.							
19.5.3	816	Speed thr pos	rpm	UINT16	SDO	10	0	8191	RW
		Positive speed threshold for Speed threshold signal.							
19.5.4	818	Speed thr neg	rpm	UINT16	SDO	10	0	8191	RW
		Negative speed threshold for Speed threshold signal.							
19.5.5	820	Speed thr delay	ms	UINT16	SDO	100	0	65535	RW
		Time delay for the Speed threshold signal.							
19.5.6	822	Speed set error	rpm	UINT16	SDO	10	1	8191	RW
		Speed threshold for the Speed set signal.							
19.5.7	824	Speed set delay	ms	UINT16	SDO	100	0	65535	RW
		Time delay for Speed set signal.							
19.5.8	1012	Arm curr thr	%	FLOAT	SDO	100	0	150	RW
		Current threshold for Arm curr threshold signal, expressed as a percentage of the motor's rated armature current.							
19.5.9	1018	Arm curr thr delay	ms	UINT16	SDO	1000	0	65535	RW
		Time delay for Arm curr threshold signal.							

19.6 DROOP

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
19.6.1	4400	Droop enable	-	BIT	PDO	0	0	1	RW
		Droop function enable.							
19.6.2	4402	Droop enable mon	-	BIT	PDO	0	-	-	R
		Droop function enable parameter monitor.							
19.6.3	4404	Droop gain	rpm/A	FLOAT	SDO	0	0	100	RW
		Proportional gain of the Droop function.							
19.6.4	4406	Droop filter	ms	UINT16	SDO	0	0	1000	RW
		Time constant of the low-pass filter applied between the gain and the output limitation block of the Droop function.							
19.6.5	4408	Droop limit	rpm	UINT16	SDO	1500	0	8191	RW
		Maximum absolute value that the Droop out mon output can assume.							
19.6.6	4410	Load comp dig	%	FLOAT	PDO	0	-150	150	RW
		Current value supplied by the Master drive (see fig. below), expressed as a percentage of the motor's rated armature current.							
19.6.7	4412	Load comp mon	%	FLOAT	PDO	0	-	-	R
		Monitor of the current supplied by the Master drive, expressed as a percentage of the motor's rated armature current.							
19.6.8	4414	Droop out mon	rpm	FLOAT	PDO	0	-	-	R
		Monitor of the output of the Droop function.							

19.7 SPEED DRAW

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
19.7.1	4350	Speed draw ratio dig	-	FLOAT	PDO	1.0	0	4	RW
		Setting of the scale factor in action at the ramp output, with resolution 0.0001.							

19.7.2	4352	Speed draw ratio mon	-	FLOAT	PDO	0	-	-	R
Monitor of the scale factor in action at the ramp output.									
19.7.3	4354	Speed draw out	rpm	FLOAT	PDO	0	-	-	R
Monitor of the speed reference at the output of the Speed draw function, after application of the scale factor.									

19.8 OVERLOAD

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
19.8.1	4300	Overload mode	-	Enum	SD0	None	0	3	RWZ
Overload type selection.									
19.8.2	4302	Motor ventilation	-	Enum	SD0	Servo fan	0	1	RWZ
Motor ventilation type selection.									
19.8.3	4304	Motor derating	%	UINT16	SD0	50	0	100	RWZ
Derating factor when Motor ventilation = Auto fan.									
19.8.4	4306	Motor I2t time	s	UINT16	SD0	30	0	540	RWZ
Allows you to set the time for defining the motor I2t overload in case Overload mode = I2t Drive and Motor. Represents the maximum time during which the Motor I2t current is allowed.									
19.8.5	4308	Motor I2t current	%	FLOAT	SD0	100	80	CALC	RWZ
Allows you to set the current level to define the I2t overload of the motor when Overload mode = I2t Drive and Motor. Represents the maximum armature current allowed during Motor I2t time.									
19.8.6	4310	Motor I2t lim curr	%	FLOAT	SD0	100	0	100.01	RW
Allows you to set the current limit when the motor overload condition Motor I2t accum = 100% is reached.									
19.8.7	4312	Motor I2t alert	-	UINT16	PDO	0	-	-	R
Monitor used to signal that the Motor I2t accum parameter has reached the value 80%.									
19.8.8	4314	Motor I2t accum	%	FLOAT	PDO	0	-	-	R
Monitor of the status of the motor I2t accumulator, which represents an indication of how close the drive is to the motor overload condition.									
19.8.9	4316	Drive I2t time	s	FLOAT	SD0	60	1	100	RWZ
Allows you to set the time for defining the drive I2t overload in Control Unit configuration if Overload mode = I2t drive or I2t Drive and Motor.									
19.8.10	4318	Drive I2t current	%	FLOAT	SD0	100	100	CALC	RWZ
Allows you to set the current to define the I2t overload of the drive in Control Unit configuration when Overload mode = I2t drive or I2t Drive and Motor.									
19.8.11	4320	Drive I2t alert	-	UINT16	PDO	0	-	-	R
Monitor used to signal that the Drive I2t accum parameter has reached 80%.									
19.8.12	4322	Drive I2t accum	%	FLOAT	PDO	0	-	-	R
Monitor of the status of the drive's I2t accumulator, which indicates how close the drive is to overload condition.									
19.8.13	4324	C/T overload lim mon	%	FLOAT	PDO	0	-	-	R
Monitor of the current limit imposed by the cascade overload function on the other limiting contributions.									

19.9 C/T SPEED LIMIT

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
19.9.1	1150	C/T speed lim enable	-	BIT	SD0	0	0	1	RWZ
Enabling of armature current limits based on speed.									
19.9.2	1152	C/T speed lim 0	%	FLOAT	SD0	100.0	0	CALC	RWZ
Current limit 0, as a percentage of the motor armature rated current.									
19.9.3	1154	C/T speed lim 1	%	FLOAT	SD0	80.0	0	CALC	RWZ
Current limit 1, as a percentage of the motor's rated armature current.									
19.9.4	1156	C/T speed lim 2	%	FLOAT	SD0	60.0	0	CALC	RWZ
Current limit 2, as a percentage of the motor's rated armature current.									
19.9.5	1158	C/T speed lim 3	%	FLOAT	SD0	40.0	0	CALC	RWZ

Current limit 3, as a percentage of the motor's rated armature current.									
19.9.6	1160	C/T speed lim 4	%	FLOAT	SDO	20.0	0	CALC	RWZ
Current limit 4, as a percentage of the motor's rated armature current.									
19.9.7	1162	C/T speed lim thr 0	rpm	FLOAT	SDO	CALC	0	6500	RWZ
Speed threshold 0.									
19.9.8	1164	C/T speed lim thr 1	rpm	FLOAT	SDO	CALC	0	6500	RWZ
Speed threshold 1.									
19.9.9	1166	C/T speed lim thr 2	rpm	FLOAT	SDO	CALC	0	6500	RWZ
Speed threshold 2.									
19.9.10	1168	C/T speed lim thr 3	rpm	FLOAT	SDO	CALC	0	6500	RWZ
Speed threshold 3.									
19.9.11	1170	C/T speed lim thr 4	rpm	FLOAT	SDO	CALC	0	6500	RWZ
Speed threshold 4.									
19.9.12	1172	C/T speed lim in use	%	FLOAT	PDO	0	-	-	R
Monitor of the current limit imposed by the function, as a percentage of the motor's rated armature current.									

19.10 BRAKE CONTROL

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
19.10.1	4100	Brake control enable	-	Enum	SDO	OFF	0	1	RWZ
Enables brake control function.									
19.10.2	4102	Fwd open C/T thr	%	FLOAT	SDO	0	0	150	RW
Current threshold for opening the brake in the forward direction, expressed as a percentage of the motor's rated armature current.									
19.10.3	4104	Fwd open speed thr	rpm	UINT16	SDO	10	0	CALC	RW
Speed threshold for opening the brake in the forward direction.									
19.10.4	4106	Fwd open speed ref	rpm	UINT16	SDO	20	0	CALC	RW
Speed reference for opening the brake in the forward direction.									
19.10.5	4108	Fwd close speed thr	rpm	UINT16	SDO	20	0	CALC	RW
Speed threshold for closing the brake in the forward direction.									
19.10.6	4110	Rev open C/T thr	%	FLOAT	SDO	0	0	150	RW
Current threshold for opening the brake in the reverse direction, expressed as a percentage of the motor's rated armature current.									
19.10.7	4112	Rev open speed thr	rpm	UINT16	SDO	10	0	CALC	RW
Speed threshold for opening the brake in reverse direction.									
19.10.8	4114	Rev open speed ref	rpm	UINT16	SDO	20	0	CALC	RW
Speed reference for opening the brake in Reverse direction.									
19.10.9	4116	Rev close speed thr	rpm	UINT16	SDO	20	0	CALC	RW
Speed threshold for closing the brake in Reverse direction.									
19.10.10	4134	Brake ramp acc time	s	UINT16	SDO	2	1	65535	RW
Ramp acceleration time during the brake opening phase.									
19.10.11	4118	Brake pretorque dig	%	FLOAT	PDO	50	0	150	RW
Torque level injected at the moment the brake is opened, expressed as a percentage of the motor's rated armature current.									
19.10.12	4120	Brake pretorque mon	%	FLOAT	PDO	0	-	-	R
Monitor of the torque injected at the moment the brake is released.									
19.10.13	4136	Brake pretorque time	ms	UINT16	SDO	10	0	10000	RW
Ramp time, used for the gradual increase of the torque to be injected at the moment the brake is released, from 0 to 100% of the motor's rated armature current.									
19.10.14	4122	Brake open delay	ms	UINT16	SDO	50	0	10000	RW
Delay in opening the brake after the relevant threshold is exceeded.									
19.10.15	4138	Brake ramp delay	ms	UNIT 16	SDO	0	0	10000	RW

Speed reference freeze time at the Fwd/Rev open speed ref value after completion of the pretorque phase.									
19.10.16	4124	Brake disable delay	ms	UINT16	SDO	50	0	10000	RW
Delay in disabling the drive after the brake is closed during stopping.									
19.10.17	4126	Brake fbk type	-	Enum	SDO	None	0	2	RW
Selection of brake feedback type.									
19.10.18	4128	Brake fbk time	ms	UINT16	SDO	0	0	10000	RW
Maximum time allowed between sending the brake release command and receiving the feedback signal. If, at the end of the maximum time set, the feedback signal is not consistent with the command signal, the drive signals the Brake fault alarm.									
19.10.19	4130	Brake fbk mon	-	UINT16	PDO	0	-	-	R
Brake feedback status monitor.									
19.10.20	4132	Brake cmd mon	-	UINT16	PDO	0	-	-	R
Brake open/close command status monitor.									
19.10.21	4148	Brake control state	-	Enum	PDO	Wait for start	-	-	R
Brake control function status monitor.									

19.11 TEST GENERATOR

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
19.11.1	4450	Test gen dest	-	Enum	SDO	OFF	0	4	RWZ
Allows you to select the destination of the generated waveform to simulate certain reference signals for speed, current or field control.									
19.11.2	4452	Test gen frequency	Hz	FLOAT	SDO	0.1	0.1	62.5	RW
Frequency of the generated waveform.									
19.11.3	4454	Test gen amplitude	%	FLOAT	SDO	0	0	200	RW
Amplitude of the generated waveform, as a percentage of the full scale of the selected quantity.									
19.11.4	4456	Test gen offset	%	FLOAT	SDO	0	-200	200	RW
Offset of the generated waveform, as a percentage of the full scale of the selected quantity.									
19.11.5	4458	Test gen out	-	FLOAT	PDO	0	-	-	R
Instantaneous monitoring of the value of the generated waveform.									

19.12 LINK 1

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
19.12.1	4650	Link 1 source	-	UINT16	SDO	0	0	9999	RW
IPA parameter source Link 1.									
19.12.2	4652	Link 1 destination	-	UINT16	SDO	0	0	9999	RW
IPA parameter destination Link 1.									
19.12.3	4654	Link 1 mul gain	-	FLOAT	SDO	1.0	-10000	10000	RW
Link 1 source multiplication factor.									
19.12.4	4656	Link 1 div gain	-	FLOAT	SDO	1.0	-10000	10000	RW
Link 1 source divider.									
19.12.5	4658	Link 1 input max	-	FLOAT	SDO	99999	-99999	99999	RW
Maximum value of Link 1 source.									
19.12.6	4660	Link 1 input min	-	FLOAT	SDO	0	-99999	99999	RW
Minimum value of Link 1 source.									
19.12.7	4662	Link 1 input offset	-	FLOAT	SDO	0	-10000	10000	RW
Offset on Link 1 source.									
19.12.8	4664	Link 1 output offset	-	FLOAT	SDO	0	-10000	10000	RW
Offset on Link 1 destination.									
19.12.9	4666	Link 1 input abs	-	Enum	SDO	OFF	0	1	RW

Enable absolute value applicable to Link 1 source.

19.13 LINK 2

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
19.13.1	4670	Link 2 source	-	UINT16	SDO	0	0	9999	RW
		IPA parameter source Link 2.							
19.13.2	4672	Link 2 destination	-	UINT16	SDO	0	0	9999	RW
		IPA parameter destination Link 2.							
19.13.3	4674	Link 2 mul gain	-	FLOAT	SDO	1.0	-10000	10000	RW
		Link 2 source multiplication factor.							
19.13.4	4676	Link 2 div gain	-	FLOAT	SDO	1.0	-10000	10000	RW
		Link 2 source divider.							
19.13.5	4678	Link 2 input max	-	FLOAT	SDO	99999	-99999	99999	RW
		Maximum value of Link 2 source.							
19.13.6	4680	Link 2 input min	-	FLOAT	SDO	0	-99999	99999	RW
		Minimum value of Link 2 source.							
19.13.7	4682	Link 2 input offset	-	FLOAT	SDO	0	-10000	10000	RW
		Offset on Link 2 source.							
19.13.8	4684	Link 2 output offset	-	FLOAT	SDO	0	-10000	10000	RW
		Offset on Link 2 destination.							
19.13.9	4686	Link 2 input abs	-	Enum	SDO	OFF	0	1	RW
		Enabling the absolute value applicable to the Link 2 source.							

19.14 LINK 3

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
19.14.1	4690	Link 3 source	-	UINT16	SDO	0	0	9999	RW
		IPA parameter source Link 3.							
19.14.2	4692	Link 3 destination	-	UINT16	SDO	0	0	9999	RW
		IPA parameter destination Link 3.							
19.14.3	4694	Link 3 mul gain	-	FLOAT	SDO	1.0	-10000	10000	RW
		Link 3 source multiplication factor.							
19.14.4	4696	Link 3 div gain	-	FLOAT	SDO	1.0	-10000	10000	RW
		Link 3 source divider.							
19.14.5	4698	Link 3 input max	-	FLOAT	SDO	99999	-99999	99999	RW
		Link 3 source maximum value.							
19.14.6	4700	Link 3 input min	-	FLOAT	SDO	0	-99999	99999	RW
		Minimum value of Link 3 source.							
19.14.7	4702	Link 3 input offset	-	FLOAT	SDO	0	-10000	10000	RW
		Offset on Link 3 source.							
19.14.8	4704	Link 3 output offset	-	FLOAT	SDO	0	-10000	10000	RW
		Offset on Link 3 destination.							
19.14.9	4706	Link 3 input abs	-	Enum	SDO	OFF	0	1	RW
		Enable absolute value applicable to Link 3 source.							

19.15 LINK 4

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
19.15.1	4710	Link 4 source	-	UINT16	SDO	0	0	9999	RW
		IPA parameter source Link 4.							
19.15.2	4712	Link 4 destination	-	UINT16	SDO	0	0	9999	RW
		IPA parameter destination Link 4.							
19.15.3	4714	Link 4 mul gain	-	FLOAT	SDO	1.0	-10000	10000	RW
		Link 4 source multiplication factor.							
19.15.4	4716	Link 4 div gain	-	FLOAT	SDO	1.0	-10000	10000	RW
		Link 4 source divider.							
19.15.5	4718	Link 4 input max	-	FLOAT	SDO	99999	-99999	99999	RW
		Link 4 source maximum value.							
19.15.6	4720	Link 4 input min	-	FLOAT	SDO	0	-99999	99999	RW
		Link 4 source minimum value.							
19.15.7	4722	Link 4 input offset	-	FLOAT	SDO	0	-10000	10000	RW
		Offset on Link 4 source.							
19.15.8	4724	Link 4 output offset	-	FLOAT	SDO	0	-10000	10000	RW
		Offset on Link 4 destination.							
19.15.9	4726	Link 4 input abs	-	Enum	SDO	OFF	0	1	RW
		Enabling the absolute value applicable to the Link 4 source.							

19.16 LINK 5

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
19.16.1	4730	Link 5 source	-	UINT16	SDO	0	0	9999	RW
		IPA parameter source Link 5.							
19.16.2	4732	Link 5 destination	-	UINT16	SDO	0	0	9999	RW
		IPA parameter destination Link 5.							
19.16.3	4734	Link 5 mul gain	-	FLOAT	SDO	1.0	-10000	10000	RW
		Link 5 source multiplication factor.							
19.16.4	4736	Link 5 div gain	-	FLOAT	SDO	1.0	-10000	10000	RW
		Link 5 source divider.							
19.16.5	4738	Link 5 input max	-	FLOAT	SDO	99999	-99999	99999	RW
		Link 5 source maximum value.							
19.16.6	4740	Link 5 input min	-	FLOAT	SDO	0	-99999	99999	RW
		Minimum value of Link 5 source.							
19.16.7	4742	Link 5 input offset	-	FLOAT	SDO	0	-10000	10000	RW
		Offset on Link 5 source.							
19.16.8	4744	Link 5 output offset	-	FLOAT	SDO	0	-10000	10000	RW
		Offset on Link 5 destination.							
19.16.9	4746	Link 5 input abs	-	Enum	SDO	OFF	0	1	RW
		Enable absolute value applicable to Link 5 source.							

19.17 LINK 6

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
19.17.1	4750	Link 6 source	-	UINT16	SDO	0	0	9999	RW
		IPA parameter source Link 6.							

19.17.2	4752	Link 6 destination	-	UINT16	SDO	0	0	9999	RW
IPA parameter destination Link 6.									
19.17.3	4754	Link 6 mul gain	-	FLOAT	SDO	1.0	-10000	10000	RW
Link 6 source multiplication factor.									
19.17.4	4756	Link 6 div gain	-	FLOAT	SDO	1.0	-10000	10000	RW
Link 6 source divider.									
19.17.5	4758	Link 6 input max	-	FLOAT	SDO	99999	-99999	99999	RW
Link 6 source maximum value.									
19.17.6	4760	Link 6 input min	-	FLOAT	SDO	0	-99999	99999	RW
Minimum value of Link 6 source.									
19.17.7	4762	Link 6 input offset	-	FLOAT	SDO	0	-10000	10000	RW
Offset on Link 6 source.									
19.17.8	4764	Link 6 output offset	-	FLOAT	SDO	0	-10000	10000	RW
Offset on destination Link 6.									
19.17.9	4766	Link 6 input abs	-	Enum	SDO	OFF	0	1	RW
Enabling the absolute value applicable to the source of Link 6.									

19.18 PAD PARAMETERS

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
19.18.1	4500	Pad 0	-	FLOAT	PDO	0	-32768	32767	RW
Pad 0 value.									
19.18.2	4502	Pad 1	-	FLOAT	PDO	0	-32768	32767	RW
Pad 1 value.									
19.18.3	4504	Pad 2	-	FLOAT	PDO	0	-32768	32767	RW
Pad 2 value.									
19.18.4	4506	Pad 3	-	FLOAT	PDO	0	-32768	32767	RW
Pad 3 value.									
19.18.5	4508	Pad 4	-	FLOAT	PDO	0	-32768	32767	RW
Pad 4 value.									
19.18.6	4510	Pad 5	-	FLOAT	PDO	0	-32768	32767	RW
Pad 5 value.									
19.18.7	4512	Pad 6	-	FLOAT	PDO	0	-32768	32767	RW
Pad 6 value.									
19.18.8	4514	Pad 7	-	FLOAT	PDO	0	-32768	32767	RW
Pad 7 value.									
19.18.9	4516	Pad 8	-	INT16	PDO	0	-32768	32767	RW
Pad 8 value.									
19.18.10	4518	Pad 9	-	INT16	PDO	0	-32768	32767	RW
Pad 9 value.									
19.18.11	4520	Pad 10	-	INT16	PDO	0	-32768	32767	RW
Pad 10 value.									
19.18.12	4522	Pad 11	-	INT16	PDO	0	-32768	32767	RW
Pad 11 value.									
19.18.13	4524	Pad 12	-	INT16	PDO	0	-32768	32767	RW
Pad 12 value.									
19.18.14	4526	Pad 13	-	INT16	PDO	0	-32768	32767	RW
Pad 13 value.									

19.18.15	4528	Pad 14	-	INT16	PDO	0	-32768	32767	RW
		Pad 14 value.							
19.18.16	4530	Pad 15	-	INT16	PDO	0	-32768	32767	RW
		Pad 15 value.							
19.18.17	4550	Bitword Pad A	-	UINT16	PDO	0	0	65535	RW
		Value of Pad A bit.							
19.18.18	4552	Pad A bit 0	-	BIT	PDO	0	0	1	RW
		Setting and monitoring of Pad A bit - bit 0.							
19.18.19	4554	Pad A bit 1	-	BIT	PDO	0	0	1	RW
		Setting and monitoring of bit A pad - bit 1.							
19.18.20	4556	Pad A bit 2	-	BIT	PDO	0	0	1	RW
		Setting and monitoring of bit A pad - bit 2.							
19.18.21	4558	Pad A bit 3	-	BIT	PDO	0	0	1	RW
		Setting and monitoring of bit A pad - bit 3.							
19.18.22	4560	Pad A bit 4	-	BIT	PDO	0	0	1	RW
		Setting and monitoring of bit A pad - bit 4.							
19.18.23	4562	Pad A bit 5	-	BIT	PDO	0	0	1	RW
		Setting and monitoring of bit A pad - bit 5.							
19.18.24	4564	Pad A bit 6	-	BIT	PDO	0	0	1	RW
		Setting and monitoring of bit A pad - bit 6.							
19.18.25	4566	Pad A bit 7	-	BIT	PDO	0	0	1	RW
		Setting and monitoring of bit A pad - bit 7.							
19.18.26	4568	Pad A bit 8	-	BIT	PDO	0	0	1	RW
		Setting and monitoring of bit A pad - bit 8.							
19.18.27	4570	Pad A bit 9	-	BIT	PDO	0	0	1	RW
		Setting and monitoring of bit A pad - bit 9.							
19.18.28	4572	Pad A bit 10	-	BIT	PDO	0	0	1	RW
		Setting and monitoring of bit A pad - bit 10.							
19.18.29	4574	Pad A bit 11	-	BIT	PDO	0	0	1	RW
		Setting and monitoring of bit A pad - bit 11.							
19.18.30	4576	Pad A bit 12	-	BIT	PDO	0	0	1	RW
		Setting and monitoring of bit A pad - bit 12.							
19.18.31	4578	Pad A bit 13	-	BIT	PDO	0	0	1	RW
		Setting and monitoring of bit A pad - bit 13.							
19.18.32	4580	Pad A bit 14	-	BIT	PDO	0	0	1	RW
		Setting and monitoring of bit A pad - bit 14.							
19.18.33	4582	Pad A bit 15	-	BIT	PDO	0	0	1	RW
		Setting and monitoring of bit A pad - bit 15.							
19.18.34	4600	Bitword Pad B	-	UINT16	PDO	0	0	65535	RW
		Value of Pad bit B.							
19.18.35	4602	Pad B bit 0	-	BIT	PDO	0	0	1	RW
		Setting and monitoring of bit B pad - bit 0.							
19.18.36	4604	Pad B bit 1	-	BIT	PDO	0	0	1	RW
		Setting and monitoring of bit B pad - bit 1.							
19.18.37	4606	Pad B bit 2	-	BIT	PDO	0	0	1	RW
		Setting and monitoring of bit B pad - bit 2.							
19.18.38	4608	Pad B bit 3	-	BIT	PDO	0	0	1	RW
		Setting and monitoring of bit B pad - bit 3.							

19.18.39	4610	Pad B bit 4	-	BIT	PDO	0	0	1	RW
Setting and monitoring of bit B pad - bit 4.									
19.18.40	4612	Pad B bit 5	-	BIT	PDO	0	0	1	RW
Setting and monitoring of bit B pad - bit 5.									
19.18.41	4614	Pad B bit 6	-	BIT	PDO	0	0	1	RW
Setting and monitoring of bit B pad - bit 6.									
19.18.42	4616	Pad B bit 7	-	BIT	PDO	0	0	1	RW
Setting and monitoring of bit B pad - bit 7.									
19.18.43	4618	Pad B bit 8	-	BIT	PDO	0	0	1	RW
Setting and monitoring of bit B pad - bit 8.									
19.18.44	4620	Pad B bit 9	-	BIT	PDO	0	0	1	RW
Setting and monitoring of bit B pad - bit 9.									
19.18.45	4622	Pad B bit 10	-	BIT	PDO	0	0	1	RW
Setting and monitoring of bit B pad - bit 10.									
19.18.46	4624	Pad B bit 11	-	BIT	PDO	0	0	1	RW
Setting and monitoring of bit B pad - bit 11.									
19.18.47	4626	Pad B bit 12	-	BIT	PDO	0	0	1	RW
Setting and monitoring of bit B pad - bit 12.									
19.18.48	4628	Pad B bit 13	-	BIT	PDO	0	0	1	RW
Setting and monitoring of bit B pad - bit 13.									
19.18.49	4630	Pad B bit 14	-	BIT	PDO	0	0	1	RW
Setting and monitoring of bit B pad - bit 14.									
19.18.50	4632	Pad B bit 15	-	BIT	PDO	0	0	1	RW
Setting and monitoring of bit B pad - bit 15.									

20 COMMUNICATION

20.1 NETWORK CONFIG

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
20.1.1	9562	IP Address	-	UINT32	-	0	-	-	R
IP address of the drive network.									
20.1.2	9564	IP Netmask	-	UINT32	-	0	-	-	R
IP address of the subnet.									
20.1.3	9566	IP Gateway	-	UINT32	-	0	-	-	R
Gateway IP address.									
20.1.4	9604	IP assignment	-	Enum	-	Static	0	1	RW
IP address assignment mode.									
20.1.5	9556	IP Address set	-	UINT32	-	169.254.10.10	0	0	RW
Drive network IP address setting.									
20.1.6	9558	IP Netmask set	-	UINT32	-	255.255.0.0	0	0	RW
Set the IP address of the subnet.									
20.1.7	9560	IP Gateway set	-	UINT32	-	0.0.0.0	0	0	RW
Set the IP address of the gateway.									
20.1.8	9200	Wi-Fi fw version	-	UINT32	-	0	-	-	R
Indicates the FW version of the WiFi Drive Link module connected to the drive.									
20.1.9	9202	Wi-Fi S/N	-	UINT32	-	0	-	-	R

Indicates the serial number of the WiFi Drive Link module connected to the drive.									
20.1.10	9204	Wi-Fi network name	-	STRING16	-	0	-	-	R
Name of the Wi-Fi network generated by the Wi-Fi Drive Link module.									
20.1.11	9206	Wi-Fi network pwd	-	STRING16	-	0	-	-	R
Password used to connect to the network generated by the Wi-Fi Drive Link module.									

20.2 FIELDBUS CONFIG

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
20.2.1	6000	Fieldbus enable	-	Enum	-	OFF	0	1	RWZ
Enables communication with the fieldbus.									
20.2.2	6002	Fieldbus type	-	Enum	-	None	-	-	R
Monitors the type of fieldbus module installed.									
20.2.3	6004	Fieldbus state	-	Enum	-	Disable	-	-	R
Monitor the status of the installed fieldbus module.									
20.2.4	6006	Fieldbus baudrate	-	Enum	-	500k	0	4	RW
Select the fieldbus baudrate.									
20.2.5	6008	Fieldbus address	-	UINT16	SDO	0	0	255	RW
Fieldbus address (PROFIBUS).									
20.2.6	6010	Fieldbus IP address	-	UINT32	-	0	0	0	RW
Fieldbus IP address (PROFINET, EtherNet/IP).									
20.2.7	6012	Fieldbus IP netmask	-	UINT32	-	0	0	0	RW
Fieldbus netmask (PROFINET, EtherNet/IP).									
20.2.8	6014	Fieldbus DHCP enable	-	Enum	-	OFF	0	1	RW
DHCP enable (PROFINET, EtherNet/IP).									

20.3 FIELDBUS MS

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
20.3.1	6020	Fieldbus MS 1 ipa	-	UINT16	SDO	0	0	20000	RW
Configuration parameter for channel 1 from Master to Slave.									
20.3.2	6030	Fieldbus MS 2 ipa	-	UINT16	SDO	0	0	20000	RW
Configuration parameter for channel 2 from Master to Slave.									
20.3.3	6040	Fieldbus MS 3 ipa	-	UINT16	SDO	0	0	20000	RW
Configuration parameter for channel 3 from Master to Slave.									
20.3.4	6050	Fieldbus MS 4 ipa	-	UINT16	SDO	0	0	20000	RW
Configuration parameter for channel 4 from Master to Slave.									
20.3.5	6060	Fieldbus MS 5 ipa	-	UINT16	SDO	0	0	20000	RW
Configuration parameter for channel 5 from Master to Slave.									
20.3.6	6070	Fieldbus MS 6 ipa	-	UINT16	SDO	0	0	20000	RW
Configuration parameter for channel 6 from Master to Slave.									
20.3.7	6080	Fieldbus MS 7 ipa	-	UINT16	SDO	0	0	20000	RW
Configuration parameter for channel 7 from Master to Slave.									
20.3.8	6090	Fieldbus MS 8 ipa	-	UINT16	SDO	0	0	20000	RW
Configuration parameter for channel 8 from Master to Slave.									
20.3.9	6100	Fieldbus MS 9 ipa	-	UINT16	SDO	0	0	20000	RW
Configuration parameter for channel 9 from Master to Slave.									
20.3.10	6110	Fieldbus MS 10 ipa	-	UINT16	SDO	0	0	20000	RW
Configuration parameter for channel 10 from Master to Slave.									

20.3.11	6120	Fieldbus MS 11 ipa	-	UINT16	SDO	0	0	20000	RW
Configuration parameter for channel 11 from Master to Slave.									
20.3.12	6130	Fieldbus MS 12 ipa	-	UINT16	SDO	0	0	20000	RW
Configuration parameter for channel 12 from Master to Slave.									
20.3.13	6140	Fieldbus MS 13 ipa	-	UINT16	SDO	0	0	20000	RW
Configuration parameter for channel 13 from Master to Slave.									
20.3.14	6150	Fieldbus MS 14 ipa	-	UINT16	SDO	0	0	20000	RW
Configuration parameter for channel 14 from Master to Slave.									
20.3.15	6160	Fieldbus MS 15 ipa	-	UINT16	SDO	0	0	20000	RW
Configuration parameter for channel 15 from Master to Slave.									
20.3.16	6170	Fieldbus MS 16 ipa	-	UINT16	SDO	0	0	20000	RW
Configuration parameter for channel 16 from Master to Slave.									
20.3.17	6024	Fieldbus MS 1 div	-	UINT16	PDO	1	-	-	R
Divider of the value received on channel 1 from Master to Slave.									
20.3.18	6034	Fieldbus MS 2 div	-	UINT16	PDO	1	-	-	R
Divider of the value received on channel 2 from Master to Slave.									
20.3.19	6044	Fieldbus MS 3 div	-	UINT16	PDO	1	-	-	R
Divider of the value received on channel 3 from Master to Slave.									
20.3.20	6054	Fieldbus MS 4 div	-	UINT16	PDO	1	-	-	R
Divider of the value received on channel 4 from Master to Slave.									
20.3.21	6064	Fieldbus MS 5 div	-	UINT16	PDO	1	-	-	R
Divider of the value received on channel 5 from Master to Slave.									
20.3.22	6074	Fieldbus MS 6 div	-	UINT16	PDO	1	-	-	R
Divider of the value received on channel 6 from Master to Slave.									
20.3.23	6084	Fieldbus MS 7 div	-	UINT16	PDO	1	-	-	R
Divider of the value received on channel 7 from Master to Slave.									
20.3.24	6094	Fieldbus MS 8 div	-	UINT16	PDO	1	-	-	R
Divider of the value received on channel 8 from Master to Slave.									
20.3.25	6104	Fieldbus MS 9 div	-	UINT16	PDO	1	-	-	R
Divider of the value received on channel 9 from Master to Slave.									
20.3.26	6114	Fieldbus MS 10 div	-	UINT16	PDO	1	-	-	R
Divider of the value received on channel 10 from Master to Slave.									
20.3.27	6124	Fieldbus MS 11 div	-	UINT16	PDO	1	-	-	R
Divider of the value received on channel 11 from Master to Slave.									
20.3.28	6134	Fieldbus MS 12 div	-	UINT16	PDO	1	-	-	R
Divider of the value received on channel 12 from Master to Slave.									
20.3.29	6144	Fieldbus MS 13 div	-	UINT16	PDO	1	-	-	R
Divider of the value received on channel 13 from Master to Slave.									
20.3.30	6154	Fieldbus MS 14 div	-	UINT16	PDO	1	-	-	R
Divider of the value received on channel 14 from Master to Slave.									
20.3.31	6464	Fieldbus MS 15 div	-	UINT16	PDO	1	-	-	R
Divider of the value received on channel 15 from Master to Slave.									
20.3.32	6174	Fieldbus MS 16 div	-	UINT16	PDO	1	-	-	R
Divider of the value received on channel 16 from Master to Slave.									
20.3.33	6022	Fieldbus MS 1 mon	-	INT32	-	0	-	-	R
32-bit monitor of the value received on channel 1 from Master to Slave.									
20.3.34	6032	Fieldbus MS 2 mon	-	INT32	-	0	-	-	R
32-bit monitor of the value received on channel 2 from Master to Slave.									

20.3.35	6042	Fieldbus MS 3 mon	-	INT32	-	0	-	-	R
32-bit monitor of the value received on channel 3 from Master to Slave.									
20.3.36	6052	Fieldbus MS 4 mon	-	INT32	-	0	-	-	R
32-bit monitor of the value received on channel 4 from Master to Slave.									
20.3.37	6062	Fieldbus MS 5 mon	-	INT32	-	0	-	-	R
32-bit monitor of the value received on channel 5 from Master to Slave.									
20.3.38	6072	Fieldbus MS 6 mon	-	INT32	-	0	-	-	R
32-bit monitor of the value received on channel 6 from Master to Slave.									
20.3.39	6082	Fieldbus MS 7 mon	-	INT32	-	0	-	-	R
32-bit monitor of the value received on channel 7 from Master to Slave.									
20.3.40	6092	Fieldbus MS 8 mon	-	INT32	-	0	-	-	R
32-bit monitor of the value received on channel 8 from Master to Slave.									
20.3.41	6102	Fieldbus MS 9 mon	-	INT32	-	0	-	-	R
32-bit monitor of the value received on channel 9 from Master to Slave.									
20.3.42	6112	Fieldbus MS 10 mon	-	INT32	-	0	-	-	R
32-bit monitor of the value received on channel 10 from Master to Slave.									
20.3.43	6122	Fieldbus MS 11 mon	-	INT32	-	0	-	-	R
32-bit monitor of the value received on channel 11 from Master to Slave.									
20.3.44	6132	Fieldbus MS 12 mon	-	INT32	-	0	-	-	R
32-bit monitor of the value received on channel 12 from Master to Slave.									
20.3.45	6142	Fieldbus MS 13 mon	-	INT32	-	0	-	-	R
32-bit monitor of the value received on channel 13 from Master to Slave.									
20.3.46	6152	Fieldbus MS 14 mon	-	INT32	-	0	-	-	R
32-bit monitor of the value received on channel 14 from Master to Slave.									
20.3.47	6162	Fieldbus MS 15 mon	-	INT32	-	0	-	-	R
32-bit monitor of the value received on channel 15 from Master to Slave.									
20.3.48	6172	Fieldbus MS 16 mon	-	INT32	-	0	-	-	R
32-bit monitor of the value received on channel 16 from Master to Slave.									

20.4 FIELDBUS SM

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
20.4.1	6220	Fieldbus SM 1 ipa	-	UINT16	SDO	0	0	2000	RW
Configuration parameter for channel 1 from Slave to Master.									
20.4.2	6230	Fieldbus SM 2 ipa	-	UINT16	SDO	0	0	2000	RW
Configuration parameter for channel 2 from Slave to Master.									
20.4.3	6240	Fieldbus SM 3 ipa	-	UINT16	SDO	0	0	2000	RW
Configuration parameter for channel 3 from Slave to Master.									
20.4.4	6250	Fieldbus SM 4 ipa	-	UINT16	SDO	0	0	2000	RW
Configuration parameter for channel 4 from Slave to Master.									
20.4.5	6260	Fieldbus SM 5 ipa	-	UINT16	SDO	0	0	2000	RW
Configuration parameter for channel 5 from Slave to Master.									
20.4.6	6270	Fieldbus SM 6 ipa	-	UINT16	SDO	0	0	2000	RW
Configuration parameter for channel 6 from Slave to Master.									
20.4.7	6280	Fieldbus SM 7 ipa	-	UINT16	SDO	0	0	2000	RW
Configuration parameter for channel 7 from Slave to Master.									
20.4.8	6290	Fieldbus SM 8 ipa	-	UINT16	SDO	0	0	2000	RW
Configuration parameter for channel 8 from Slave to Master.									
20.4.9	6300	Fieldbus SM 9 ipa	-	UINT16	SDO	0	0	2000	RW

Configuration parameter for channel 9 from Slave to Master.									
20.4.10	6310	Fieldbus SM 10 ipa	-	UINT16	SDO	0	0	2000	RW
Configuration parameter for channel 10 from Slave to Master.									
20.4.11	6320	Fieldbus SM 11 ipa	-	UINT16	SDO	0	0	2000	RW
Configuration parameter for channel 11 from Slave to Master.									
20.4.12	6330	Fieldbus SM 12 ipa	-	UINT16	SDO	0	0	2000	RW
Configuration parameter for channel 12 from Slave to Master.									
20.4.13	6340	Fieldbus SM 13 ipa	-	UINT16	SDO	0	0	2000	RW
Configuration parameter for channel 13 from Slave to Master.									
20.4.14	6350	Fieldbus SM 14 ipa	-	UINT16	SDO	0	0	2000	RW
Configuration parameter for channel 14 from Slave to Master.									
20.4.15	6360	Fieldbus SM 15 ipa	-	UINT16	SDO	0	0	2000	RW
Configuration parameter for channel 15 from Slave to Master.									
20.4.16	6370	Fieldbus SM 16 ipa	-	UINT16	SDO	0	0	2000	RW
Configuration parameter for channel 16 from Slave to Master.									
20.4.17	6222	Fieldbus SM 1 mul	-	UINT16	PDO	1	-	-	R
Multiplier of the value sent on channel 1 from Slave to Master.									
20.4.18	6232	Fieldbus SM 2 mul	-	UINT16	PDO	1	-	-	R
Multiplier of the value sent on channel 21 from Slave to Master.									
20.4.19	6242	Fieldbus SM 3 mul	-	UINT16	PDO	1	-	-	R
Multiplier of the value sent on channel 3 from Slave to Master.									
20.4.20	6252	Fieldbus SM 4 mul	-	UINT16	PDO	1	-	-	R
Multiplier of the value sent on channel 4 from Slave to Master.									
20.4.21	6262	Fieldbus SM 5 mul	-	UINT16	PDO	1	-	-	R
Multiplier of the value sent on channel 5 from Slave to Master.									
20.4.22	6272	Fieldbus SM 6 mul	-	UINT16	PDO	1	-	-	R
Multiplier of the value sent on channel 6 from Slave to Master.									
20.4.23	6282	Fieldbus SM 7 mul	-	UINT16	PDO	1	-	-	R
Multiplier of the value sent on channel 7 from Slave to Master.									
20.4.24	6292	Fieldbus SM 8 mul	-	UINT16	PDO	1	-	-	R
Multiplier of the value sent on channel 8 from Slave to Master.									
20.4.25	6302	Fieldbus SM 9 mul	-	UINT16	PDO	1	-	-	R
Multiplier of the value sent on channel 9 from Slave to Master.									
20.4.26	6312	Fieldbus SM 10 mul	-	UINT16	PDO	1	-	-	R
Multiplier of the value sent on channel 10 from Slave to Master.									
20.4.27	6322	Fieldbus SM 11 mul	-	UINT16	PDO	1	-	-	R
Multiplier of the value sent on channel 11 from Slave to Master.									
20.4.28	6332	Fieldbus SM 12 mul	-	UINT16	PDO	1	-	-	R
Multiplier of the value sent on channel 12 from Slave to Master.									
20.4.29	6342	Fieldbus SM 13 mul	-	UINT16	PDO	1	-	-	R
Multiplier of the value sent on channel 13 from Slave to Master.									
20.4.30	6352	Fieldbus SM 14 mul	-	UINT16	PDO	1	-	-	R
Multiplier of the value sent on channel 14 from Slave to Master.									
20.4.31	6362	Fieldbus SM 15 mul	-	UINT16	PDO	1	-	-	R
Multiplier of the value sent on channel 15 from Slave to Master.									
20.4.32	6372	Fieldbus SM 16 mul	-	UINT16	PDO	1	-	-	R
Multiplier of the value sent on channel 16 from Slave to Master.									

20.5 STATUS WORD

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
20.5.1	6400	Status word 0 sel	-	Enum	SD0	OFF	0	82	RW
		Selection of bit 0 of the status word.							
20.5.2	6402	Status word 1 sel	-	Enum	SD0	OFF	0	82	RW
		Selection of bit 1 of the status word.							
20.5.3	6404	Status word 2 sel	-	Enum	SD0	OFF	0	82	RW
		Selection of bit 2 of the status word.							
20.5.4	6406	Status word 3 sel	-	Enum	SD0	OFF	0	82	RW
		Selection of bit 3 of the status word.							
20.5.5	6408	Status word 4 sel	-	Enum	SD0	OFF	0	82	RW
		Selection of bit 4 of the status word.							
20.5.6	6410	Status word 5 sel	-	Enum	SD0	OFF	0	82	RW
		Selection of bit 5 of the status word.							
20.5.7	6412	Status word 6 sel	-	Enum	SD0	OFF	0	82	RW
		Selection of bit 6 of the status word.							
20.5.8	6414	Status word 7 sel	-	Enum	SD0	OFF	0	82	RW
		Selection of bit 7 of the status word.							
20.5.9	6416	Status word 8 sel	-	Enum	SD0	OFF	0	82	RW
		Selection of bit 8 of the status word.							
20.5.10	6418	Status word 9 sel	-	Enum	SD0	OFF	0	82	RW
		Selection of bit 9 of the status word.							
20.5.11	6420	Status word 10 sel	-	Enum	SD0	OFF	0	82	RW
		Selection of bit 10 of the status word.							
20.5.12	6422	Status word 11 sel	-	Enum	SD0	OFF	0	82	RW
		Selection of bit 11 of the status word.							
20.5.13	6424	Status word 12 sel	-	Enum	SD0	OFF	0	82	RW
		Selection of bit 12 of the status word.							
20.5.14	6426	Status word 13 sel	-	Enum	SD0	OFF	0	82	RW
		Selection of bit 13 of the status word.							
20.5.15	6428	Status word 14 sel	-	Enum	SD0	OFF	0	82	RW
		Selection of bit 14 of the status word.							
20.5.16	6430	Status word 15 sel	-	Enum	SD0	OFF	0	82	RW
		Selection of bit 15 of the status word.							
20.5.17	6432	Status word mon	-	UINT16	PDO	0	-	-	R
		Status word monitor, in hexadecimal format.							

20.6 CONTROL WORD

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
20.6.1	6450	Control word dig	-	UINT16	PDO	0	0	65535	RW
		Direct parameter on which to set the control word.							
20.6.2	6452	Control word sel	-	Enum	SD0	Control word dig	0	11	RW
		Control word source selector.							
20.6.3	6454	Control word 0 dest	-	Enum	SD0	OFF	0	90	RW
		Selection of the function of bit 0 of the control word.							
20.6.4	6456	Control word 1 dest	-	Enum	SD0	OFF	0	90	RW
		Selection of the function of bit 1 of the control word.							

20.6.5	6458	Control word 2 dest	-	Enum	SDO	OFF	0	90	RW
Selection of the function of bit 2 of the control word.									
20.6.6	6460	Control word 3 dest	-	Enum	SDO	OFF	0	90	RW
Selection of the function of bit 3 of the control word.									
20.6.7	6462	Control word 4 dest	-	Enum	SDO	OFF	0	90	RW
Selection of the function of bit 4 of the control word.									
20.6.8	6464	Control word 5 dest	-	Enum	SDO	OFF	0	90	RW
Selection of the function of bit 5 of the control word.									
20.6.9	6466	Control word 6 dest	-	Enum	SDO	OFF	0	90	RW
Selection of the function of bit 6 of the control word.									
20.6.10	6468	Control word 7 dest	-	Enum	SDO	OFF	0	90	RW
Selection of the function of bit 7 of the control word.									
20.6.11	6470	Control word 8 dest	-	Enum	SDO	OFF	0	90	RW
Selection of the function of bit 8 of the control word.									
20.6.12	6472	Control word 9 dest	-	Enum	SDO	OFF	0	90	RW
Selection of the function of bit 9 of the control word.									
20.6.13	6474	Control word 10 dest	-	Enum	SDO	OFF	0	90	RW
Selection of the function of bit 10 of the control word.									
20.6.14	6476	Control word 11 dest	-	Enum	SDO	OFF	0	90	RW
Selection of the function of bit 11 of the control word.									
20.6.15	6478	Control word 12 dest	-	Enum	SDO	OFF	0	90	RW
Selection of the function of bit 12 of the control word.									
20.6.16	6480	Control word 13 dest	-	Enum	SDO	OFF	0	90	RW
Selection of the function of bit 13 of the control word.									
20.6.17	6482	Control word 14 dest	-	Enum	SDO	OFF	0	90	RW
Selection of the function of bit 14 of the control word.									
20.6.18	6484	Control word 15 dest	-	Enum	SDO	OFF	0	90	RW
Selection of the function of bit 15 of the control word.									
20.6.19	6486	Control word mon	-	UINT16	PDO	0	-	-	R
Control word status monitor.									

20.7 RS485

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
20.7.1	5900	Serial address	-	UINT16	-	1	0	255	RW
Allows you to set the address to which the drive responds when connected via RS485 serial line with Modbus-RTU protocol.									
20.7.2	5902	Serial baudrate	-	Enum	-	38400 bps	0	4	RW
Allows you to set the serial communication speed.									
20.7.3	5904	Serial frame	-	Enum	-	8-N-1	0	5	RW
Allows you to set the frame format for serial communication.									

20.8 OPTICAL FIBER

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
20.8.1	5300	OPTIC mode	-	Enum	SDO	off	0	1	RWZ
Selection of the behaviour of the drive in the network.									
20.8.2	5302	OPTIC device 1	-	Enum	SDO	none	0	1	RWZ
Selection of the behaviour of the drive set as Slave 1 in the network									

20.8.3	5304	OPTIC device 2	-	Enum	SDO	none	0	1	RWZ
Selection of the behaviour of the drive set as Slave 2 in the network									
20.8.4	5306	OPTIC device 3	-	Enum	SDO	none	0	1	RWZ
Selection of the behaviour of the drive set as Slave 3 in the network									
20.8.5	5308	OPTIC device 4	-	Enum	SDO	none	0	1	RWZ
Selection of the behaviour of the drive set as Slave 4 in the network									

21 ALARM CONFIG

21.1 FAILURE SUPPLY

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
21.1.1	5000	FS latch	-	Enum	SDO	ON	0	1	RWZ
Alarm latch management.									
21.1.2	5002	FS OK relay open	-	Enum	SDO	ON	0	1	RW
Relay OK open in case of alarm intervention.									

21.2 UNDERVOLTAGE

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
21.2.1	5010	UV holdoff	ms	UINT16	SDO	0	0	5000	RW
Alarm holdoff time.									
21.2.2	5012	UV restart time	ms	UINT16	SDO	1000	0	10000	RW
Maximum alarm reset time to perform automatic restart.									
21.2.3	5014	UV latch	-	Enum	SDO	ON	0	1	RWZ
Alarm latch management.									
21.2.4	5016	UV OK relay open	-	Enum	SDO	ON	0	1	RW
Relay OK open in case of alarm intervention.									
21.2.5	5018	UV threshold	V	UINT16	SDO	230	1	1000	RW
Alarm intervention threshold.									

21.3 OVERVOLTAGE

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
21.3.1	5020	OV activity	-	Enum	SDO	Disable	0	2	RWZ
Defines the behaviour of the drive in the event of an alarm.									
21.3.2	5022	OV holdoff	ms	UINT16	SDO	0	0	10000	RW
Alarm holdoff time.									
21.3.3	5024	OV restart time	ms	UINT16	SDO	0	0	10000	RW
Maximum alarm reset time for automatic restart.									
21.3.4	5026	OV latch	-	Enum	SDO	ON	0	1	RWZ
Alarm latch management.									
21.3.5	5028	OV OK relay open	-	Enum	SDO	ON	0	1	RW
OK relay open in case of alarm intervention.									

21.4 OVERSPEED

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
21.4.1	5030	OS activity	-	Enum	SD0	Disable	0	5	RWZ
Defines the behaviour of the drive in the event of an alarm.									
21.4.2	5032	OS holdoff	ms	UINT16	SD0	0	0	10000	RW
Alarm holdoff time.									
21.4.3	5034	OS restart time	ms	UINT16	SD0	0	0	10000	RW
Maximum alarm reset time for automatic restart.									
21.4.4	5036	OS latch	-	Enum	SD0	ON	0	1	RWZ
Alarm latch management.									
21.4.5	5038	OS OK relay open	-	Enum	SD0	ON	0	1	RW
OK relay open in case of alarm intervention.									
21.4.6	5040	OS threshold	rpm	FLOAT	SD0	1800	1	8000	RW
Alarm intervention threshold.									

21.5 HEATSINK

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
21.5.1	5050	HS activity	-	Enum	SD0	Disable	0	3	RWZ
Defines the behaviour of the drive in the event of an alarm.									
21.5.2	5052	HS OK relay open	-	Enum	SD0	ON	0	1	RW
Relay OK open in the event of an alarm									

21.6 MOTOR OVERTEMP

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
21.6.1	5060	MotOT activity	-	Enum	SD0	Disable	0	5	RWZ
Defines the behaviour of the drive in the event of an alarm.									
21.6.2	5062	MotOT OK relay open	-	Enum	SD0	ON	0	1	RW
Relay OK open in the event of an alarm.									

21.7 EXTERNAL FAULT

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
21.7.1	5070	EF activity	-	Enum	SD0	Disable	0	5	RWZ
Defines the behaviour of the drive in the event of an alarm.									
21.7.2	5072	EF holdoff	ms	UINT16	SD0	104	0	10000	RW
Alarm holdoff time.									
21.7.3	5074	EF restart time	ms	UINT16	SD0	0	0	10000	RW
Maximum alarm reset time to perform automatic restart.									
21.7.4	5076	EF latch	-	Enum	SD0	ON	0	1	RWZ
Alarm latch management.									
21.7.5	5078	EF OK relay open	-	Enum	SD0	ON	0	1	RW
OK relay open in case of alarm intervention.									

21.8 BRAKE FAULT

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
21.8.1	5080	BF activity	-	Enum	SD0	Disable	0	5	RWZ

Defines the behaviour of the drive in the event of an alarm.									
21.8.2	5082	BF OK relay open	-	Enum	SDO	ON	0	1	RW
Relay OK open in the event of an alarm.									

21.9 MOTOR I2T

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
21.9.1	5090	MotI2T activity	-	Enum	SDO	Warning	0	5	RWZ
Defines the behaviour of the drive in the event of an alarm.									
21.9.2	5092	MotI2T latch	-	Enum	SDO	ON	0	1	RWZ
Alarm latch management.									
21.9.3	5094	MotI2T OK relay open	-	Enum	SDO	ON	0	1	RW
Relay OK open in case of alarm intervention.									

21.10 DRIVE I2T

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
21.10.1	5100	Drvl2T activity	-	Enum	SDO	Warning	0	5	RWZ
Defines the behaviour of the drive in the event of an alarm.									
21.10.2	5104	Drvl2T OK relay open	-	Enum	SDO	ON	0	1	RW
Relay opening OK in case of alarm activation.									

21.11 OVERCURRENT

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
21.11.1	5110	OC activity	-	Enum	SDO	Disable	0	2	RWZ
Defines the behaviour of the drive in the event of an alarm.									
21.11.2	5112	OC holdoff	ms	UINT16	SDO	0	0	10000	RW
Alarm holdoff time.									
21.11.3	5114	OC restart time	ms	UINT16	SDO	0	0	10000	RW
Alarm latch management.									
21.11.4	5116	OC latch	-	Enum	SDO	ON	0	1	RWZ
Gestione latch allarme.									
21.11.5	5118	OC OK relay open	-	Enum	SDO	ON	0	1	RW
OK relay open in case of alarm intervention.									
21.11.6	5120	OC threshold	%	UINT16	SDO	150	0	200	RWZ
Alarm intervention threshold, expressed as a percentage of the motor's rated armature current.									

21.12 FIELD LOSS

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
21.12.1	5132	FL holdoff	ms	UINT16	SDO	100	0	10000	RW
Alarm holdoff time.									
21.12.2	5134	FL restart time	ms	UINT16	SDO	0	0	10000	RW
Maximum alarm reset time to perform automatic restart.									
21.12.3	5136	FL latch	-	Enum	SDO	ON	0	1	RWZ
Alarm latch management.									
21.12.4	5138	FL OK relay open	-	Enum	SDO	ON	0	1	RW
Relay OK open in case of alarm intervention.									

21.12.5	5128	FL missing bypass	-	Enum	SDO	OFF	0	1	RWZ
Disabling detection of missing cable connecting the field card to the control card.									

21.13 DELTA FREQUENCY

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
21.13.1	5140	DF activity	-	Enum	SDO	Ignore	0	2	RWZ
Defines the behaviour of the drive in the event of an alarm.									
21.13.2	5142	DF holdoff	ms	UINT16	SDO	0	0	10000	RW
Alarm holdoff time.									
21.13.3	5144	DF restart time	ms	UINT16	SDO	0	0	10000	RW
Maximum alarm reset time to perform automatic restart.									
21.13.4	5146	DF latch	-	Enum	SDO	ON	0	1	RWZ
Alarm latch management.									
21.13.5	5148	DF OK relay open	-	Enum	SDO	ON	0	1	RW
OK relay open in case of alarm intervention.									
21.13.6	5150	DF threshold	%	UINT16	SDO	5	1	15	RWZ
Alarm intervention threshold, expressed as a percentage of the mains frequency value calculated at power-up.									

21.14 SPEED FBK LOSS

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
21.14.1	5160	SFL activity	-	Enum	SDO	Disable	0	2	RWZ
Defines the behaviour of the drive in the event of an alarm.									
21.14.2	5162	SFL holdoff	ms	UINT16	SDO	8	0	10000	RW
Alarm holdoff time.									
21.14.3	5164	SFL code	-	UINT16	SDO	0	-	-	R
Hexadecimal code indicating the sensor identified as faulty.									
21.14.4	5168	SFL OK relay open	-	Enum	SDO	ON	0	1	RW
Relay OK open in case of alarm intervention.									

21.15 BUS LOSS

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
21.15.1	5170	BLoss activity	-	Enum	SDO	Disable	0	5	RWZ
Defines the behaviour of the drive in the event of an alarm.									
21.15.2	5172	BLoss holdoff	ms	UINT16	SDO	0	0	10000	RW
Alarm holdoff time.									
21.15.3	5174	BLoss restart time	ms	UINT16	SDO	0	0	10000	RW
Maximum alarm reset time for automatic restart.									
21.15.4	5176	BLoss latch	-	Enum	SDO	ON	0	1	RWZ
Alarm latch management.									
21.15.5	5178	BLoss OK relay open	-	Enum	SDO	ON	0	1	RW
OK relay open in case of alarm intervention.									

21.16 ENABLE SEQ ERR

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
21.16.1	5200	EnSEQ activity	-	Enum	SDO	Disable	0	2	RWZ

Defines the behaviour of the drive in the event of an alarm.									
21.16.2	5206	EnSEQ latch	-	Enum	SDO	ON	0	1	RWZ
Alarm latch management.									
21.16.3	5208	EnSEQ OK relay open	-	Enum	SDO	ON	0	1	RW
OK relay open in case of alarm intervention.									

21.17 SUSTAINED CURR

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
21.17.1	5220	SC activity	-	Enum	SDO	Ignore	0	2	RWZ
Defines the behaviour of the drive in the event of an alarm.									
21.17.2	5226	SC holdoff	ms	UINT16	SDO	ON	0	1	RW
Alarm holdoff time.									
21.17.3	5228	SC OK relay open	-	Enum	SDO	ON	0	1	RWZ
OK relay open in case of alarm intervention.									

21.18 SCR TEST

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
21.18.1	5230	SCR open activity	-	Enum	SDO	Ignore	0	2	RW
Enables the SCR open test and defines the behaviour of the drive when the corresponding alarm is triggered.									
21.18.2	5232	SCR short activity	-	Enum	SDO	Ignore	0	1	RW
Enables the SCR short test and defines the behaviour of the drive when the corresponding alarm is triggered.									
21.18.3	5234	SCR open code	-	Enum	SDO	None	0	0	R
Alphanumeric code indicating which SCR has been detected as open.									
21.18.4	5236	SCR short code	-	Enum	SDO	None	0	0	R
Alphanumeric code indicating which SCR has been detected in short circuit.									
21.18.5	5238	SCR open threshold	-	FLOAT	SDO	30	0	100	RW
Allows you to configure the sensitivity of the open SCR detection algorithm, so that a higher percentage value corresponds to an increase in the sensitivity of the algorithm.									

21.19 OPTIC ERROR

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
21.19.1	5190	OPTIC error activity	-	Enum	-	Disable	0	5	RW
Defines the behaviour of the drive in the event of an alarm.									

24 RECIPE CONFIG

Menu	IPA	Parameter name	Unit	Type	FB mode	Def	Min	Max	Acc
24.1	5500	Recipe config 1	-	UINT16	SDO	0	0	20000	RW
IPA of the parameter to be entered in position 1 of the RECIPE menu.									
24.2	5502	Recipe config 2	-	UINT16	SDO	0	0	20000	RW
IPA of the parameter to be entered in position 2 of the RECIPE menu.									
24.3	5504	Recipe config 3	-	UINT16	SDO	0	0	20000	RW
IPA of the parameter to be entered in position 3 of the RECIPE menu.									
24.4	5506	Recipe config 4	-	UINT16	SDO	0	0	20000	RW
IPA of the parameter to be entered in position 4 of the RECIPE menu.									
24.5	5508	Recipe config 5	-	UINT16	SDO	0	0	20000	RW

IPA of the parameter to be entered in position 5 of the RECIPE menu.								
24.6	5510	Recipe config 6	-	UINT16	SDO	0	0	20000 RW
IPA of the parameter to be entered in position 6 of the RECIPE menu.								
24.7	5512	Recipe config 7	-	UINT16	SDO	0	0	20000 RW
IPA of the parameter to be entered in position 7 of the RECIPE menu.								
24.8	5514	Recipe config 8	-	UINT16	SDO	0	0	20000 RW
IPA of the parameter to be entered in position 8 of the RECIPE menu.								
24.9	5516	Recipe config 9	-	UINT16	SDO	0	0	20000 RW
IPA of the parameter to be entered in position 9 of the RECIPE menu.								
24.10	5518	Recipe config 10	-	UINT16	SDO	0	0	20000 RW
IPA of the parameter to be entered in position 10 of the RECIPE menu.								
24.11	5520	Recipe config 11	-	UINT16	SDO	0	0	20000 RW
IPA of the parameter to be entered in position 11 of the RECIPE menu.								
24.12	5522	Recipe config 12	-	UINT16	SDO	0	0	20000 RW
IPA of the parameter to be entered in position 12 of the RECIPE menu.								
24.13	5524	Recipe config 13	-	UINT16	SDO	0	0	20000 RW
IPA of the parameter to be entered in position 13 of the RECIPE menu.								
24.14	5526	Recipe config 14	-	UINT16	SDO	0	0	20000 RW
IPA of the parameter to be entered in position 14 of the RECIPE menu.								
24.15	5528	Recipe config 15	-	UINT16	SDO	0	0	20000 RW
IPA of the parameter to be entered in position 15 of the RECIPE menu.								
24.16	5530	Recipe config 16	-	UINT16	SDO	0	0	20000 RW
IPA of the parameter to be entered in position 16 of the RECIPE menu.								
24.17	5532	Recipe config 17	-	UINT16	SDO	0	0	20000 RW
IPA of the parameter to be entered in position 17 of the RECIPE menu.								
24.18	5534	Recipe config 18	-	UINT16	SDO	0	0	20000 RW
IPA of the parameter to be entered in position 18 of the RECIPE menu.								
24.19	5536	Recipe config 19	-	UINT16	SDO	0	0	20000 RW
IPA of the parameter to be entered in position 19 of the RECIPE menu.								
24.20	5538	Recipe config 20	-	UINT16	SDO	0	0	20000 RW
IPA of the parameter to be entered in position 20 of the RECIPE menu.								
24.21	5540	Recipe config 21	-	UINT16	SDO	0	0	20000 RW
IPA of the parameter to be entered in position 21 of the RECIPE menu.								
24.22	5542	Recipe config 22	-	UINT16	SDO	0	0	20000 RW
IPA of the parameter to be entered in position 22 of the RECIPE menu.								
24.23	5544	Recipe config 23	-	UINT16	SDO	0	0	20000 RW
IPA of the parameter to be entered in position 23 of the RECIPE menu.								
24.24	5546	Recipe config 24	-	UINT16	SDO	0	0	20000 RW
IPA of the parameter to be entered in position 24 of the RECIPE menu.								
24.25	5548	Take recipe config	-	BIT	SDO	0	0	1 RW
Recipe menu acquisition command.								

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