SIEMENS

SED2 variable speed drives

Operating instructions

CM1U5192en
01.2002

Siemens Building Technologies
HVAC Products

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1 Introduction

1.1 Purpose of this document

These operating instructions contain all the information necessary to correctly mount, install, commission, and parameterize (programming) SED2 variable speed drives (VSD) as well as for effective and troublefree operation.

1.2 Validity

The operating instructions apply to all SED2 variable speed drives, frame sizes A to F. They are supplied with the product, and are part of the full range of SED2 VSD literature.

1.3 Target audience

This document is primarily intended for installers, electrical installers, service technicians, and operators or end users of HVAC plants (Heating, Ventilating, and Air Conditioning).

1.4 Document structure

The document is divided into the following sections:

Chapter 1	Introduction
Chapter 2	Safety instructions
Chapter 3	Mechanical installation
Chapter 4	Electrical installation and wiring of the motor and VSD
Chapter 5	Commissioning Description of basic and advanced operator panels Quick commissioning
Chapter 6	Programming (parameterization) Description of functions System parameter list
Chapter 7	Troubleshooting, warning and error code lists
Chapter 8	Technical data
Chapter 9	Appendix: Applicable standards and declarations of conformity List of abbreviations, index

1.5 Referenced documents

CM1G5192X

Getting Started Guide:
The **Getting started guide** is a brief multilingual guide to provide users fast access to all the basic information necessary to install, set up, and operate the VSD.
Target audience: Installers, installing engineers, and commissioning engineers.

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Engineering manual: Documentation on basics.
This manual contains in-depth information on all technical matters relating to the SED2 VSD.
Target audience: Project design engineers, planners, users of the product, technical staff, and service.

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Data sheet
The data sheet contains a brief description of functions, notes on use, type codes, accessories, ordering information, technical data, and a range overview.
Target audience: Project design engineers, planners, purchasing and sales staff, and service.

1.6 Document conventions

Danger

Information pointing at immediate danger is printed under the heading “Danger” with the symbol shown in the left margin. Failure to observe this information may result in severe physical injury or death or severe property damage.

Warning

Information under the heading “Warning” is shown with the symbol in the left margin. **Failure to observe this category of information may result in physical injury and/or property damage.**

Caution

Information under the heading “Caution” is shown with the symbol in the left margin. **Failure to observe this type of information may result in property damage and/or loss of data.**

Important

Other important information (headed “Important” or “Note”) is shown on a gray background. Failure to observe this information will not result in any damage.

Note 

This relates to additional information important for the safety of personnel and equipment, or provides details of additional options or technical requirements.

Tips 

Helpful information to simplify the use of the product for the user.

Authorized personnel

"Authorized personnel" are persons familiar with installing, mounting, commissioning, and operating the equipment, and aware of the associated hazards.
Authorized personnel must satisfy the following requirements:

- They must be trained and authorized to switch on, switch off, disconnect, and ground electric circuits, and to attach warning labels in accordance with the established safety instructions.
- They must have training in the proper care and use of protective devices in accordance with all prevailing safety regulations.
- They must be trained in and capable of administering first aid.

1.7 Environmental compatibility and disposal

General notes

This product was developed and manufactured using materials and processes which take full account of environmental issues and which comply with our environmental standards.
Please not the following for disposal at the end of the product life, or in the event of its replacement:

- For disposal, this product is defined as waste from electrical and electronic equipment (“electronic waste”); do not dispose of it as household waste. This applies particularly to the PCB assembly.
- Always use the most environmentally compatible method of disposal, in line with the state-of-the-art technology in environmental protection, recycling, and waste management.
  Observe all local and applicable laws.
- Always aim for maximum re-use of the basic materials at minimum environmental stress. Observe any notes on materials and disposal that may be attached to individual components.
- Use local depots and waste management companies, or refer to your supplier or manufacturer to return used products or to obtain further information on environmental compatibility and waste disposal.

Special electronic components

The law may mandate special handling of components such as electrolytic capacitors and LCD panels, or it may be environmentally desirable.

Packaging

The variable speed drive is delivered in re-usable packaging. Please retain the packaging for later use or in case you need to return the product to the manufacturer.

2 Safety instructions

The following warnings and notes on danger are provided for your safety and as a means of preventing damage to the product or to any components of the connected machinery. This section contains general warnings, preventive measures, and danger warnings, which apply to all work on the SED2 variable speed drives. Specific warnings applicable to particular tasks are summarized at the beginning of each chapter and repeated throughout the chapter as necessary at the relevant points.

Please read this information carefully, as it is provided for your personal safety, and to help extend the life of the SED2 variable speed drive and any equipment connected to it.

Format of warnings

Refer to section 1.6 Document conventions for information on the format of warning notes and associated symbols.

2.1 General

Warning

- This equipment uses hazardous voltages and drives potentially dangerous rotating mechanical parts. Non-compliance with **warnings** or failure to follow the instructions in this manual may put lives at risk, or result in severe physical injury, or serious damage to property/equipment.
- Only authorized personnel may work on this equipment. They must first acquaint themselves with all the safety instructions, and installation and operating instructions in this manual. Successful and safe operation of this device depends on its proper handling, installation, commissioning, and operation.
- Prevent children and other unauthorized persons from accessing the equipment.

Risk of electric shock

The DC link capacitors remain charged with dangerous voltages for five minutes after power has been switched off.

Danger

Do not open the device for five minutes after switching off the supply voltage.

Purpose

Use the equipment only for purposes as specified by the manufacturer. Unauthorized modifications and use of spare parts or accessories not supplied or recommended by the manufacturer of this equipment may cause fires, electric shock, and physical injury.

Availability of the operating instructions

Keep these operating instructions within easy reach of the equipment and make them available to all users.

2.2 Commissioning

- Only authorized personnel trained in the setup, installation, commissioning, and operation of the product may work on the product and plant.
- Only hard-wired mains connections are permissible. Ground the VSD (IEC 536, Class 1, NEC and other relevant industry standards).
- If a residual current device (RCD) is to be used, it must be a type B device.
- Do not connect machines with a 3-phase power supply fitted with EMC filters to the mains via an earth leakage current circuit breaker (ELCB) (see *DIN VDE 0160, section 6.5*).

Danger

The following terminals may carry dangerous voltages even when the variable speed drive is not running:

– Power supply terminals L1, L2, L3.
– Motor terminals U, V, W.
– Link terminals DC-, DC+/B+, DC/R+, B-.

Caution

To prevent inductive and capacitive interference, connect the power, motor, and control cables to the variable speed drive as illustrated and described in section 4.2.1 “EMC-compatible wiring“.

2.3 Operation

Danger

- SED2 variable speed drives operate at high voltages.
- Emergency stop facilities in accordance with EN 60204 IEC 204 (VDE 0113) must remain operative in all operating modes of the control equipment. Resetting the emergency stop facility may not cause an uncontrolled or undefined restart.
- In cases where faults in the control equipment could cause significant equipment damage or severe physical injury (e.g., potentially dangerous short circuits), take additional external precautions or provide facilities to ensure or enforce safe operation even in the event of a short circuit (e.g., independent limit switches, mechanical interlocks, etc.).
- Certain parameter settings can cause an automatic restart of the variable speed drive following an fault or supply voltage failure, provided the fault has been eliminated/acknowledged or the supply voltage has been restored.
- The variable speed drive is capable of protecting the motor from overload. (Motor overload protection in accordance with UL 508C, section 42). See P0610 and P0335.
- Protection against motor overload can be instituted via an external PTC thermistors (temperature variable conductor) via a special input (Class 14/15, see also section 4.3.12, page 37).
- Do not use the variable speed drive as an “Emergency Stop” mechanism *(see EN60204, 9.2.5.4).*

2.4 Repairs

- Only the Siemens service, repair centers authorized by Siemens, or authorized personnel fully acquainted with all the warnings and operating procedures as specified in this manual may repair this equipment.
- Replace defective parts or components using parts from the relevant spare parts list.

Danger

Disconnect the power supply before opening the device.

3 Mechanical installation

3.1 Installing the SED2 after extended storage

Recharge the capacitors in the variable speed drive following an extended period of storage. **Remember to calculate the storage time from the date of manufacture, and not from the date of delivery.** The required procedure varies according to the storage period and is described below.

Period of storage	Required action	Preparation time
1 year or less	Recharging not required.	No preparation
1 to 2 years	Before issuing the “Run” command, connect the variable speed drive to the supply voltage for one hour.	1 hour
2 to 3 years	Use a variable AC power source. 1. Apply 25% of the input voltage for 30 minutes. 2. Increase the voltage to 50% for a further 30 minutes. 3. Increase the voltage to 75% for a further 30 minutes. 4. Increase the voltage to 100% for a further 30 minutes. The variable speed drive is then ready for operation.	2 hours
3 or more years	Use a variable AC power source. 1. Apply 25% of the input voltage for 2 hours. 2. Increase the voltage to 50% for a further 2 hours. 3. Increase the voltage to 75% for a further 2 hours. 4. Increase the voltage to 100% for a further 2 hours. The variable speed drive is then ready for operation.	8 hours

3.2 Ambient conditions

Temperature

	IP20	IP54
Min. operating temperature	–10 °C	–10 °C
Max. operating temperature	+40 °C*	+40 °C

* Be aware of the potential increase in temperature inside the control cabinet (derating necessary; refer to the engineering manual).

Humidity

Max. 95%, non-condensing.

Height above sea level

If you want to install the VSD at an altitude of more than 1000 m, derating is required. (Refer to the engineering manual).

Overheating

Install the VSD vertically for optimum cooling. Do not obstruct the vents on the VSD. Additional ventilation may be required if the drive is mounted horizontally. If mounted vertically, VSDs with a protection standard of IP20 may be installed side by side. A minimum clearance of 100 mm is necessary above and below the VSD. VSD of class IP54 require greater clearances. See section 3.3.4 "Mounting SED2 drives with IP54 / NEMA 12 rating".

Electromagnetic radiation

Do not install the VSD in the vicinity of powerful sources for electromagnetic radiation.

Atmospheric pollution

Do not install the VSD in an environment containing atmospheric pollutants such as dust, corrosive gases, etc. Devices subject to protection standard IP20 need additional protection from dust, atmospheric pollutants, and water.

Shock

Do not install the VSD in a location where it might be exposed to repeated shock or vibration.

3.3 Mounting

Danger

The device must be grounded.

- Extremely dangerous conditions can arise if you do not correctly ground the variable speed drive.
- To ensure safe operation of the equipment, authorized persons must install and commission it in full compliance with the notes and warnings set out in these operating instructions.
- Take particular note of general and regional installation and safety regulations regarding work on sites with dangerous voltages (e.g. EN 50178), and of the relevant regulations for the correct use of tools and personal protective equipment.

Dangerous voltages may occur at the following terminals even when the variable speed drive is not running:

- Power supply terminals L1, L2, L3.
- Motor connection terminals U, V, W, DC-, DC+/B+, DC/R+, B-.
- Link terminals DC-, DC+/B+, DC/R+, B-.

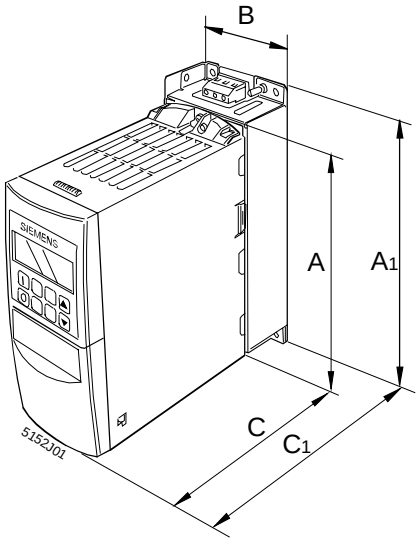
Danger

Do not open the device for five minutes after switching off the supply voltage.

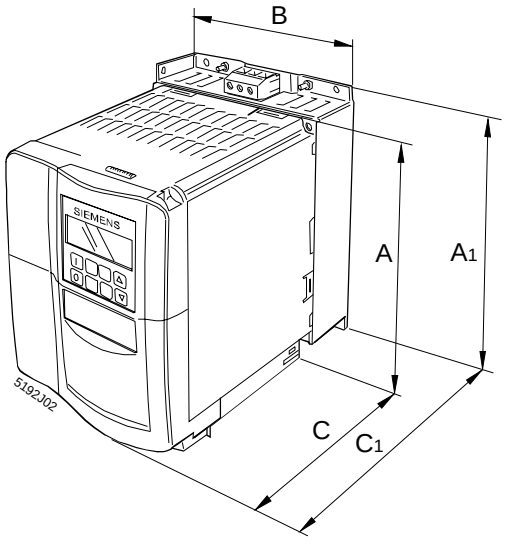
3.3.1 Dimensions of SED2 drives with IP20/NEMA 0 rating

3.3.1.1 Dimensions of SED2 frame sizes A to C

Frame size	Dimensions				
	A	**A_1**	**B**	**C**	**C_1**
A	173	200	73	149	192.5
B	202	213	149	172	222.5
C	245	261	185	195	250



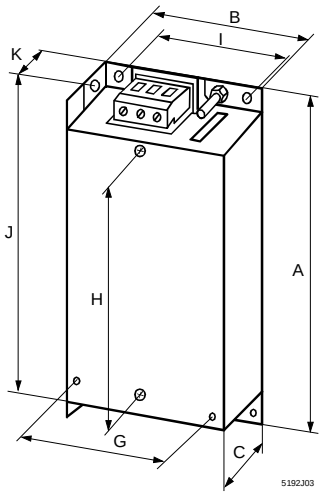
Frame size A



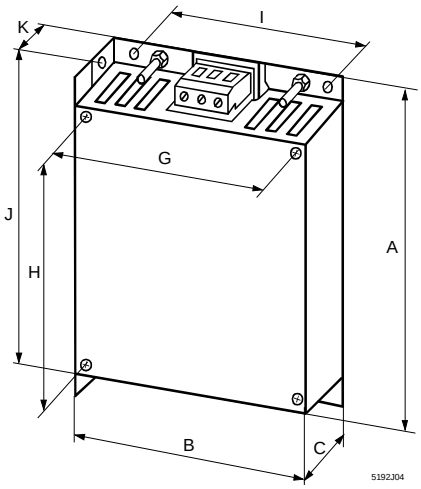
Frame sizes B and C

3.3.1.2 Dimensions of SED2 footprint filters for frame sizes A to C

Frame size	Dimensions in mm							
	A	B	C	G	H	I	J	K
A	200	73	43.5	60	160	56	187	22
B	213	149	50.5	138	174	120	200	24
C	245	185	55	174	204	156	232	35

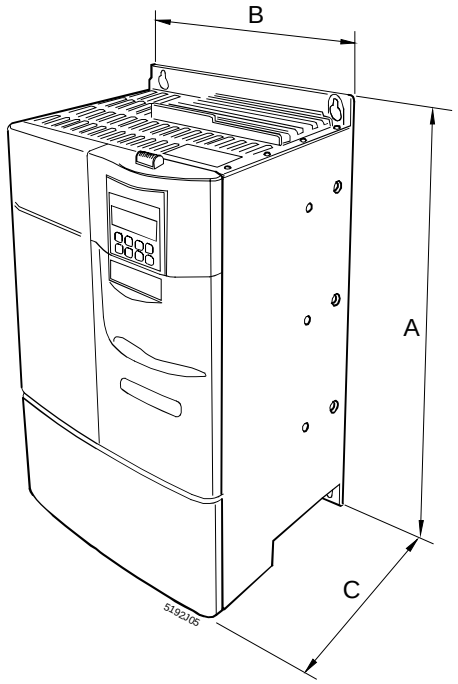


Filter for frame size A



Filter for frame sizes B and C

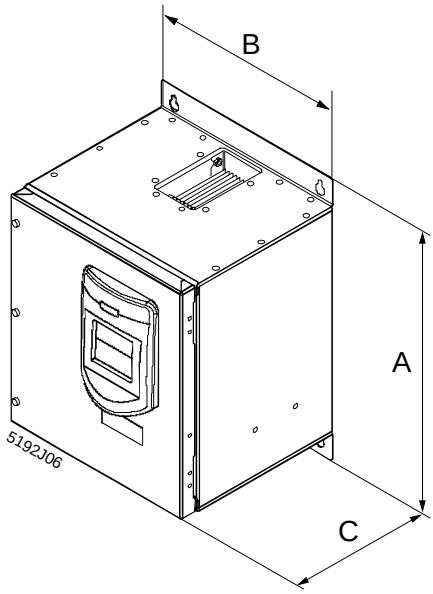
3.3.1.3 Dimensions of SED2 frame sizes D to F



Frame size	Dimensions in mm		
	A	B	C
D	520	275	245
E	650	275	245
F	850 (with filter 1150)	350	320

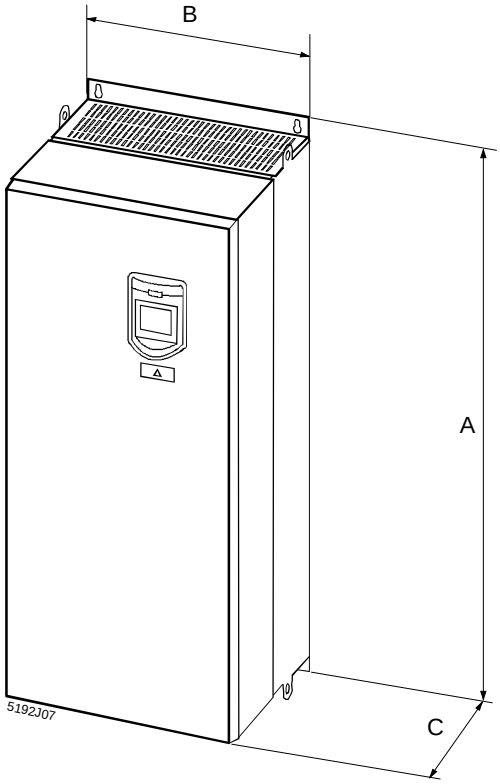
3.3.2 Dimensions of SED2 drives with IP54/NEMA 12 rating

3.3.2.1 Dimensions of SED2 frame sizes B and C



Frame size	Dimensions in mm		
	A	B	C
B	385	270	268
C	606	350	284

3.3.2.2 Dimensions of SED2 frame sizes D to F



Frame size	Dimensions in mm		
	A	B	C
D	685	360	353
E	885	360	453
F	1150	450	473

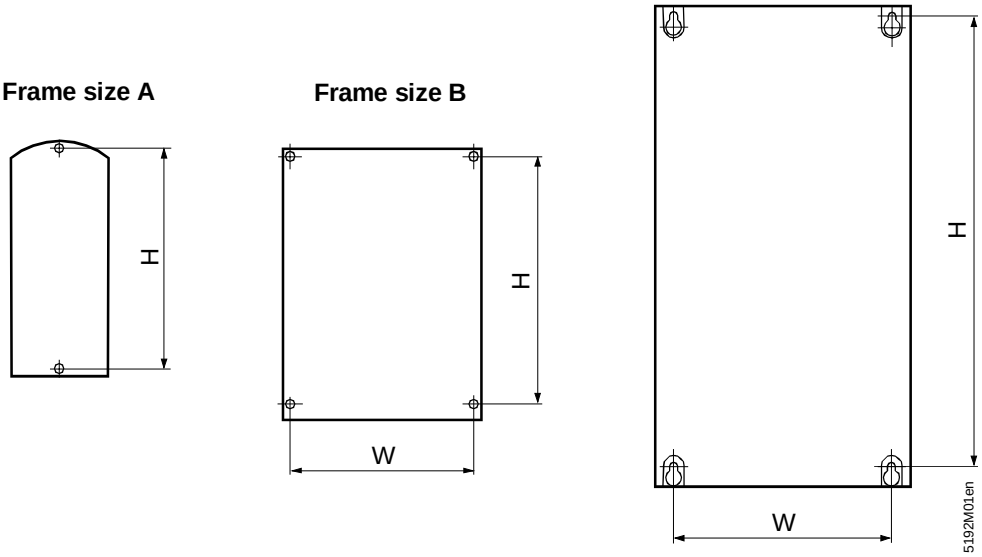
3.3.3 Mounting SED2 drives with IP20/NEMA 0 rating

Drilling plan for SED2 IP20

Frame sizes D, E and F

Frame size A

Frame size B



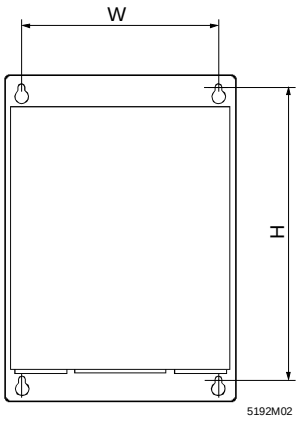
Frame size	Hole spacing		Mounting materials	Tightening torque
	H in mm	**W** in mm		
A	160 * 187	- * 56	2 x M4 bolts 2 x M4 nuts 2 x M4 spring lock washers 2 x M4 washers or mounting on DIN rail	2.5 Nm
B	174 * 200	138 * 120	4 x M4 bolts 4 x M4 nuts 4 x M4 spring lock washers 4 x M4 washers	2.5 Nm
C	204 * 232	174 * 156	4 x M5 bolts 4 x M5 nuts 4 x M5 spring lock washers 4 x M5 washers	3.0 Nm
D	486	235	4 x M8 bolts 4 x M8 nuts 4 x M8 spring lock washers 4 x M8 washers	13 Nm
E	616.4	235	4 x M8 bolts 4 x M8 nuts 4 x M8 spring lock washers 4 x M8 washers	13 Nm
F	810 1110 with filter	300	4 x M8 bolts 4 x M8 nuts 4 x M8 spring lock washers 4 x M8 washers	25 Nm

* with footprint filter

Note ☞ A minimum clearance of 100 mm is required above and below each variable speed drive.

3.3.4 Mounting SED2 drives with IP54 / NEMA 12 rating

Drilling plan for SED2 IP54



Frame size	Hole spacing		Clearance (mm)			Mounting materials	Tightening torque
	H (mm)	**W**(mm)	Top	Bottom	Side		
B	342.8	230	150	150	100	4xM6 bolts 4xM6 washers 4xM6 spring lock washers	5 Nm
C	564	312.7	150	150	100	4xM6 bolts 4xM6 washers 4xM6 spring lock washers	5 Nm
D	647	310	200	200	150	4xM8 bolts 4xM8 washers 4xM8 spring lock washers	13 Nm
E	847	310	200	200	150	4xM8 bolts 4xM8 washers 4xM8 spring lock washers	13 Nm
F	1112	400	300	250	150	4xM8 bolts 4xM8 washers 4xM8 spring lock washers	20 Nm

4 Electrical installation

Danger

The VSD must be grounded.

- To ensure safe operation of the equipment, authorized persons must install and commission it in full compliance with the notes and warnings set out in these operating instructions.
- Take particular note of general and regional installation and safety regulations regarding work on sites with dangerous voltages (e.g. EN 50178), and of the relevant regulations for the correct use of tools and personal protective equipment.
- The cross-section of the ground bonding conductor must be at least equal to that of the mains connection cables.

Danger

Dangerous voltages may occur at the following terminals even when the variable speed drive is not running:

- Power supply terminals L1, L2, L3.
- Motor terminals U, V, W, DC+, DC-.
- Link terminals DC-, DC+/B+, DC/R+, B-.

After switching off the supply voltage, wait at least 5 minutes before starting any installation or service work.

4.1 General

4.1.1 Maximum length of motor cables

The performance data given in the specifications cannot be guaranteed if the motor cables exceed the following lengths: 50 m for shielded cables
100 m for unshielded cables

For devices featuring EMC filters, the maximum cable length is 25 m. For cables shorter than > 25 m, the EMC guideline for filtered devices does not apply.

Note ☞

If you connect several motors to one VSD, the individual motor lines must be added to the total line length.

4.1.2 Operation with ungrounded systems

IP20/NEMA 0

SED2 variable speed drives with a protection standard of IP20 operate in ungrounded systems, and remain in operation when an input phase connects to ground. In the event of an output phase with a ground fault, the SED2 switches off and displays message F0001.

IP54/NEMA 12

SED2 drives with a protection standard of IP54/NEMA 12 cannot be operated in ungrounded systems.

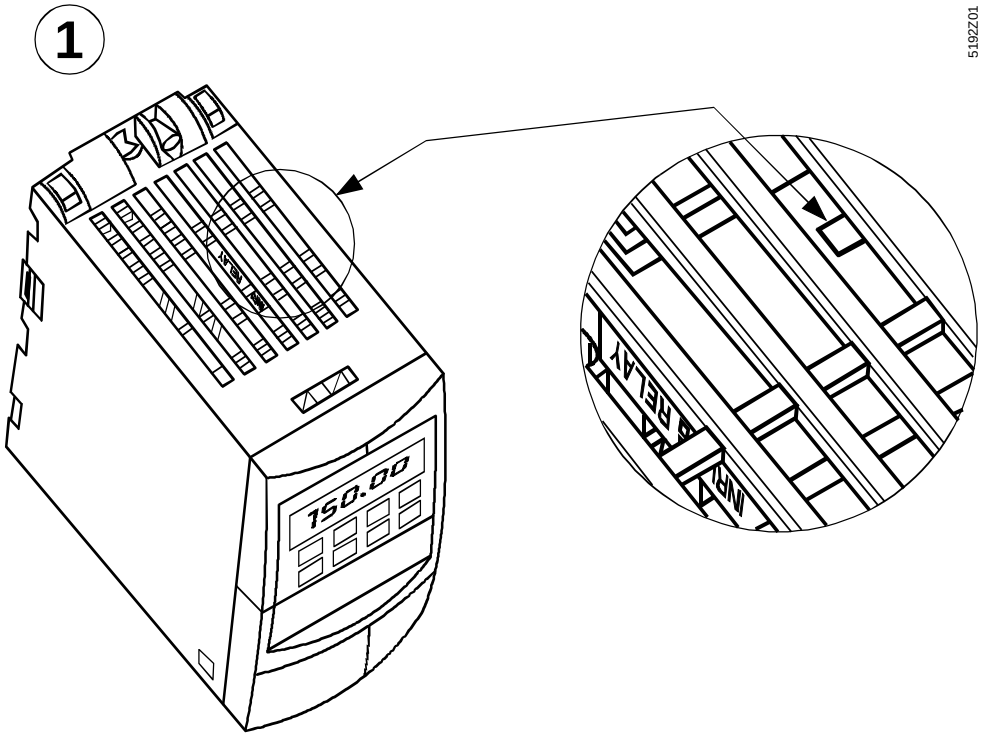
4.1.2.1 **Precautions for ungrounded systems** (IT protective systems)

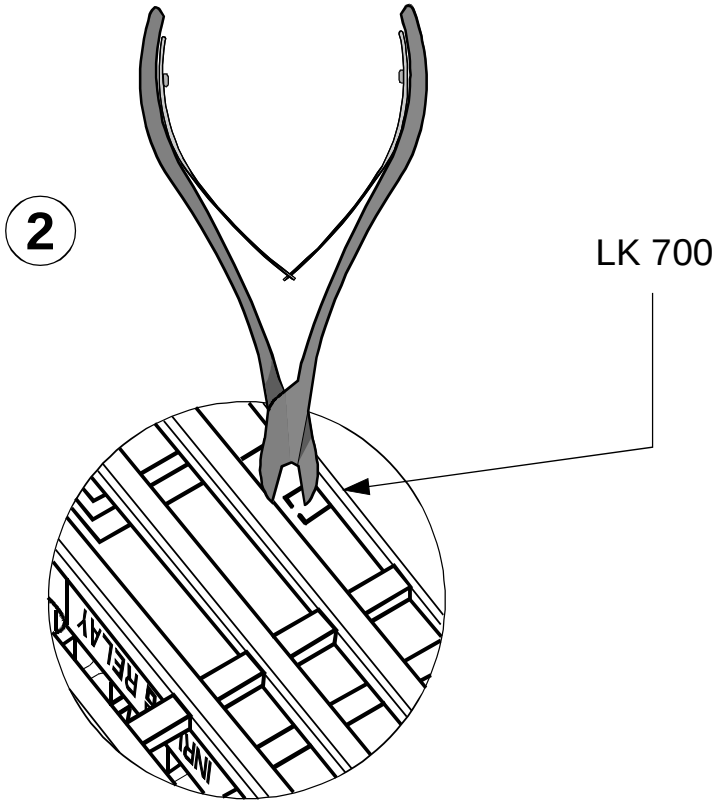
In ungrounded systems, remove the Y capacitor, or break the connections to this capacitor and integrate an output choke. The following procedure shows how to remove or disconnect the capacitor.

Important

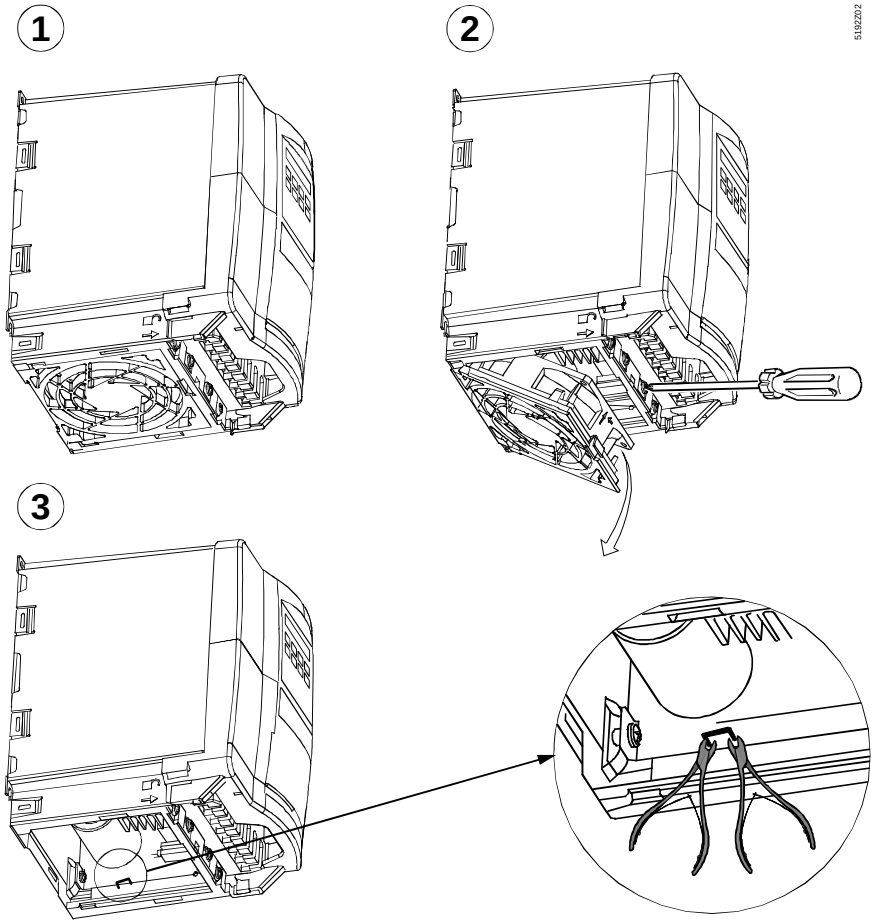
Operation in ungrounded systems is possible only using the SED2, IP20, without filter.

Disconnecting the Y capacitor in SED2 drives, frame size A

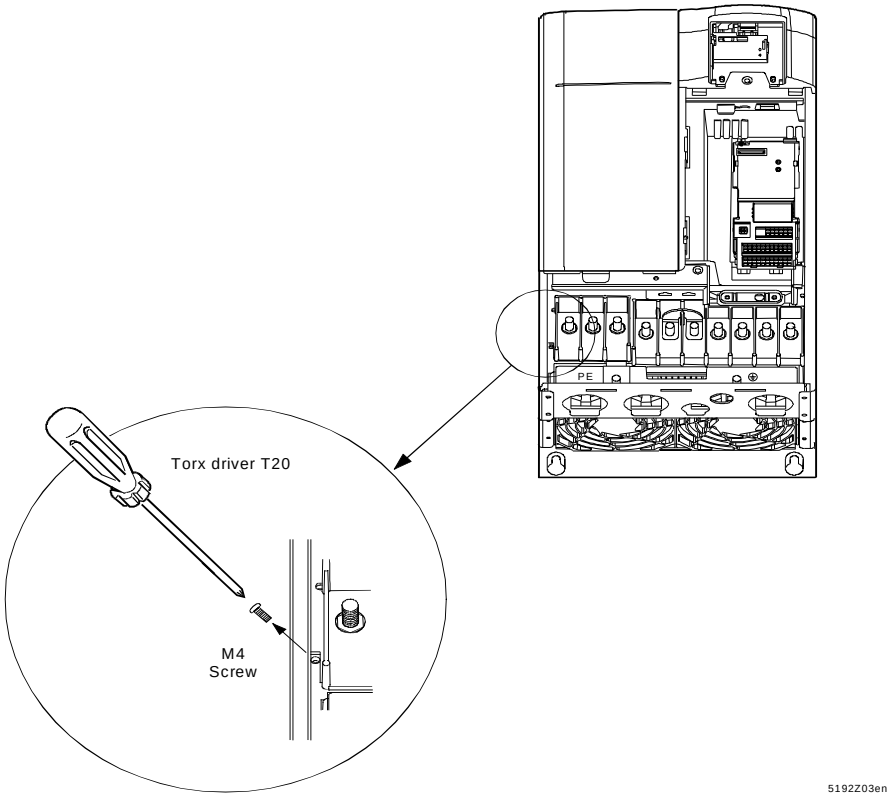




Disconnecting the Y capacitor in SED2 drives, frame sizes B and C

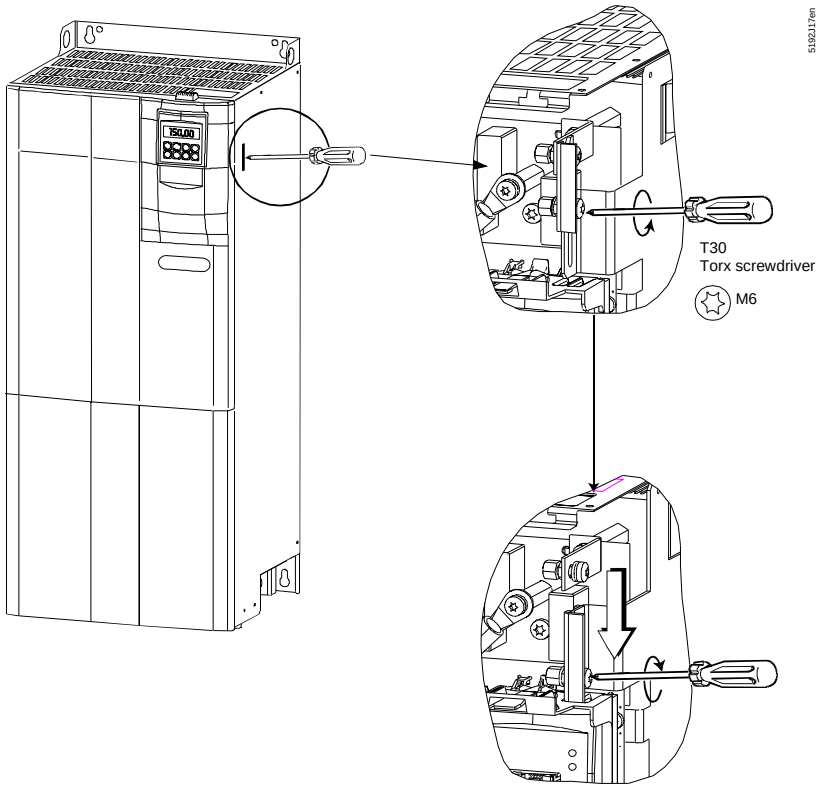


Disconnecting the Y capacitor in SED2 drives, frame sizes D and E



4.1.3 Operation with a residual current device (RCD)

Disconnecting the Y capacitor in SED2 drives, frame size F



If a residual current device (also referred to as a GLCI or RCCB) is connected, the VSD operates without unwanted interruptions under the following conditions:

- ☑ An RCD type B must be used.
- ☑ The RCD must have a threshold current of 300 mA.
- ☑ The neutral conductor in the system must be grounded.
- ☑ Each RCD supplies only one VSD and no other consumers.
- ☑ The output cables must not exceed 50 m in length (shielded) or 100 m (unshielded).

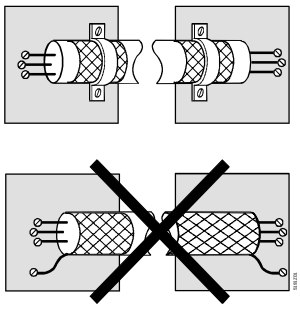
4.2 EMC-compatible installation

The SED2 VSDs operate in environments where they may be exposed to high levels of electromagnetic interference (EMI). Normally, good installation practices ensure safe and interference-free operation. However, should problems associated with EMI occur, follow the guidelines below:

- Ensure good electrical contact between the mounting plate and the metal housing of the VSD via the mounting screws.
- Use serrated lock washers and electrically conductive mounting plates.
- If a footprint EMC filter is used, fit it under the VSD and ground it via the metal backplate. When connecting the EMC filter to the inputs of the VSD, use shielded cables and make sure that they are correctly grounded using cable clamps.

4.2.1 EMC-compatible wiring

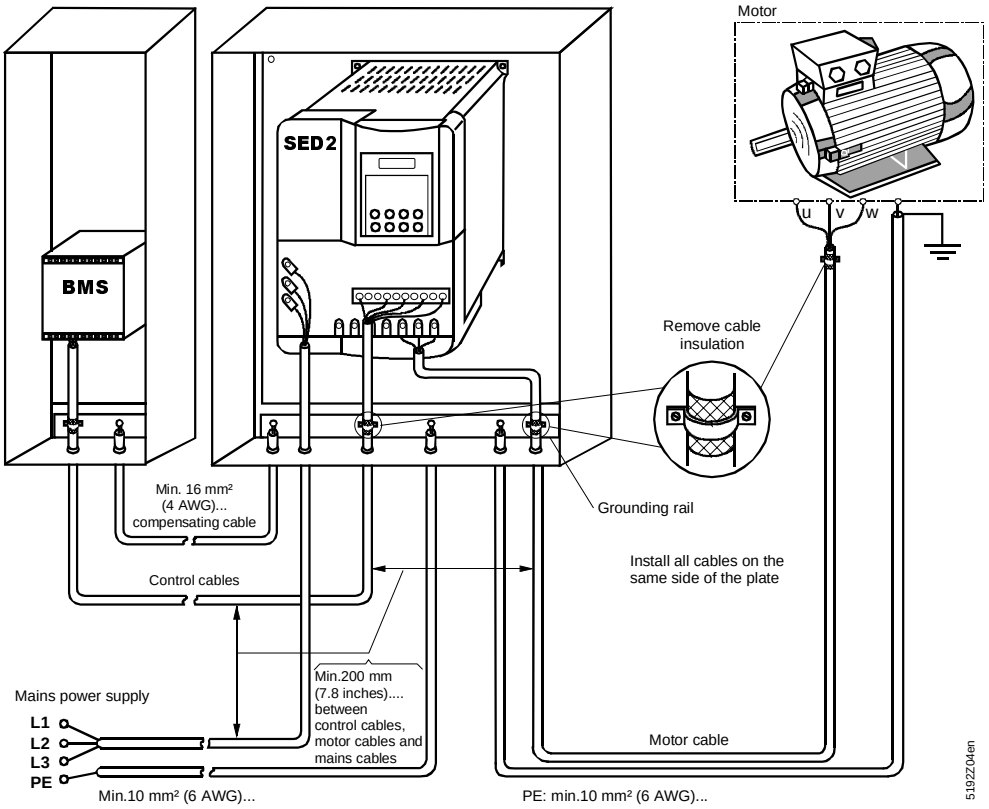
- Use shielded cables also inside control cabinets.
- Ensure that all equipment in the control cabinet is properly grounded. Thus, make sure that all equipment is connected by short, thick grounding conductors to a common grounding point (flat ribbon lines are best) or bus bar.
- Ensure that any control equipment (e.g. PLC or BACS[1]) connected to a VSD is connected with a short, thick cable to the same ground or grounding point as the variable speed drive itself.
- Use only shielded motor and control cables. The shielding must be continuous.
- Connect motor and control cables to ground at both ends.
- Lay control, mains, and motor cables separately by routing them in separate cable ducts and maintaining a minimum clearance of at least 200 mm (see diagram below). If you must cross cables, run them at an angle of 90° if possible.
- Motor cables should be as short as possible and should not exceed 25 m.
- Connect the neutral conductor for the motors controlled by the variable speed drives directly to the ground connection (PE) of the associated VSD.
- Use flat ribbon cables, as they have a lower impedance at high frequencies.
- Avoid pigtails. Use only grounding clamps to bond the screen (see diagram below).



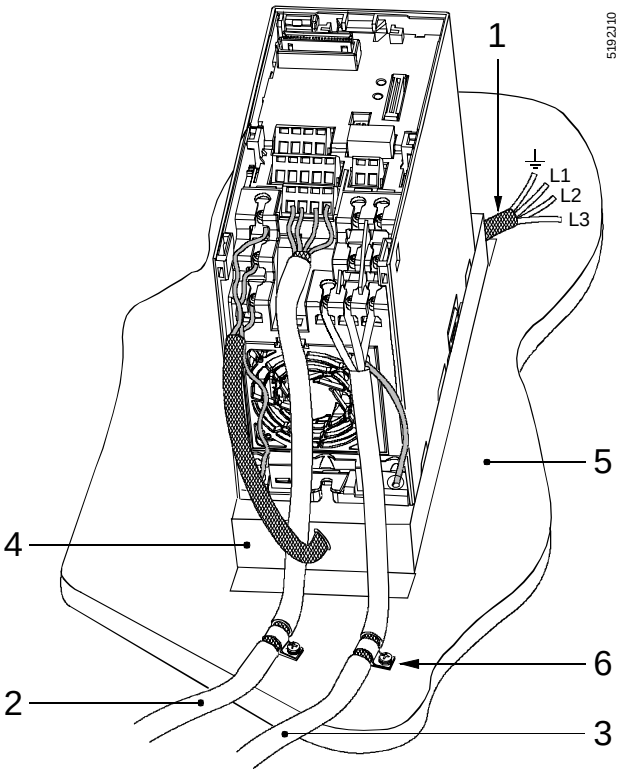
- Check that the contactors in the control cabinet are suppressed—either with RC circuits for AC contactors, or flywheel diodes for DC contactors—and fit the suppressors to the coils. Varistor surge voltage protectors are also effective. This is important if the contactors are controlled by the variable speed drive relay.

[1] SPS: Programmable controllers

BACS: Building automation and control system; sometimes incorrectly referred to as BMS (building management system)

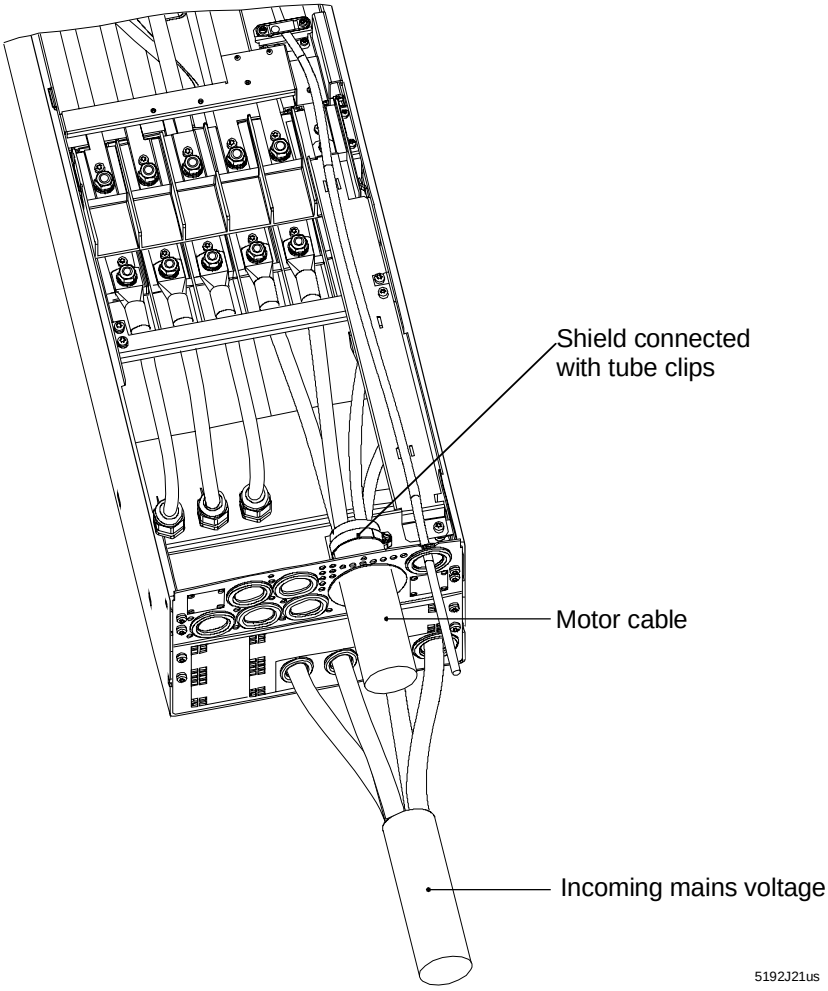


Cable routing for frame sizes A to C, with footprint filter



1 Incoming mains cable
2 Control cable
3 Motor cable
4 Footprint filter
5 Metal backplate
6 Use suitable cable clamps to ensure good conductive contact between the shield of the motor and control cables and the metal backplate
7 Connect the motor cable shield to ⏚.

Cable routing for frame sizes D to F, IP20 with EMC filter



4.3 Mains and motor connections

Caution

Warning and safety instructions

- Check that the VSD and motor are correctly sized for the supply voltage. Check that the VSD corresponds to at least the motor output.
- Check that the mains cables are correctly sized for the anticipated use.
- Check that appropriate circuit breakers or fuses exist between the mains and the variable speed drive.

Warning

Never use high voltage insulation test equipment on any cables connected to the variable speed drive.

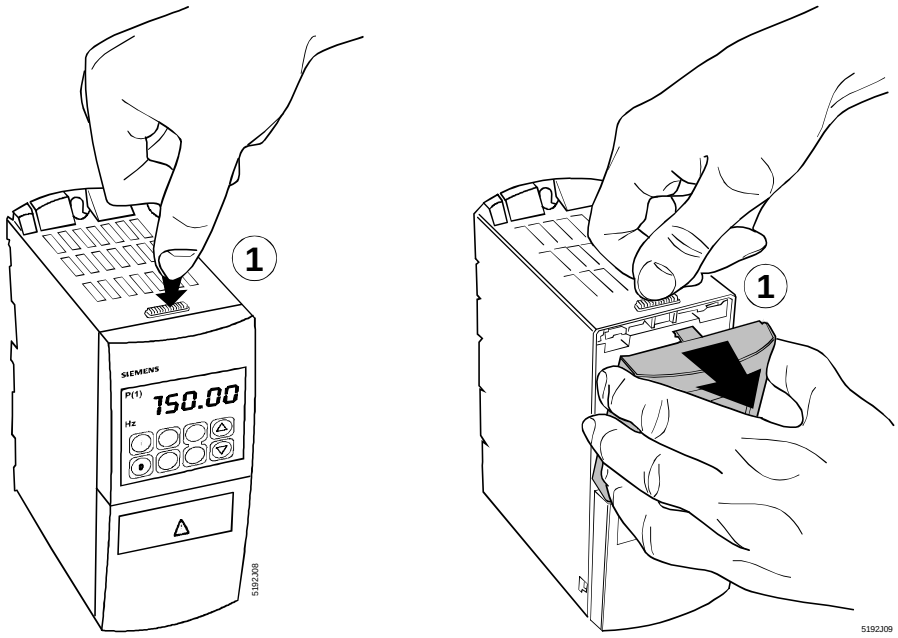
Danger

- Always isolate the power cables before connecting them to the VSD.
- Check that the terminal cover was replaced properly after connecting the power and motor cables.
- Never switch on the VSD with the cover open.
- Always use insulated tools when working on the incoming power supply and the motor terminals.

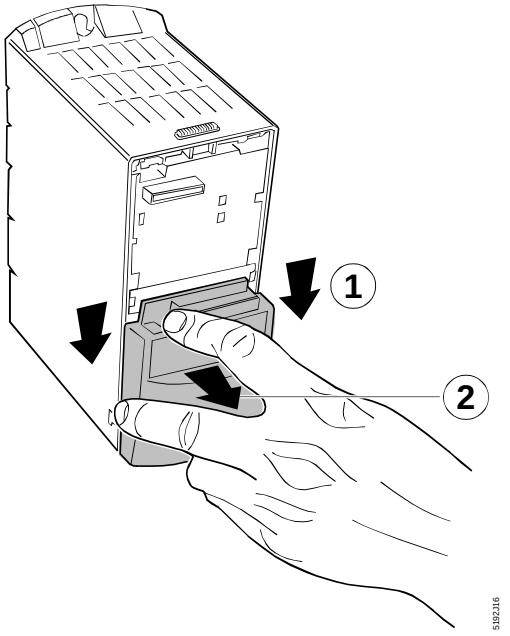
4.3.1 Access to connection terminals: Frame size A

To access the mains and motor terminals, first remove the operator panel, cover, and I/O module as illustrated below.

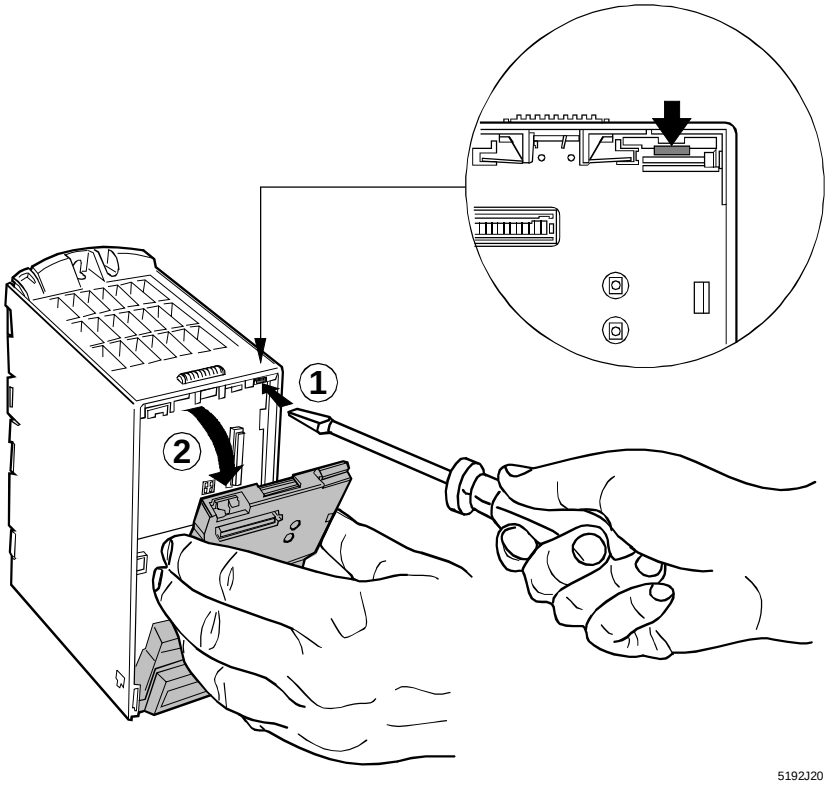
Removing the operator panel (BOP or AOP)



Removing the terminal cover of the I/O module

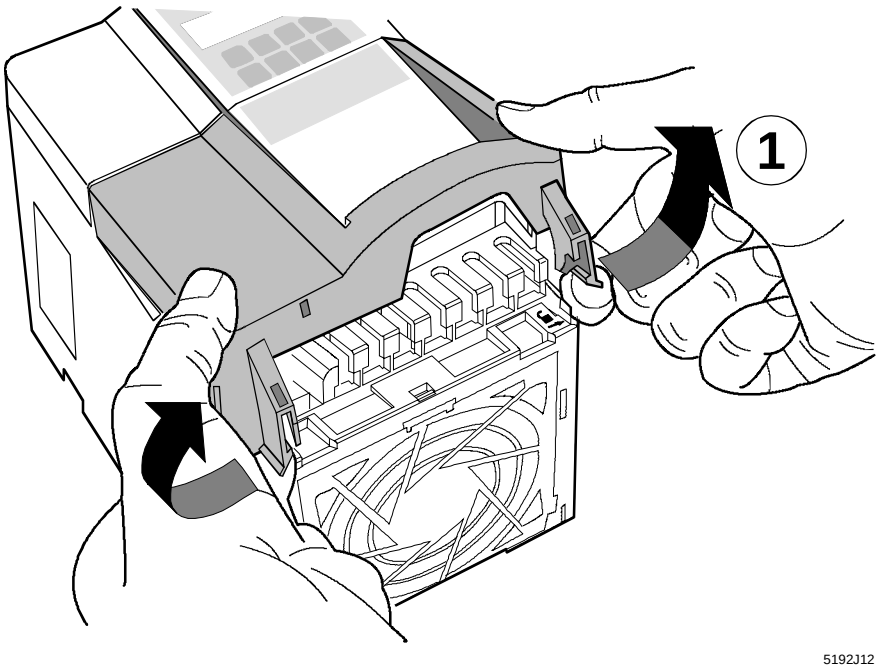


Removing the I/O module



4.3.2 Access to connection terminals: Frame sizes B and C

Removing the cover of the mains and motor terminals

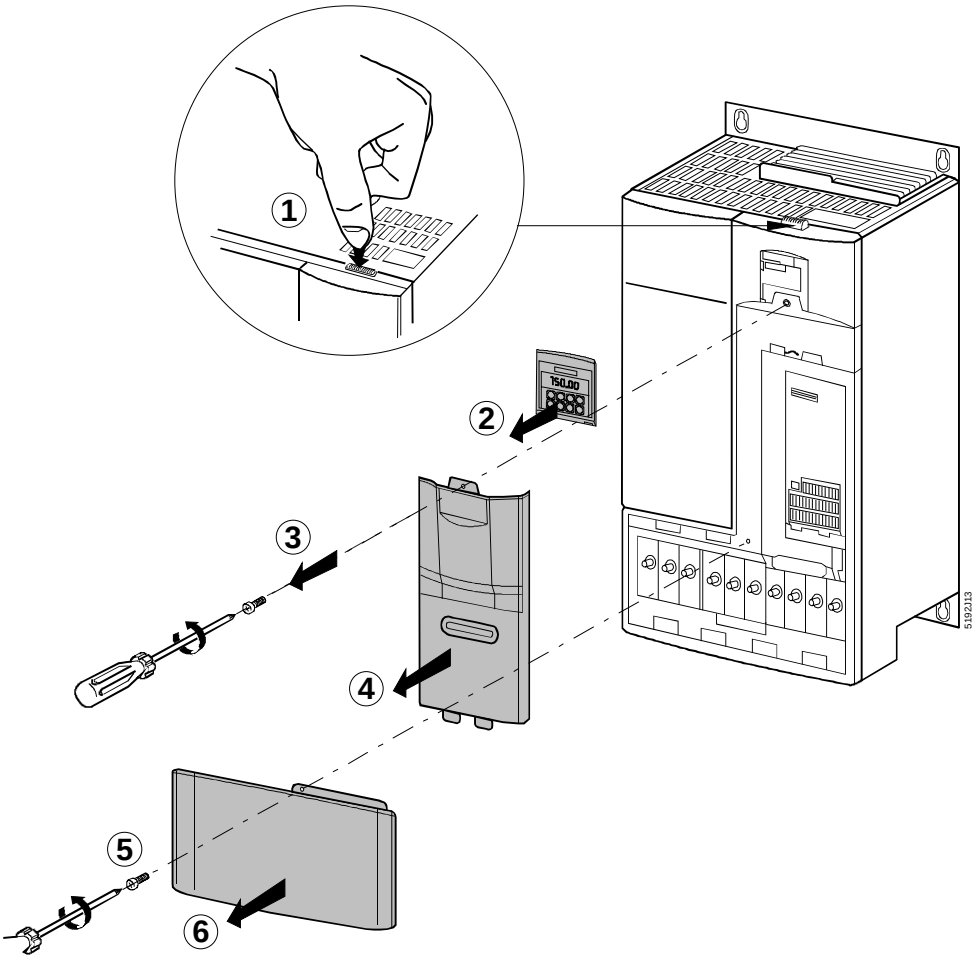


4.3.3 Access to connection terminals: Frame sizes D to F IP20

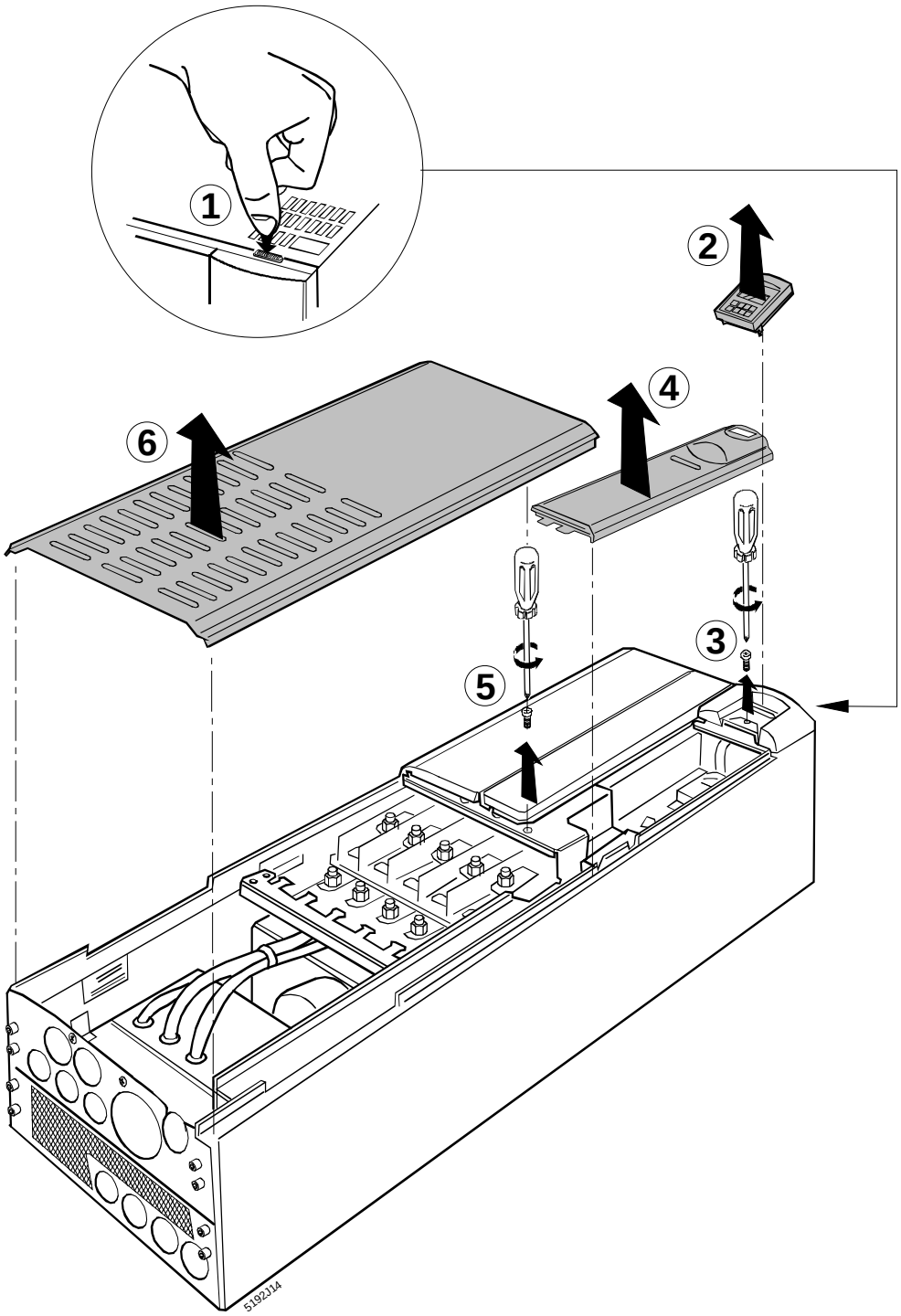
Removing the operator panel (BOP or AOP)

Refer to the relevant paragraph in Access to connection terminals: Frame size A.

Opening the housing: Frame sizes D and E

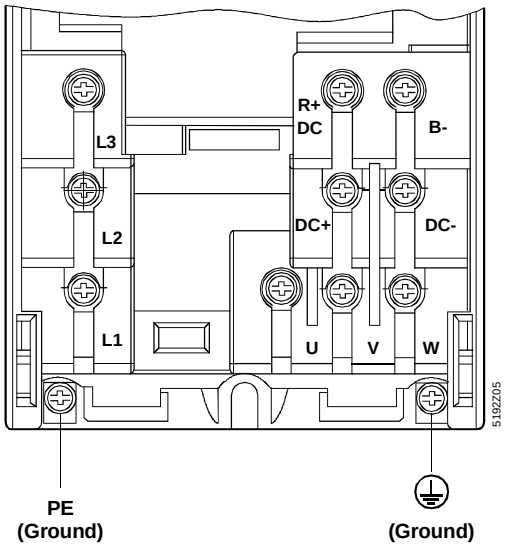


Opening the housing:
Frame size F

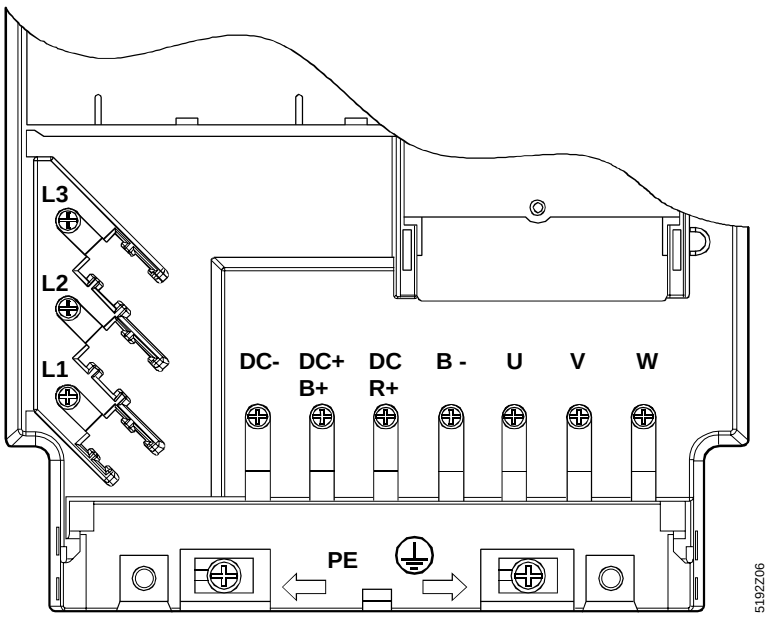


4.3.4 Power and motor terminals: Frame sizes A to F

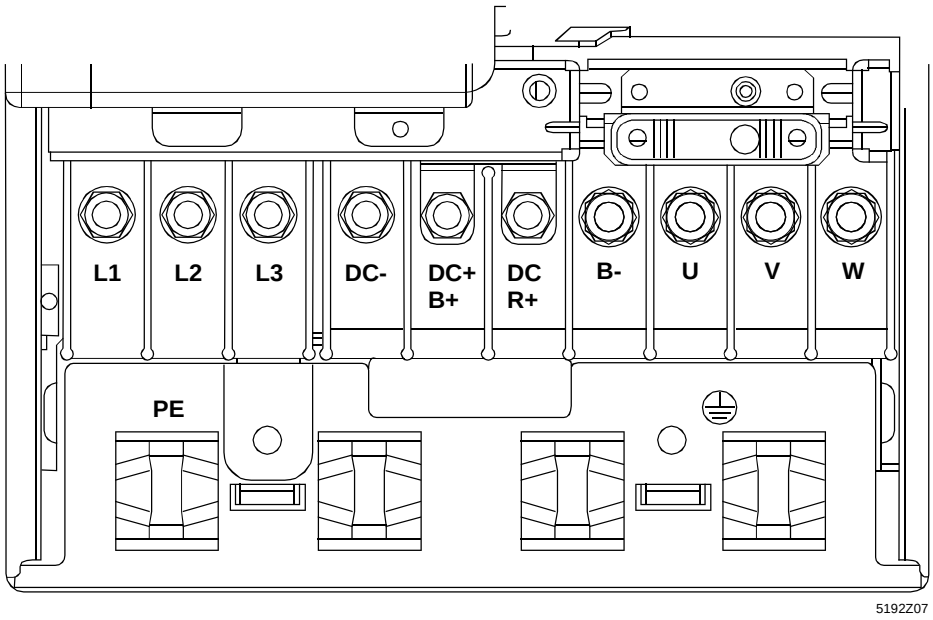
Terminal layout: Frame size A



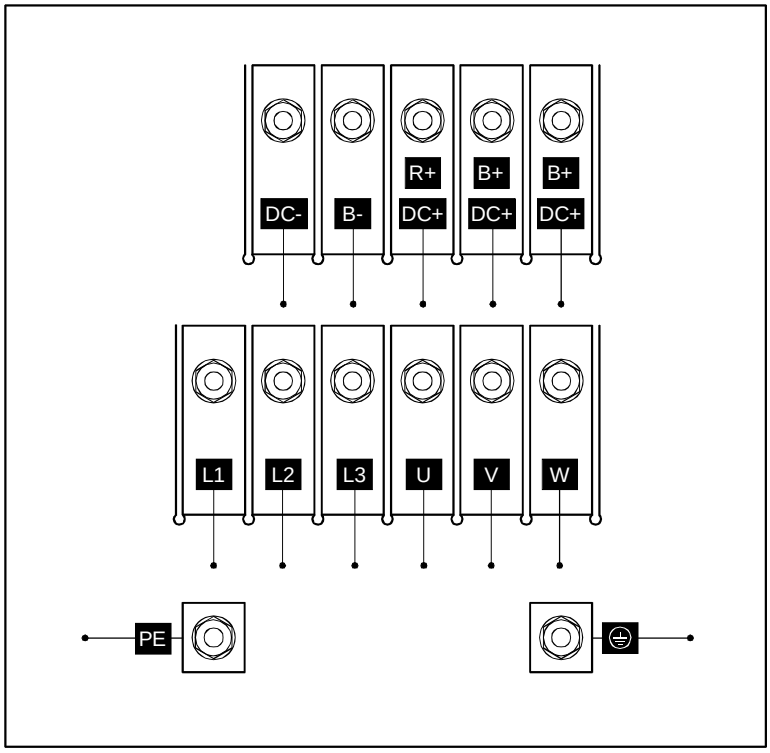
Terminal layout: Frame sizes B and C



Terminal layout: Frame sizes D and E



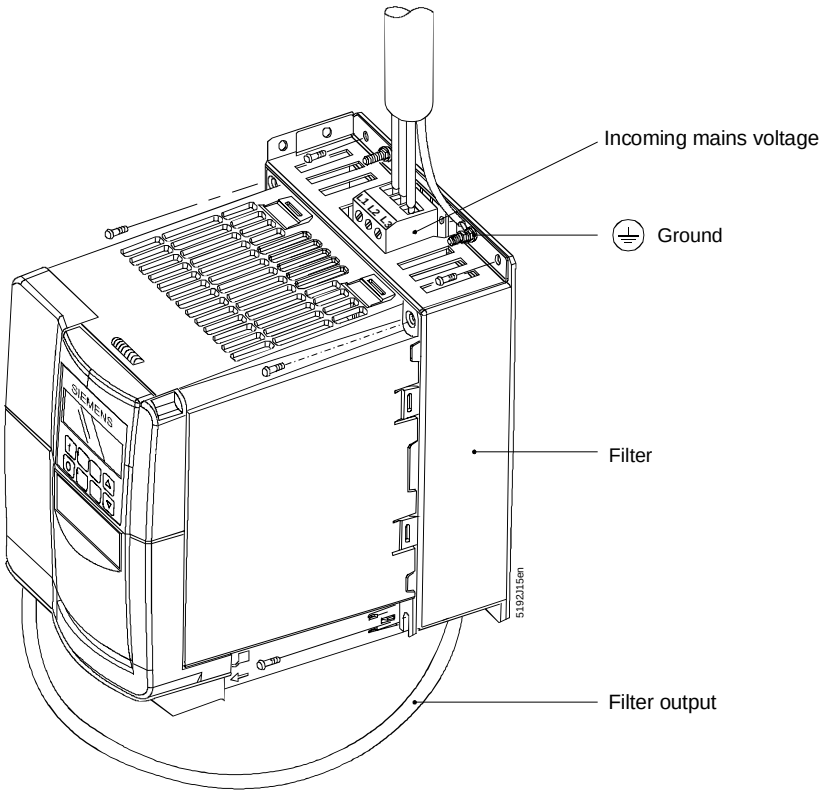
Terminal layout: Frame size F



4.3.5 Power connection for drives with a built-in EMC filter

Power connection to the footprint filter for frame sizes A to C

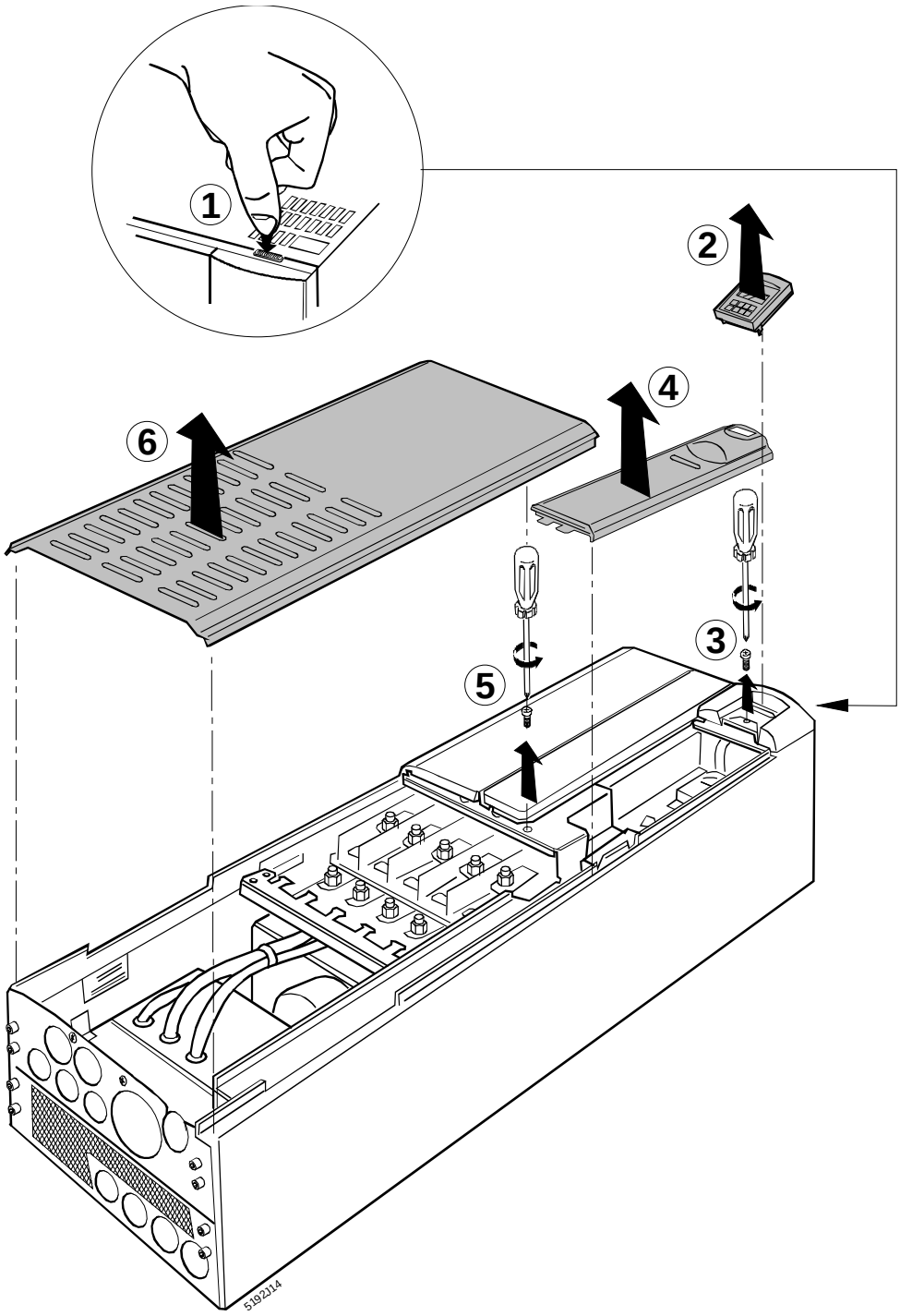
The SED2 drives with frame sizes A, B, and C are delivered with built-in ready-wired EMC footprint filters. Route the power supply to the terminals of the pre-installed footprint filter.

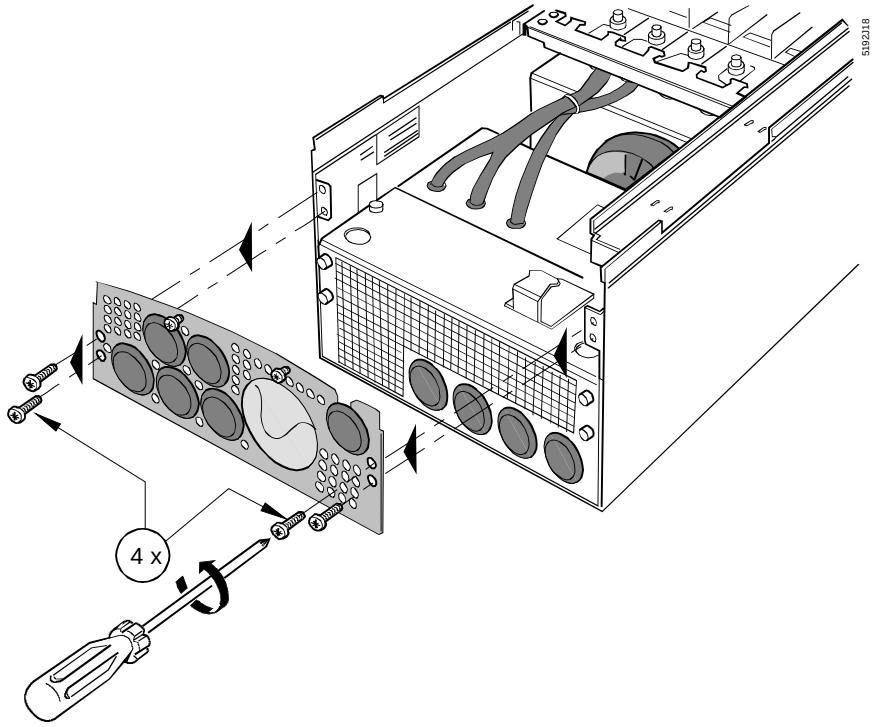


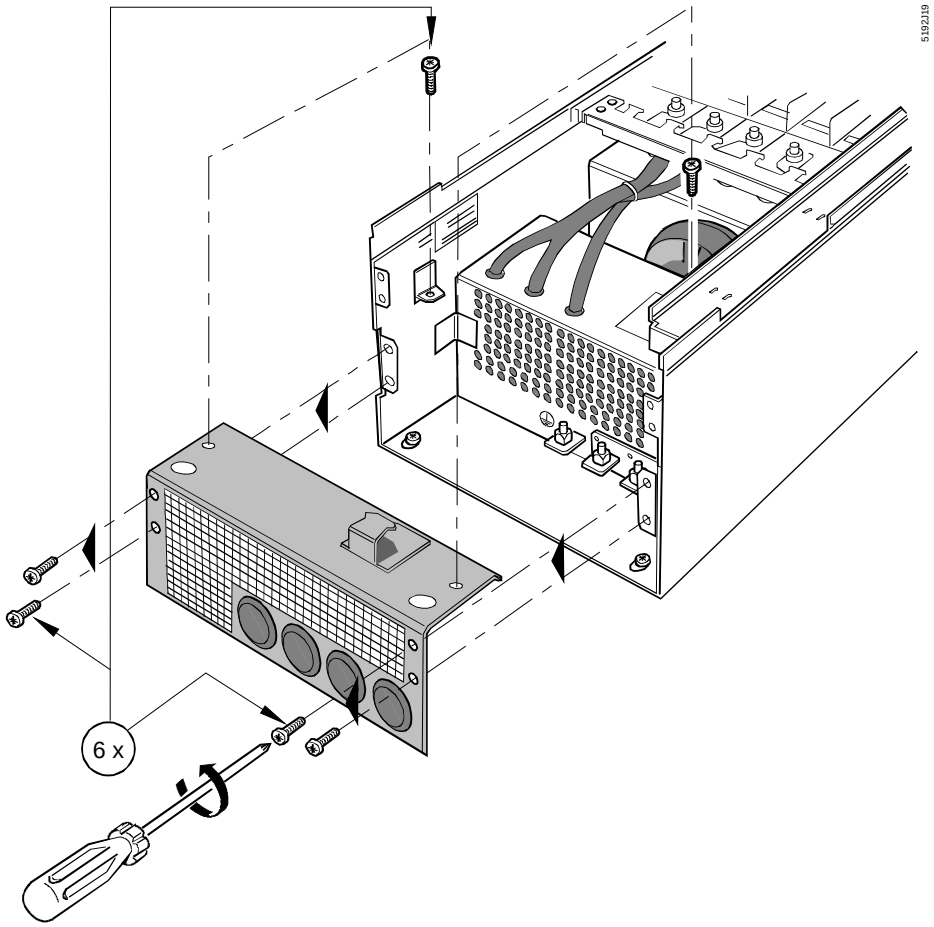
Power connection at the integrated EMC filter for frame sizes D to F

The SED2 drives with frame sizes D, E, and F are delivered with built-in ready-wired EMC filters. Wire the power supply to the connections of the built-in filter. The diagrams below show how to access the mains connections of the built-in filter.

Access to the mains connection of the EMC filter for frame sizes D to F

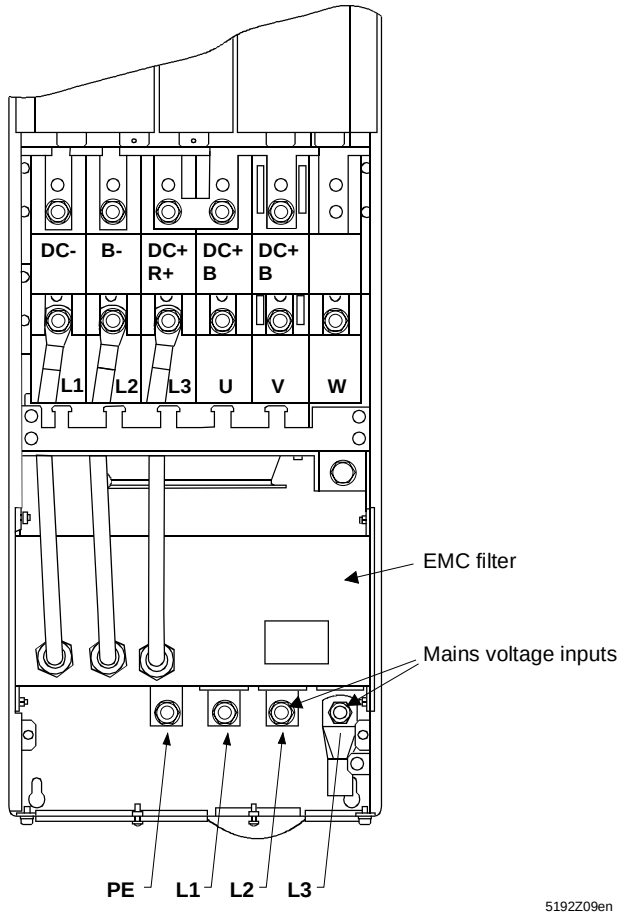



5192118
4 x


5192119
6 x

Connection terminals of SED2 frame size F, IP20, with built-in EMC filter

View without cable entry guide
and without lower terminal connection plate



4.3.6 Tightening torque for connection terminals

Frame size		A	B	C	D	E	F
Tightening torque	Nm	1.1	1.5	2.25	10 (max.)	10 (max.)	50

4.3.7 Cross-sections for power and motor cables

Input voltage range 200 V – 240 VAC, 3-phase				
Output rating kW (hp)	**Min. cross-section of supply cable mm^2 (AWG)**	**Max. cross-section of supply cable mm^2 (AWG)**	**Min. cross-section of motor cable mm^2 (AWG)**	**Max. cross-section of motor cable mm^2 (AWG)**
0.37 (0.5)	1 (17)	2.5 (13)	1 (17)	2.5 (13)
0.55 (0.75)	1 (17)	2.5 (13)	1 (17)	2.5 (13)
0.75 (1)	1 (17)	2.5 (13)	1 (17)	2.5 (13)
1.1 (1.5)	1 (17)	6 (9)	1 (17)	6 (9)
1.5 (2)	1.5 (15)	6 (9)	1 (17)	6 (9)
2.2 (3)	2.5 (13)	6 (9)	1 (17)	6 (9)
3 (4)	4 (11)	10 (7)	1.5 (15)	10 (7)
4 (5)	4 (11)	10 (7)	4 (11)	10 (7)
5.5 (7.5)	4 (11)	10 (7)	4 (11)	10 (7)
7.5 (10)	10 (7)	35 (2)	10 (7)	35 (2)

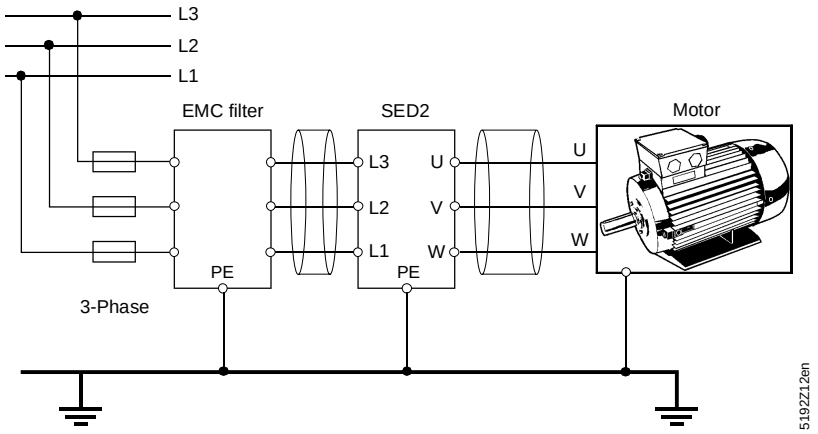
Input voltage range 200 V – 240 VAC, 3-phase				
Output rating kW (hp)	**Min. cross-section of supply cable mm² (AWG)**	**Max. cross-section of supply cable mm² (AWG)**	**Min. cross-section of motor cable mm² (AWG)**	**Max. cross-section of motor cable mm² (AWG)**
11 (15)	16 (5)	35 (2)	16 (5)	35 (2)
15 (20)	16 (5)	35 (2)	16 (5)	35 (2)
18.5 (25)	25 (3)	35 (2)	25 (3)	35 (2)
22 (30)	35 (2)	35 (2)	35 (2)	35 (2)
30 (40)	50 (0)	150 (-5)	50 (0)	150 (-5)
37 (50)	70 (-2)	150 (-5)	70 (-2)	150 (-5)
45 (60)	70 (-2)	150 (-5)	95 (-3)	150 (-5)

Input voltage range 380 V – 480 VAC, 3-phase				
Output rating kW (hp)	**Min. cross-section of supply cable mm² (AWG)**	**Max. cross-section of supply cable mm² (AWG)**	**Min. cross-section of motor cable mm² (AWG)**	**Max. cross-section of motor cable mm² (AWG)**
0.37 (0.5)	1 (17)	2.5 (13)	1 (17)	2.5 (13)
0.55 (0.75)	1 (17)	2.5 (13)	1 (17)	2.5 (13)
0.75 (1)	1 (17)	2.5 (13)	1 (17)	2.5 (13)
1.1 (1.5)	1 (17)	2.5 (13)	1 (17)	2.5 (13)
1.5 (2)	1 (17)	2.5 (13)	1 (17)	2.5 (13)
2.2 (3)	1 (17)	6 (9)	1 (17)	6 (9)
3 (4)	1 (17)	6 (9)	1 (17)	6 (9)
4 (5)	1 (17)	6 (9)	1 (17)	6 (9)
5.5 (7.5)	2.5 (13)	10 (7)	2.5 (13)	10 (7)
7.5 (10)	4 (11)	10 (7)	4 (11)	10 (7)
11 (15)	6 (9)	10 (7)	6 (9)	10 (7)
15 (20)	10 (7)	35 (2)	10 (7)	35 (2)
18.5 (25)	10 (7)	35 (2)	10 (7)	35 (2)
22 (30)	16 (5)	35 (2)	16 (5)	35 (2)
30 (40)	25 (3)	35 (2)	25 (3)	35 (2)
37 (50)	25 (3)	35 (2)	35 (2)	35 (2)
45 (60)	35 (2)	150 (-5)	35 (2)	150 (-5)
55 (75)	70 (-2)	150 (-5)	70 (-2)	150 (-5)
75 (100)	70 (-2)	150 (-5)	95 (-3)	150 (-5)
90 (125)	70 (-2)	150 (-5)	95 (-3)	150 (-5)

Input voltage range 500 V – 600 VAC, 3-phase				
Output rating kW (hp)	**Min. cross-section of supply cable mm² (AWG)**	**Max. cross-section of supply cable mm² (AWG)**	**Min. cross-section of motor cable mm² (AWG)**	**Max. cross-section of motor cable mm² (AWG)**
0.75 (1)	1 (17)	10 (7)	1 (17)	10 (7)
1.1 (1.5)	1 (17)	10 (7)	1 (17)	10 (7)
1.5 (2)	1 (17)	10 (7)	1 (17)	10 (7)
2.2 (3)	1 (17)	10 (7)	1 (17)	10 (7)
3 (4)	1 (17)	10 (7)	1 (17)	10 (7)

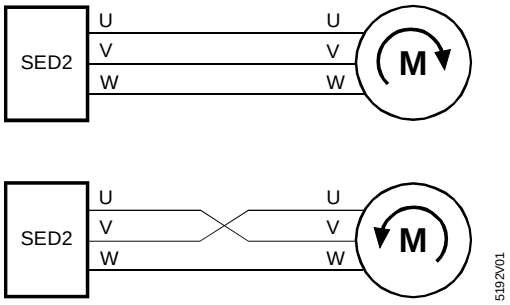
Input voltage range 500 V – 600 VAC, 3-phase				
Output rating kW (hp)	**Min. cross-section of supply cable mm^2 (AWG)**	**Max. cross-section of supply cable mm^2 (AWG)**	**Min. cross-section of motor cable mm^2 (AWG)**	**Max. cross-section of motor cable mm^2 (AWG)**
4 (5)	1 (17)	10 (7)	1 (17)	10 (7)
5.5 (7.5)	1.5 (15)	10 (7)	1.5 (17)	10 (7)
7.5 (10)	2.5 (13)	10 (7)	2.5 (13)	10 (7)
11 (15)	4 (11)	10 (7)	4 (11)	10 (7)
15 (20)	6 (9)	35 (2)	6 (9)	35 (2)
18.5 (25)	6 (9)	35 (2)	6 (9)	35 (2)
22 (30)	10 (7)	35 (2)	10 (7)	35 (2)
30 (40)	16 (5)	35 (2)	16 (5)	35 (2)
37 (50)	25 (3)	35 (2)	16 (5)	35 (2)
45 (60)	25 (3)	150 (-5)	25 (3)	150 (-5)
55 (75)	50 (0)	150 (-5)	35 (2)	150 (-5)
75 (100)	70 (-2)	150 (-5)	50 (0)	150 (-5)
90 (125)	70 (-2)	150 (-5)	50 (0)	150 (-5)

4.3.8 Block diagram showing typical installation



4.3.9 Direction of rotation

You can change the direction of rotation of the motor by cross-connecting two of the output conductors at the VSD or the motor.

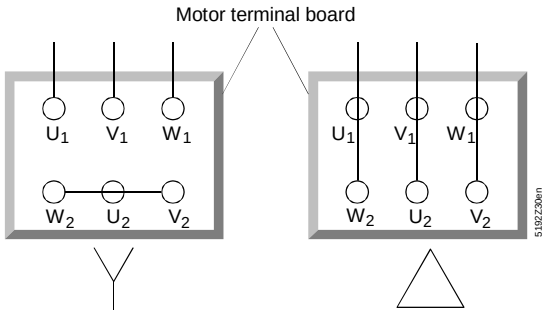


Tip

The direction of rotation can also be reversed via parameter P1820. See system parameter list.

4.3.10 Star or delta connection

The required supply voltage and method of connection are indicated on the motor rating plate. In general, larger motors (400/690 V) are connected in a delta configuration and smaller motors (230/400 V) in a star configuration.

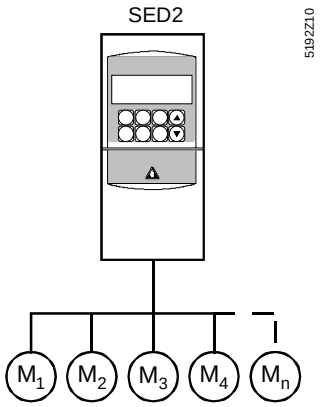


4.3.11 Connecting several motors

You can use the SED2 to control several motors in parallel. Make sure, however, that all motors have the same rating. When multiple motors are connected, the motors connected in parallel cannot be operated individually.

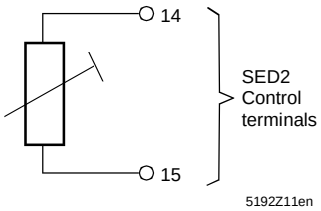
Important

When determining the required power, remember to take account of the **total current** from all the motors, i.e., the sum total of all ratings.
Note the recommended length of the motor connection cable. The sum of all connection cables represents the total cable length.



$$\sum I_{M_1..M_n} \leq I_{SED2,max.}$$
$$\sum P_{M_1..M_n} \leq P_{SED2,max.}$$

4.3.12 External motor overload protection



During operation below nominal speed, the cooling effect of the fans fitted to the motor shaft is reduced. For this reason, most motors require de-rating if operated continuously at low frequencies. To ensure that motors are protected from overheating under these conditions, mount a PTC temperature sensor to the motor and connect it to the control terminals of the variable speed drive.

Note ☞

To activate the switch-off function, set parameter P0601 to 1.

4.4 Control terminals

General information

Use only shielded cables for control cables.
Route control cables in separate cable trunks at least 20 cm away from motor and power cables.

Location of the control terminals

The control terminals are located on the I/O module. The I/O module is identical for all models. It is located under the operator panel.

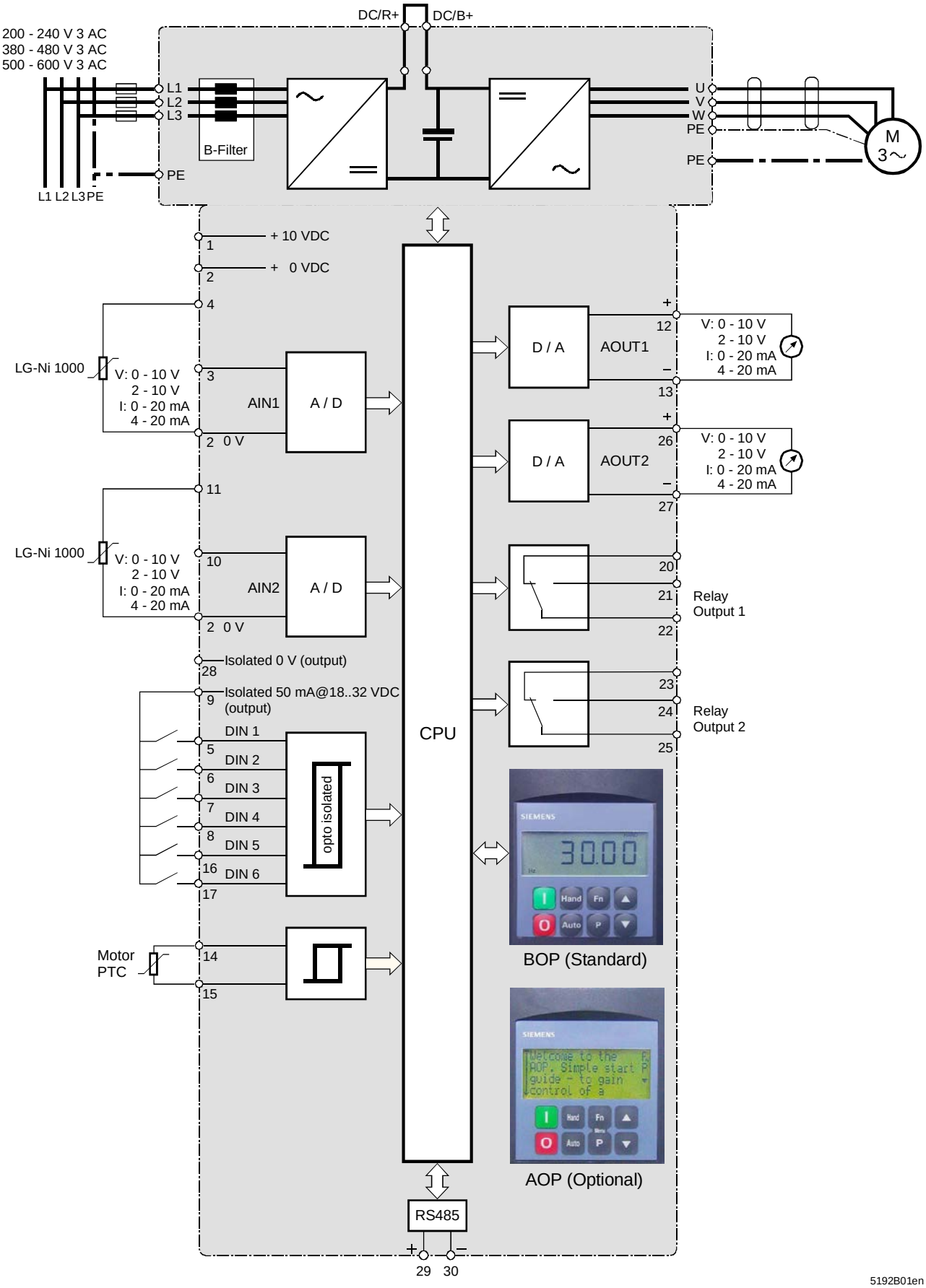
Access to the control terminals: Frame sizes A to C

To access the control terminals, remove first the relevant terminal covers.
For frame size A, see section Access to connection terminals: Frame size A on page 26.
For frame sizes B and C, see section Access to connection terminals: Frame sizes B and C on page 27.

Access to the control terminals: Frame sizes D to F, IP20

To access the control terminals, remove the operator panel, the I/O module, and the I/O module terminal cover plate.
See section Access to connection terminals: Frame sizes D to F on page 28.

4.5 SED2 block diagram



5 Commissioning

Warnings

Only authorized personnel trained in the setup, installation, commissioning, and operation of the product may work on the product and plant.

Danger

- SED2 variable speed drives operate at high voltages.
- Operation of electrical equipment inevitably involves the use of dangerous voltages in some components.
- Emergency stop facilities in accordance with EN 60204 IEC 204 (VDE 0113) must remain operative in all operating modes of the control equipment. Resetting the emergency stop facility must not result in an uncontrolled or undefined restart.
- In cases where faults in the control equipment could cause significant equipment damage or severe physical injury (e.g. potentially dangerous short circuits), take additional external precautions or provide facilities to ensure or enforce safe operation even in the event of a short circuit (e.g. independent limit switches, mechanical interlocks, etc.).
- Certain parameter settings may cause the variable speed drive to restart automatically after a power failure.

Caution

For reliable motor overload protection, the motor parameters must be configured accurately.

The equipment incorporates internal motor overload protection in accordance with UL508C, section 42. Refer to P0610; $I^2 t$ is the default for ON. Motor overload protection can also be provided via an external PTC temperature sensor (disabled by default, P0601).

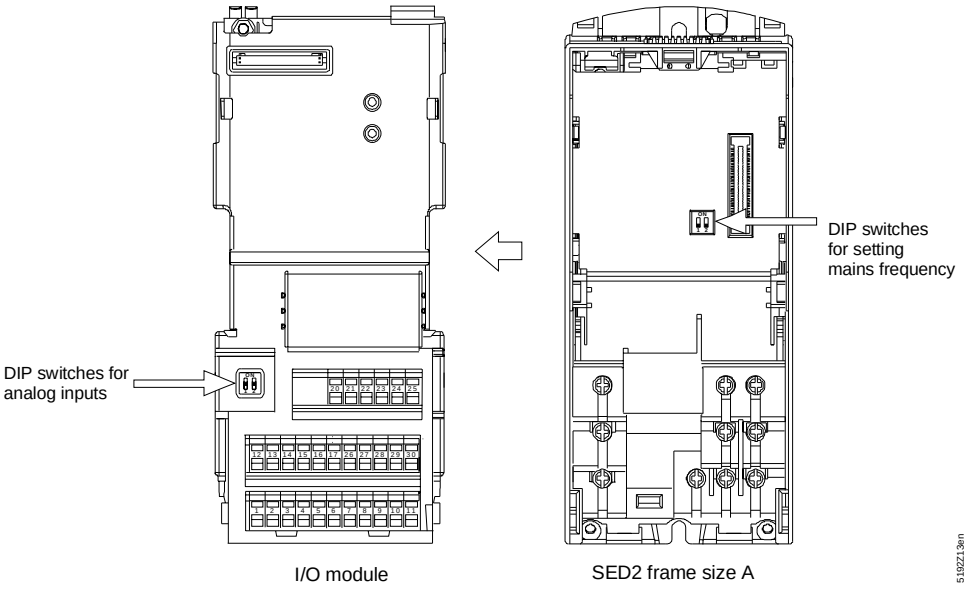
The equipment is suitable for use in a circuit delivering max. 10,000 symmetrical amps (rms), and is designed for a maximum voltage of 230V/460V/575V when protected by a type H or K fuse.

Do not use the variable speed drive as an “emergency stop facility".
(see EN60204, 9.2.5.4)

5.1.1 DIP switch settings

Location of the DIP switches

For all versions of the SED2, the DIP switches used to configure the analog inputs are located on the I/O module. The I/O module is located under the operator panel, to which it is connected either directly (frame sizes A to C, IP20) or via a cable (frame sizes D to E, and all IP54 models).



In all versions of the SED2, the DIP switches for setting the mains frequency and selecting US or European units of measurement are located on the control board under the I/O module.

5.1.1.1 Setting the DIP switches on the I/O module

- **DIP switch 1** **Analog input 1**: OFF position: Voltage 0 to 10 V
  ON position: Current 0 to 20 mA
- **DIP switch 2** **Analog input 2**: OFF position: Voltage 0 to 10 V
  ON position: Current 0 to 20 mA

Factory setting for both DIP switches: OFF = Voltage 0 to 10 V.

5.1.1.2 DIP switch settings on the control board

- **DIP switch 2:** OFF position: European default settings (50 Hz, kW etc.).
  ON position: North American default settings (60 Hz, hp, etc.).
  Factory setting: OFF = 50 Hz.
- **DIP switch 1** Not for customer use. This switch must be in the **OFF** position for correct functioning of the VSD.

5.2 Checklist prior to start

What	✓
Is the output of the VSD ≥ motor rating?	
Is the operating voltage range ok?	
Is the rated voltage of the SED2 greater than the motor rated voltage?	
Is the cross-section of the mains cable correct?	
Are the cross-section and the length of the motor cables correct, and are they connected properly?	
Are all control lines connected properly?	
Is the motor not blocked mechanically?	
Is the medium (water) available for the pump actuator? (No dry run!)	
Is there no pumping or blowing against still open valves or dampers?	
Is the danger zone free of items or personnel?	

5.3 Operator panels for the SED2

The SED2 comes with the Basic Operator Panel (BOP) mounted as standard. An advanced operator panel (AOP) is available as an option.

5192P01.jpg

Basic operator panel

5192P02.jpg

Advanced operator panel

5.3.1 Description of the basic operator panel (BOP)

The basic operator panel (BOP) provides access to the parameters of the VSD and allows for application-specific settings of the SED2.
The parameters and measured values are shown in a 5-digit LCD display. The basic operator panel can be mounted directly onto the variable speed drive or, alternatively, it can be mounted into a control cabinet door using a special installation kit.

You cannot store parameter information with the basic operator panel.

For information on setting and changing parameters, refer to section 5.4.4.2 Setting parameters with the BOP or AOP.

5.3.2 Description of the advanced operator panel (AOP)

The advanced operator panel has the following additional functions as compared to the basic operator panel:

- Multilingual and multi-line plain text display.
- Displays units of measurement for speed, frequency, direction of motor rotation, current, etc.
- Comments on current parameters, error messages, etc.
- Diagnostics menu for troubleshooting.
- Main menu can be invoked directly by pressing the **Fn** and **P** keys simultaneously.
- Load and store up to 10 parameter sets.
- Communicate via RS232 or RS485 interfaces.
- Programmable with PC without VSD (PC-AOP kit required).
- Multi-drop capability to control up to 31 SED2 variable speed drives.
- 7-day timer with 3 switching operations per day.

For more details, refer to the AOP operating instructions.

5.3.3 Exchanging the operator panels

See illustration in section Removing the operator panel (BOP or AOP) on page 26.

Tips

The BOP or AOP can be connected to or disconnected from the variable speed drive without switching off the power supply.

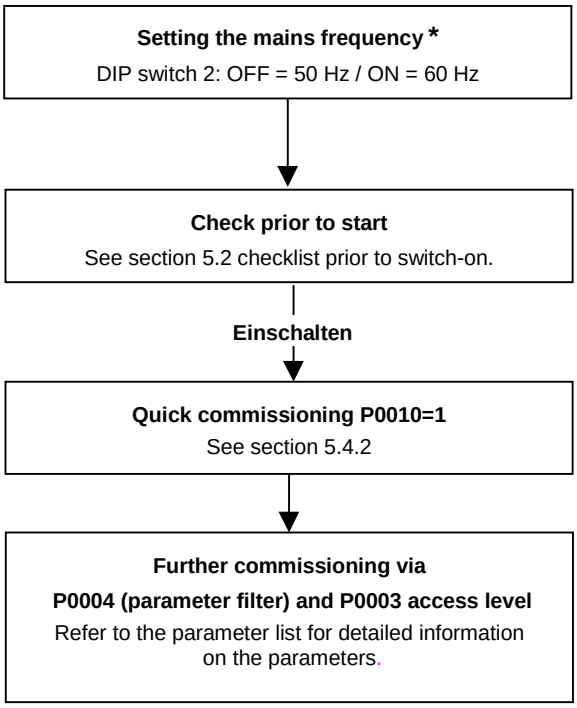
5.3.4 Buttons and their functions on the operator panel (BOP and AOP)

Operator panel/Button	Function	Effects
	Status display	The LCD (five-digit display for BOP, multi-line clear-text display for AOP) shows the settings used presently by the VSD or used to parameterize the VSD).
	Start motor	Pressing this button starts the variable speed drive. This button is enabled for manual mode as part of the factory setting.
	Stop motor	OFF1 Pressing this button stops the variable speed drive within the selected ramp-down time. This button is enabled for manual mode as part of the factory setting. OFF2 Pressing this button twice (or once with sustained pressure) causes the motor to coast freely to a standstill. This function is enabled in the manual and automatic operating modes.
	Changeover to manual control	Pressing this button while the VSD is running sets the input logic so that the operator controls the SED2. In this mode, none of the controlled variables have any influence on the control of the VSD.
	Changeover to automatic control	In automatic mode, all I/Os are set to represent the system-dependent variables. No manual inputs are accepted. The controller responds to changes depending on its parameter setting. However, it is possible to change system parameters in automatic mode.
	Functions	This button allows for displaying additional information. Refer also to the section *Buttons with special functions* in the AOP operating instructions. **Multiple display mode** When you press this button for 2 seconds during operation, the following information is displayed regardless of the parameter: 1. DC link voltage (indicated by d – units V). 2. Output current (A). 3. Output frequency (Hz). 4. Output voltage (indicated by o – units V). 5. The value selected in P0005. (If P0005 is configured to display any of the above (1 to 4), the value is not redisplayed). Briefly press the key repeatedly to cycle through the above displays. Pressing again this button for a sustained time exits the multiple display mode. **Jump function** You can jump from any parameter (rXXXX or PXXXX) directly to r0000 by pressing the **Fn** button briefly. This allows you to modify another parameter if required. After jumping to r0000, press the **Fn** button again to return to the starting point.
	AOP only	Pressing buttons Fn and P simultaneously opens the main menu.
	Access to parameters	Pressing this button allows you to: 1. Access the parameters, and 2.: Exit the parameter by accepting its value.
	Increase value	Press this button to increase the value displayed. This button helps increase the current value during parameterization. In manual mode, this button allows for increasing the speed (internal motor potentiometer).
	Decrease value	Press this button to decrease the value displayed. This button helps decrease the current value during parameterization. In manual mode, this button allows for decreasing the speed (internal motor potentiometer).

5.4 Commissioning modes

5.4.1 Overview of commissioning with the BOP or AOP

Prerequisites: Mechanical and electrical installation must be complete.



* Factory setting: 50 Hz.

Note ☞ We recommend that you commission the VSD as shown in the diagram below. However, experienced users may commission the equipment without the filter functions of P0004.

5.4.2 Quick commissioning

To achieve a structured procedure, it is **important** to use parameter P0010 for commissioning, and P0003 to select the number of parameters to be accessed. Parameter P0010 allows you to select a group of parameters that can be used for quick commissioning. These include parameters for the motor data and for the motor ramp-up and ramp-down settings (ramp settings).

At the end of the quick commissioning procedure, select P3900. When set to 1, this parameter performs the necessary motor calculations and sets all remaining parameters (those not included under P0010 = 1) to the default values, including P0010=0 (if P0010 is set to 1, the VSD cannot start). This process is only possible in “quick commissioning” mode.

Quick commissioning flow chart

P0003 Parameter access level
0 Customized Parameter List; see P0013
1 Standard: Access to most commonly used parameters (factory setting)
2 Extended: Extended access, e.g., to VSD I/O functions
3 Expert: For experienced users only
4 Service: For authorized service personnel only (password protected)

↓

P0010 Start quick commissioning
0 Ready for operation
1 Quick commissioning
30 Factory setting

Note
Always reset P0010 to "0" before operating the motor. If, after commissioning, P3900 = 1 is set, this is done automatically.

↓

P0100 Operation for Europe/North America
0 Power in kW; f default 50 Hz
1 Power in hp; f default 60 Hz
2 Power in PS; f default 60 Hz

Note
Use the DIP switch for settings 0 & 1 to allow for a permanent setting.

↓

P0304 Rated motor voltage [1)]
10 V – 2000 V
Rated motor voltage (V) from rating plate

↓

P0305 Rated motor current [1)]
0 – 2 x VSD rated current (A)
Rated motor current (A) from rating plate

↓

P0307 Rated motor power [1)]
0 kW – 2000 kW
Rated motor power (kW) of rating plate.
If P0100 = 1, the values are output in hp

↓

P0310 Rated motor frequency [1)]
12 Hz – 650 Hz
Rated motor frequency (Hz) from rating plate

↓

P0311 Rated motor speed [1)]
0 – 40.000 U/min
Rated motor speed (U/min) from rating plate

↓

P0700 Selection of command source [2)]
(on / off / reverse)
0 Factory setting
1 Basic operator panel
2 Terminal / digital inputs

↓

P1000 Selection of frequency setpoint [2)]
0 No frequency setpoint
1 BOP frequency control ↑↓
2 Analog setpoint

↓

P1080 Min. motor frequency
Sets the minimum motor frequency (0 – 650 Hz) at which the motor runs irrespective of the frequency setpoint. The value set here applies to both directions of rotation.

↓

P1082 Max. motor frequency
Sets the maximum motor frequency (0 – 150Hz) at which the motor runs irrespective of the frequency setpoint. The value set here applies to both directions of rotation.

↓

P1120 Ramp-up time
0 s – 650 s
Time taken for the motor to accelerate from standstill to maximum motor frequency.

↓

P1121 Ramp-down time
0 s – 650 s
Time taken for the motor to decelarate from maximum motor frequency to standstill.

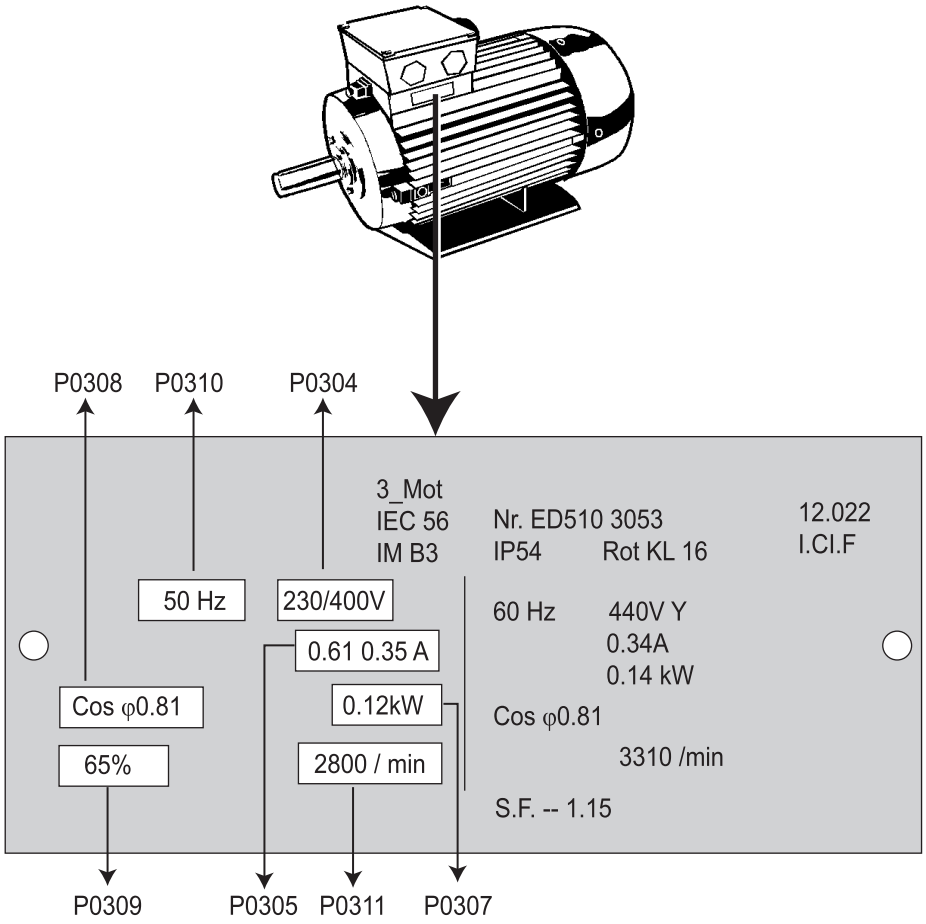
↓

P3900 End quick commissioning
0 No quick commissioning (factory setting)
1 End quick commissioning with motor calculation and resetting all other parameters to the factory setting (recommended)
2 End quick commissioning with motor calculation and I/O reset (recommended)
3 End quick commissioning with motor calculation but without I/O reset

[1)] Motor-specific parameters – see drawing of motor rating plate below.

[2)] Indicates parameters incorporating detailed lists of possible settings for use in special site applications. Refer to the engineering manual and operating instructions.

5.4.3 Motor data for parameterization



5.4.4 Commissioning with the BOP or AOP

5.4.4.1 Country-specific default settings for operation with the BOP

Parameter	Description	Default setting for Europe (North America)
P0100	European or US op mode	0 = 50 Hz, kW |(1 = 60Hz, hp) |(2 = 60Hz, kW)[1,2].
P0307	Nominal motor power	Value in kW (hp) Unit depends on the setting in P0100[2].
P0310	Nominal motor frequency	50 Hz (60 Hz).
P0311	Nominal motor speed	1395 (1680) U/min (depends on model)[3].
P1082	Max. motor frequency	50 Hz (60 Hz).

[1] Use DIP switch 2 under the BOP/AOP. This overwrites the above parameter settings.

[2] This parameter can only be modified if P00010 = 1 (commissioning mode).

[3] This parameter can only be modified if P00010 = 1 or 3.

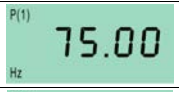
5.4.4.2 Setting parameters with the BOP or AOP

The following describes how to change parameter P1082. Use this description as a guide to setting all other parameters with the BOP.

Changing P0004 – parameter filter function

Step	Action	Resulting display
1	Press P to access the parameters.	
2	Press ▲ until P0004 is displayed.	
3	Press P to access the parameter value level.	
4	Press ▲ or ▼ to display the required value.	
5	Press P to confirm and save the value.	
6	Only the motor parameters are now visible for the user.	

Changing an indexed value under P1082 – setting the maximum motor frequency

Step	Action	Resulting display
1	Press P to access the parameters.	
2	Press ▲ until P1082 is displayed.	
3	Press P to access the parameter value level.	
4	Press ▲ or ▼ to display the required value.	
5	Press P to confirm and save the value.	
6	Press ▼ to return to P0010.	
7	Press P to access the parameter value level P0010.	
8	Press ▼ to restore the value to P0010 = 0.	
9	Press P to save the parameter and exit the parameter value level.	
10	Press ▼ until r0000 is displayed.	
11	Press P to revert to the standard motor display (as defined by the customer).	

Notes ☞

"Busy" signal

In some cases, the BOP displays  for a maximum of 5 seconds while parameters are being changed. This means that the variable speed drive is busy with higher-priority activities.

You can change motor parameters only if P0010 = 1.

Changing individual digits of the parameters

You can adjust individual digits in the display to quickly change a parameter value as follows:
Make sure that you are at the level that allows for changing parameter values (see section 5.4.4.2 Setting parameters with the BOP or AOP).

1. Press Fn (function button) – the rightmost digit starts to flash.
2. Change the value of this digit by pressing the ▲ / ▼ buttons.
3. Pressing the Fn button again causes the next digit to start flashing.
4. Repeat steps 2 to 4 until the required value is displayed.
5. Press P to exit the parameter change level.

5.4.5 Resetting SED2 parameters to the factory settings

1. Parameter P0010 = 30
   Parameter P0970 = 1
2. Now press P to restore the factory settings of the VSD.

Note ☞

The reset process takes approximately 10 seconds.
Refer to the default values in the system parameter list for the factory settings of the parameters.

5.4.6 Basic operation with the BOP

Prerequisites

- P0010 = 0 to ensure the correct initialization of the RUN command.
- P0700[1] = 1 to enable the start/stop button on the BOP (factory setting).
- P1000[1] = 1 to enable the motor potentiometer setpoints (factory setting).

1. Press the green button I to start the motor.
2. With the motor running, press ▲.
   The motor speed increases to 50 Hz.
3. When the variable speed drive reaches 50 Hz, press ▼.
   The motor speed and the value displayed now decrease.
4. Use P1820 to change the direction of rotation.
   Note: You can also change the direction of rotation via an appropriately configured digital input.
5. To stop the motor, press the red “STOP” button O.

5.4.7 10 Hz test

The 10 Hz test helps check the installation of both motor and VSD. It helps verify the direction of rotation and the basic functions of the VSD.
This ensures that a possible faulty installation of the power section is detected early on.

Testing with the BOP

1. Restore the factory settings in the SED2. Refer to section 5.4.5.
2. Press Hand to switch to manual operation.
3. Press I to switch the device on.

Testing with the AOP

1. Restore the factory settings in the SED2.
2. Set parameter P700.1 from 1 to 4.
3. Press 0.
4. Press Hand to switch to manual operation.
5. Press I to switch the device on.

5.4.8 General operation

The SED2 engineering manual contains a full description of the standard and extended parameters.

Important

- You can change motor parameters only if P0010 = 1.
- To start the motor, reset P0010 to 0.
- The variable speed drive has no mains isolating switch and is live as soon as supply voltage is connected. It remains with the output disabled until you press I or until it receives a digital ON signal.

Note

If a BOP or AOP is used and the display of the output frequency is selected (P0005 = 21), the value on the display shows the setpoint and the actual value (0 Hz) alternating for the stopped VSD.

6 Programming

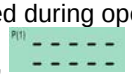
6.1 Introduction to the SED2 system parameters

6.1.1 General notes

Important

You can change the parameters only via the basic operator panel (BOP), the advanced operator panel (AOP), or the serial interface.

The BOP or AOP can be used to enter and change parameters to define the required characteristics of the variable speed drive, such as motor data, ramp times, maximum and minimum frequency, etc.

- Read-only parameters are identified by the letter "**r**" in place of the "**P**".
- P0010 = 1 initiates the "Quick commissioning" procedure.
- The variable speed drive runs only if P0010 is set to 0 after access. This function is automatic if P3900 is greater than 0.
- P0004 operates as a filter and allows access to the parameters according to their functionality.
- If you attempt to change a parameter that cannot be changed under the current conditions (e.g., because it cannot be changed during operation or can only be changed in the "quick commissioning" mode),  is displayed.
- **Busy signal**

  In some cases, the BOP displays  for a maximum of 5 seconds while parameters are being changed. This means that the variable speed drive is busy with higher-priority activities.

6.2 Access to parameters

6.2.1 Parameter access levels (P0003)

In total, there are four access levels. The three access levels available to the user are **Standard, Extended,** and **Expert**. Set the required access level with parameter P0003. For most applications, the Standard and Extended levels are sufficient.

The number of parameters displayed within each function group depends on the access level set in parameter P0003. The factory setting is P0003 = 1 (Standard). Refer to the engineering manual for detailed information about the parameters.

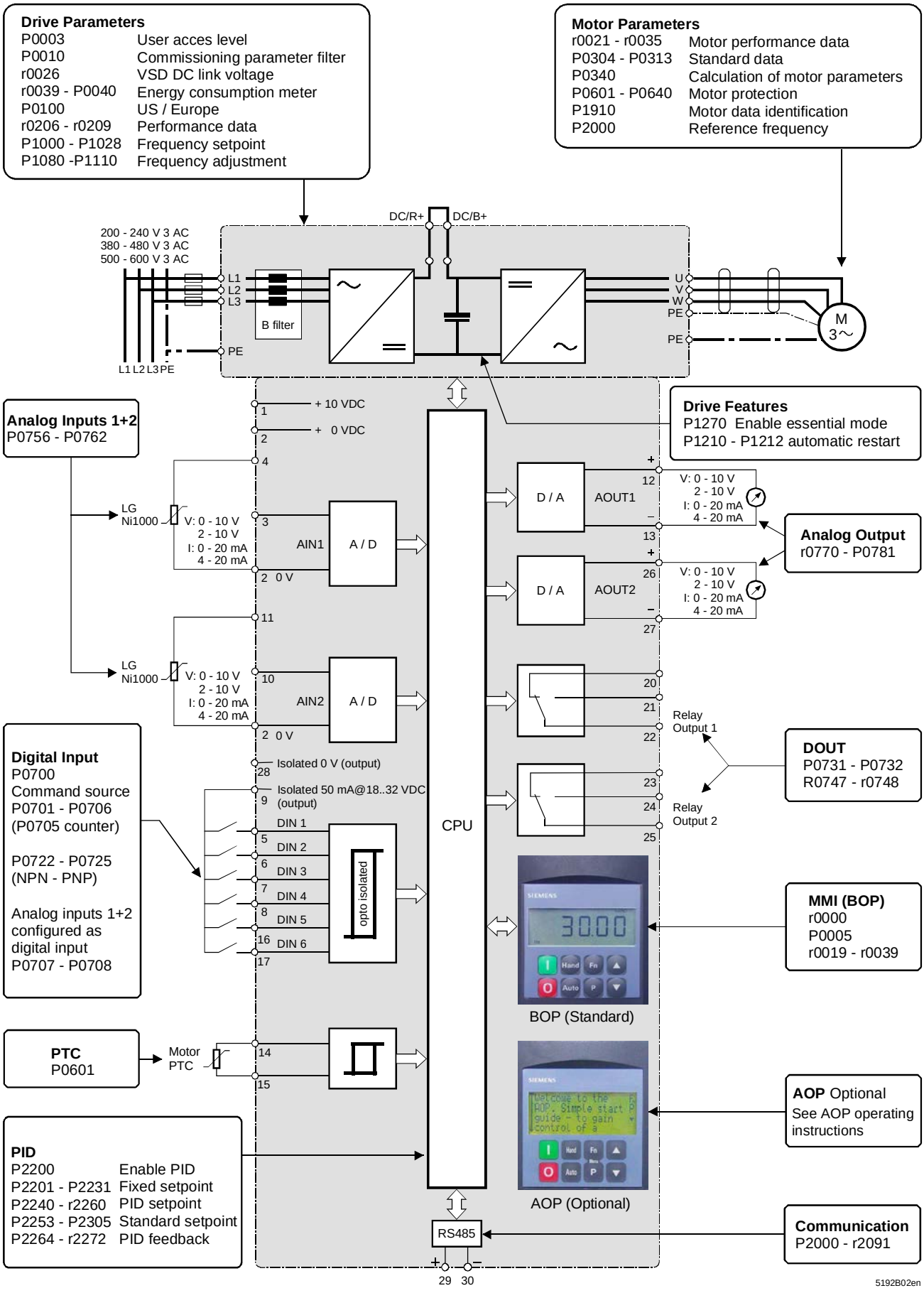
6.2.2 Parameter filter (P004)

You can further limit the selection of available parameters with parameter filter P0004. This filters the available parameters by their functionality. For example, if P0004 = 3, only the motor parameters are visible.

Note

Some parameters are intended *for commissioning only* and can be viewed as a function of this filter. However, in order to set these parameters, set P0010 to 1 (quick commissioning).

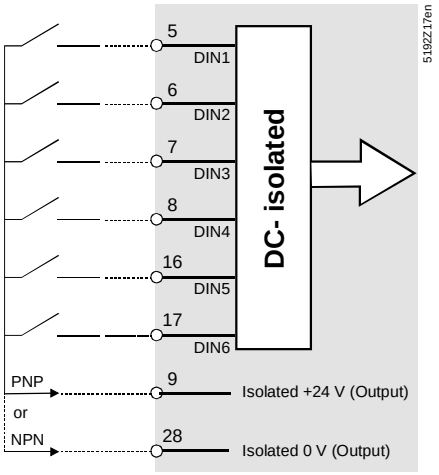
6.2.3 Diagram for a parameter overview



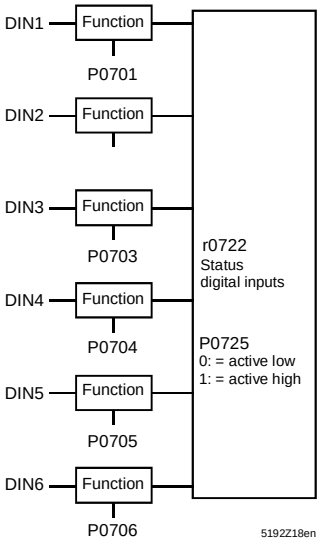
6.3 Basic functions of the SED2

6.3.1 Digital inputs

External switch-on and switch-off arrangements are required for stand-alone operation of variable speed drives. The digital input port provides six channels, which can be extended to eight by use of the two analog inputs.
You can program the function of the digital inputs as required.



Setting parameters for DIN1 to 6 (or DIN1…8) (commissioning)



P0701 to P0706
Digital inputs 1 to 6

The available settings for each of the input channels are listed below:

0	Digital input disabled.
1	ON / OFF1 – OFF as per the ramp-down time defined in P1121.
2	ON + change direction of rotation / OFF1.
3	OFF2 – coast to standstill.
4	OFF3 – faster ramp-down (quick stop = ramp-down at power limit).
9	Error acknowledgement.
10	JOG right.
11	JOG left.
12	Reverse direction of rotation.
13	Motor potentiometer (MOP) higher (increased frequency).
14	Motor potentiometer (MOP) lower (reduced frequency).
15	Fixed setpoint (binary coded).
16	Fixed setpoint (binary coded + ON).
17	Fixed setpoint (binary-coded decimal + ON).
25	Enable DC braking.
26	Enable Essential Service.
27	Enable PID controller.
28	Bypass command input (in bypass mode).
29	External fault.
33	Disable additional frequency setpoint.
99	Enable BICO parameter-setting.

Index: Example for P0701, applies also to parameters P0702 to P0708.

P0701[0]: 1. command data set (CDS).
P0701[1]: 2. command data set (CDS).
P0701[2]: 3. command data set (CDS).

Note ☞

Setting 99 (BICO) is intended for experienced users only.
For more detailed information, refer to the SED2 engineering manual.
Factory settings:

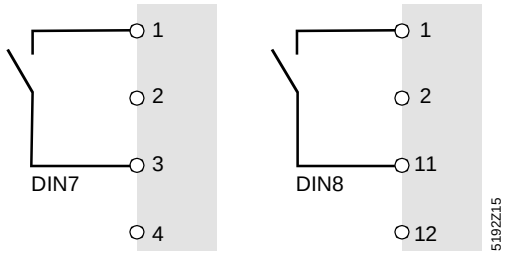
P0701	1	ON / OFF1.
P0702	12	Reverse (change dir. of rotation).
P0703	9	Error acknowledgement.
P0704	15	Fixed setpoint (binary coded).
P0705	15	Fixed setpoint (binary coded).
P0706	3	OFF2 – coast to standstill.

P0707 to P0708
Analog inputs 1 and **2** can be reconfigured with parameters P0707 and P0708 as **digital inputs** if required.

The following limit values apply to analog inputs configured as digital inputs:

≤ 1.6 VDC = Off.
≥ 4.0 VDC = On.

Factory setting: 0

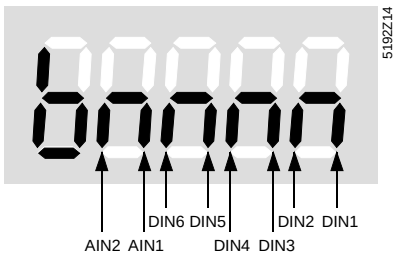


Connection of the two analog inputs for use as additional digital inputs DIN7 and DIN8.

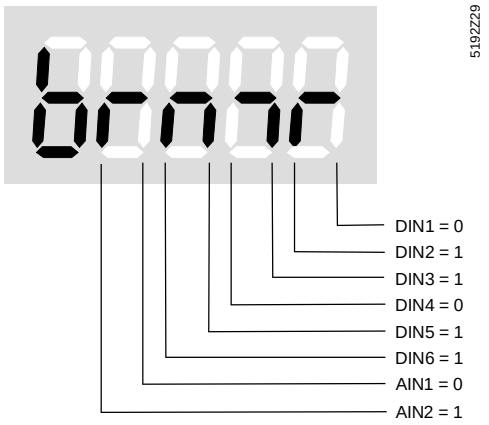
P0725
Operating mode for the digital inputs NPN or PNP
This parameter determines whether the digital inputs DIN1 to 6 are to be enabled by "logic 0" or "logic 1".
Possible settings:

0 NPN mode ⇒ active low.
1 PNP mode ⇒ active high (factory setting).

r0722
Check of the digital and analog inputs
This parameter can be used to check the functions of the digital and analog inputs. You can check the presence of a signal at the channel.
When an active signal is present, the associated segment of the display lights up. The allocation of each of the inputs to a specific segment is illustrated below.

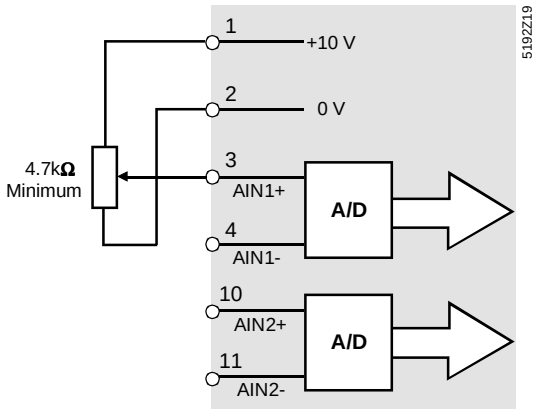


Example of the display while testing the input signals:



6.3.2 Analog inputs

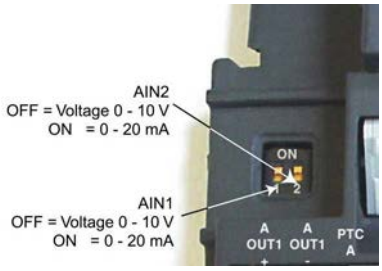
The analog inputs are used to send positioning, control, and feedback signals to the VSD and convert them to digital signals via A/D converters.



The analog inputs AIN1 and AIN2 are specified as follows:

Input level: 0 to 10 V or
0 to 20 mA
Resolution: 10 bit
Read cycle: 10 ms

Set the analog inputs to 0 to 10 V or 0 to 20 mA via the 2 DIP switches on the I/O module.



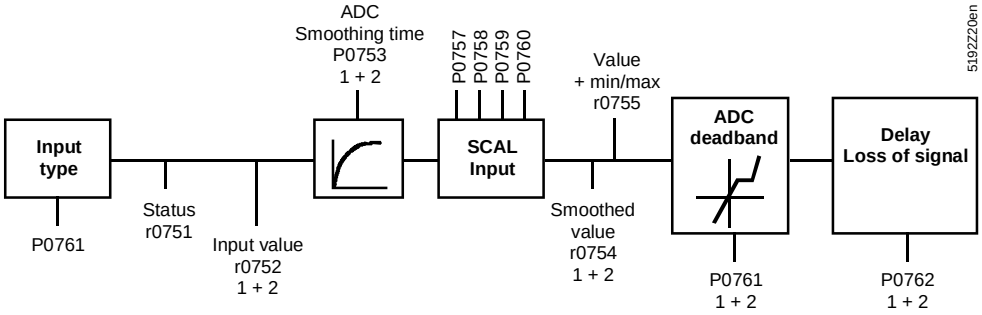
Setting the DIP switches on the I/O module

Position	DIP switch 1	DIP switch 2
ON	mA	mA
OFF	V	V

Factory setting for both DIP switches: OFF.

Refer to section 5.1.1.1, Setting the DIP switches on the I/O module.

Parameter setting for AIN1 and AIN2
(commissioning)



P0756
Defines the **type of analog input** and enables analog input monitoring.

Possible settings:

0 Unipolar voltage input (0 to 10 V) (factory setting).
1 Unipolar voltage input with monitoring (0 to 10 V).
2 Unipolar current input (0 to 20 mA).
3 Unipolar current input with monitoring (0 to 20 mA).
5 LG-Ni 1000 sensor input (–10 to +10 V).

Important: The parameter setting must match the setting of the 2 DIP switches on the I/O module.

Index:

P0756[0] : Analog input 1 (ADC 1).
P0756[1] : Analog input 2 (ADC 2).

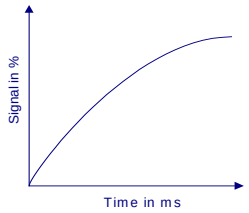
Note on dependency:

This function is disabled if the analog scaling block is programmed to negative output setpoints (see P0757 to P0760).

Note on the monitoring function

If monitoring is enabled and the dead zone is defined (P0761), an error message appears (F0080) as soon as the analog input voltage drops below 50% of the dead zone voltage.

P0753
Defines the filter time in ms **for the analog input**.
Setting range: 0 to 10,000 ms
Factory setting: 100 ms



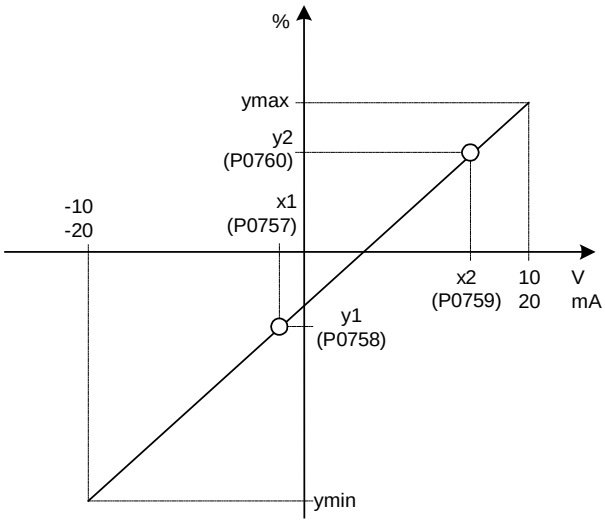
Index:

P0753[0] : Analog input 1 (ADC 1).
P0753[1] : Analog input 2 (ADC 2).

Note:

Increasing this time reduces (smoothes) the ripples but also slows down the response to the analog input.

P0757 – P0760
Parameters P0757 to P0760 are used to configure the **input scaling for the analog inputs** according to the following curve:



Parameter	Unit	Point on x/y-axis	Setting range Min.	Setting range Max.	Factory setting
P0757	V or mA	x1 value	-20.0	20	0
P0758	%	y1 value	-99999.9	99999.9	0.0
P0759	V or mA	x2 value	-20	20	10
P0760	%	y2 value	-99999.9	-99999.9	100

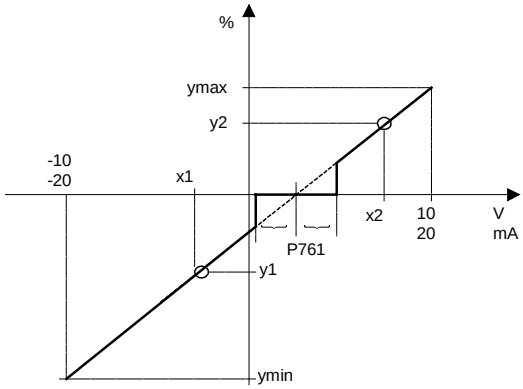
The factory setting of the input scaling corresponds to 0 V = 0% and 10 V = 100%.

P0761

Defines the **ADC dead zone for the analog inputs**.

Setting range: 0 to 20 V or mA

Factory setting: 0



Note: P0761[x] = 0: No enabled dead zone.

The dead zone runs from 0 V(mA) to the value of P0761, if the values of P0758 and P0760 (y-coordinate for ADC scaling) have the same sign. The dead zone is enabled from the intersecting point (x-axis with ADC scaling curve) in both directions, if P0758 and P0760 have different signs.

When using a configuration with neutral point in the center, Fmin (P1080) should be zero. There is no hysteresis at the end of the dead zone.

P0762

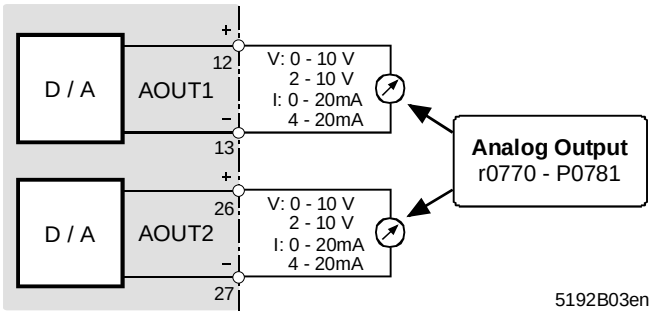
Defines the **delay time** in ms **between the drop-off of the analog setpoint and the display of error message F0080**.

Setting range: 0 to 10,000 ms

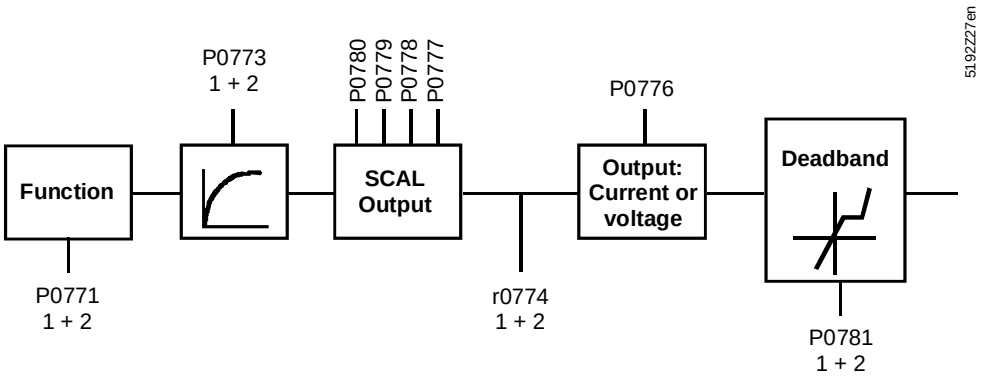
Factory setting: 1000 ms

6.3.3 Analog outputs

The analog outputs primarily help display status variables such as output frequency, motor voltage, or present motor current within the scaleable range.



Parameter setting for AOUT1 and AOUT2
(commissioning)



r0770
Shows the **number of available analog outputs**.

P0771
Defines the **physical status variable** to be displayed as an analog signal.

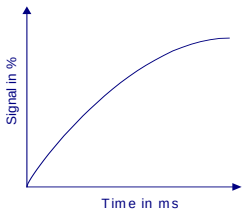
Possible settings:

21 Present output frequency (scaled to P2000), (factory setting).
24 Present VSD output frequency (scaled to P2000).
25 Present output voltage (scaled to P2001).
26 Present link voltage (scaled to P2001).
27 Present output current (scaled to P2002).

Index:

P0771[0]: Analog output 1 (DAC 1).
P0771[1]: Analog output 2 (DAC 2).

P0773



This parameter enables smoothing for the DAC input with a PT1 filter and determines the **smoothing time** in ms for the **analog output signals**.
Setting range: 0 to 1000 ms
Recommended setting: 100 ms (factory setting)

Index:

P0773[0]: Analog output 1 (DAC 1).
P0773[1]: Analog output 2 (DAC 2).
Note: The filter is disabled for P0773 = 0.

r0774
Shows the **analog output value** (in V or mA) after filtering and scaling.

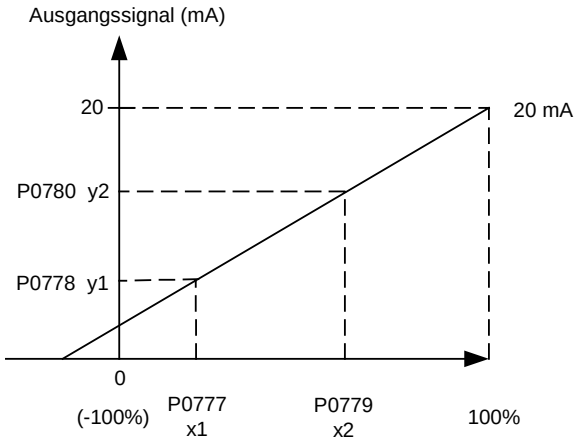
Index:
P0774[0]: Analog output 1 (DAC 1).
P0774[1]: Analog output 2 (DAC 2).

P0776
Defines the **type of analog output**.
Possible settings:

0	Current output	0 to 20 mA (factory setting)
1	Voltage output	0 to 10 V

Note: The analog outputs are designed as current outputs within 0 to 20 mA. Both analog outputs must be configured as the same type. Both channels are configured, e.g., as either current outputs with range 0 to 20 mA, or as voltage outputs with range 0 to 10 V.

P0777 to P0780:
Define the output characteristic in %. The DAC scaling parameters (P0777 to P0781) are used to set the output characteristics. They are configured according to the following curve.



Points P1 (x1, y1) and P2 (x2, y2) are freely selectable.

Example:

The factory-set scaling is as follows:
P1: 0.0 % = 0 mA or 0 V and
P2: 100.0 % = 20 mA or 10 V.

Index:
P0777[0]: Analog output 1 (DAC 1).
P0777[1]: Analog output 2 (DAC 2).

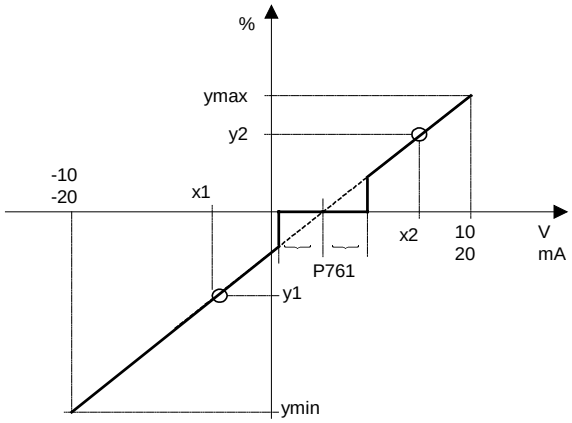
P0777:	Defines **x1** of the output characteristics	(factory setting = 0.0).
P0778:	Defines **y1** of the output characteristics	(factory setting = 0).
P0779:	Defines **x2** of the output characteristics	(factory setting = 100).
P0780:	Defines **y1** of the output characteristics	(factory setting = 10).

P0781

Defines the **DAC dead zone for the analog inputs**.

Setting range: 0 to 20 mA or 0 to10 V

Factory setting: 0



Index:

P0781[0]: Analog output 1 (DAC 1).

P0781[1]: Analog output 2 (DAC 2).

6.3.4 Frequency setpoint (P1000)

- Default setting: Terminal 3/2 (AIN+/ AIN–, 0 to 10 V corresponds to 0 to 50/60 Hz).
- Additional settings: See P1000.

6.3.5 Selecting the command source (P0700)

Possible settings for P0700:

0 Factory setting (BICO reset), resets all digital inputs to the factory settings (possible only if P0701=99).
1 Operator panel BOP or AOP.
2 Control terminal bar (factory setting).
4 USS on BOP link.
5 USS on COM link.
6 CB on COM link.

Start motor

- Default setting: Terminal 5 (DIN 1, high).
- Additional settings: See P0700 to P0708.

Notes ☞

The ramp-up and ramp-down smoothing times influence the motor's start and stop behavior. Refer to the engineering manual, parameter list, parameters P1120, P1121 for more information on these functions.

Stop motor

There are several ways to stop the motor:
Default setting:

- OFF1 Terminal 5 (DIN 1, low).
- OFF2 OFF button on BOP/AOP; sustained pressing of the OFF button (2 seconds) or repeated pressing of the button (in case of default settings not possible without BOP/AOP).

- Additional settings: See P0700 to P0708.

Reversal of the motor's direction of rotation

- Default setting: Terminal 6 (DIN 2, high).
- Additional settings: See P0700 to P0708.

6.3.6 OFF functions

OFF1

This command (by eliminating the ON command) stops the variable speed drive within the selected ramp-down time.

Parameters to change the ramp-down time: See P1121.

Notes ☞

- The ON and the consecutive OFF1 command must have the same source.
- If the ON/OFF1 command is set for more than one digital input, only the last set digital input is valid, e.g., DIN3 is enabled.

OFF2

This command causes a free coasting of the motor to standstill (impulses for the power section of the VSD are disabled).

Note ☞

The OFF2 command may have one or several sources. By default, the OFF2 command is set to BOP/AOP. This source remains even if other sources are defined by **one** of the parameters P0700 to P0708.

6.3.7 Control types

The different control types of the SED2 control the relationship between the motor speed and the voltage supplied by the VSD. Below is a summary of the available control types.

Linear V/f control P1300 = 0

Can be used for variable or constant torque applications such as delivery systems and positive displacer pumps.

Linear V/f control with flow control (FCC) P1300 = 1

This factory-set control mode can be used to improve performance and dynamic behavior of the motor.

Parabolic V/f control P1300 = 2

This factory-set control mode can be used for variable torque load such as fans and pumps.

Multi-point V/F control P1300 = 3

Refer to the engineering manual for information on this control mode.

Linear V/f control with energy saving mode P1300 = 4

This function automatically increases or decreases the motor voltage to locate the lowest possible energy consumption. This control mode is enabled as soon as the default setpoint speed is reached.

V/f control for textile applications P1300 = 5

There is no slip compensation or resonance smoothing. The Imax controller relates to voltage instead of frequency.

V/f control with FCC for textile applications P1300 = 6

A combination of P1300 = 1 and P1300 = 5.

6.3.8 Communication

A serial interface RS485 is integrated. A RS232 interface is integrated in the optional door mounting set for BOP/AOP.
See section 9.1 Options.

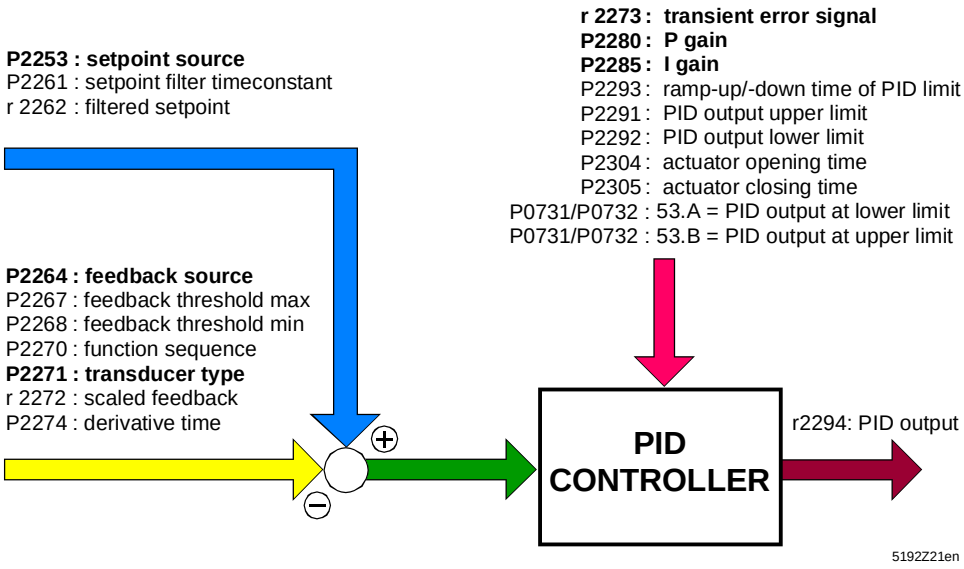
USS, P1, and N2 protocols are implemented as part of the series.
For detailed information, refer to the engineering manual.

6.4 HVAC functions of the SED2

The functions listed below were implemented specifically in the SED2 for HVAC applications.

6.4.1 PID controller

In order to achieve independent control within a stand-alone application by means of the SED2 VSD, Siemens SBT implemented a proven PID controller. This controller allows for temperature (LG-Ni 1000), pressure, and speed control.
The factory settings for the implemented PID parameters are designed for pressure control.
For temperature or speed control, the controller's time constants must be adjusted to the new control loop. See "Parameterizing the PID controller" below.



Parameterizing the PID controller
(commissioning)

Fixed setpoint	External setpoint

Note:
The setpoint and the actual value signal are to be displayed as a percentage (%) or absolute value. Make sure, however, that the two signals match each other.

P2201
Enter fixed setpoint
(or absolute value in %).
The setpoint is active if switching command "ON" is sent to DIN1.

P2253
Set to value **2224** (fixed PI setpoint).

P0701[0]
Enter value **16**
(sets DIN1 to ON with fixed setpoint; see section 6.3.1 Digital inputs).

Analog input
See the section on analog inputs for the parameter settings.

P2253[0]
Set to **755**
(setpoint is configured to AIN 1).

P0756[0]
Select the type of analog input 1 for the setpoint. See section Analog inputs.

P0757[0] to P0760[0]
Set scaling of AIN 1.

P0756[1]
Define the type of analog input 2 for the actual value signal (see section 6.3.2 Analog inputs).

Continued:
Parameterizing the PID controller

P0757[1] to P0760[1]
Set the scaling of the actual value for analog input 2
(see section 6.3.2 Analog inputs).

P2264
Set to **755[1]** (defines AIN2as actual value).

P2271
Define the reaction of the PID controller to the actual values (0=heating, 1=cooling).

P2200
Enable the PID controller (0=disable, 1=enable).

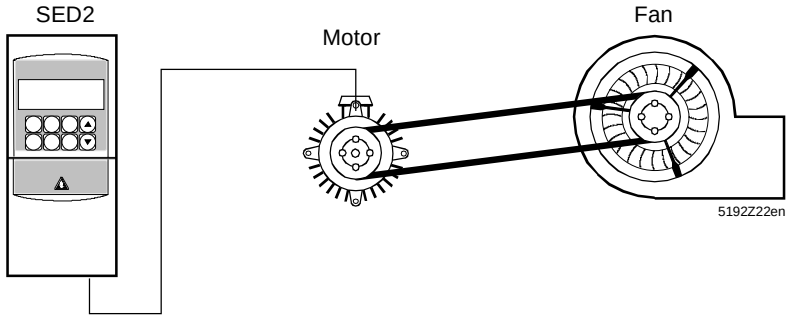
r2262
Check for setpoint (scaled PID setpoint in %).
Note: VSD must be set to automatic control.
DIN1 must be set to ON.

r2272
Check for actual value (scaled PID actual value in %).

Set and optimize **P2280** PID proportional gain and **P2285** PID integration time.

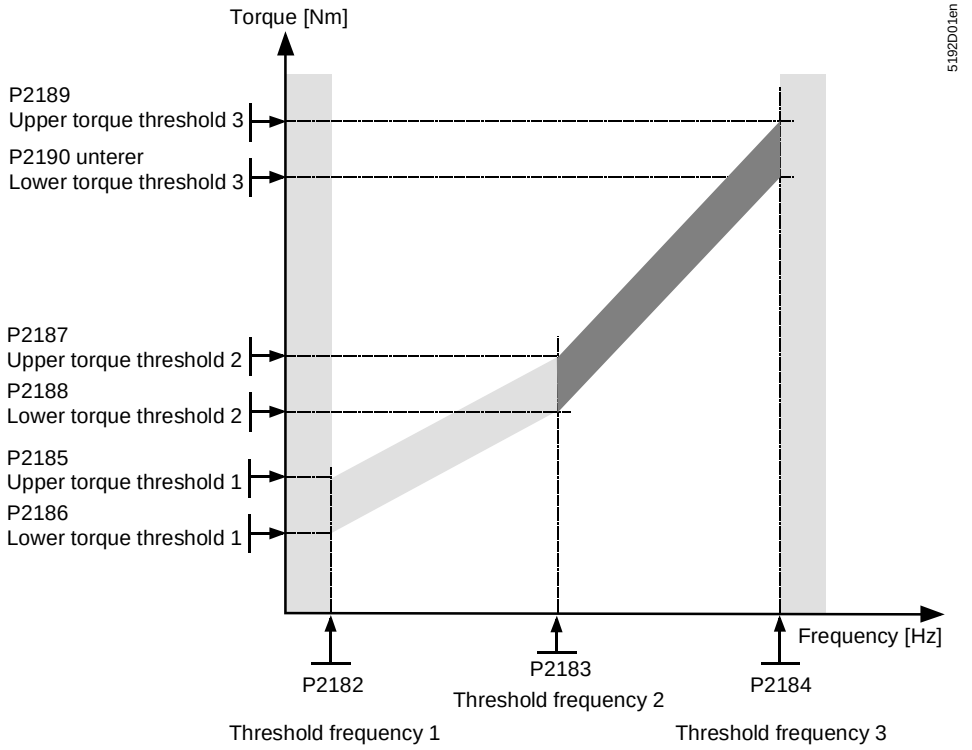
Changeover to **automatic control**.

6.4.2 Belt failure detection without sensor (P2181)



This function allows for monitoring power transmission components such as drive belts. The function can also detect motor overload, e.g. in the case of jam.
The actual frequency / torque curve is compared to a preprogrammed tolerance band (see P2182 to P2190) as part of this function. If the actual curve is outside the tolerance band, a warning or error message is generated.

Frequency / torque curve



The permissible frequency/torque area is defined by the zone shaded gray. The frequency limit values 1 to 3 define the areas used to compare the actual torque to the preset torque. Nine parameters define torque monitoring. Parameters (P2182 to P2184) define the frequency limit values to be set. Parameters (P2185 to P2190) limit the tolerance band compared to the present torque curve.

Parameterizing belt failure detection without sensor
(commissioning)

1. **Frequency limit value parameter P2182 to P2184.**
   Setting the three frequency limit values:
   The 3 frequency limit values F1;F2;F3 determine a reasonable division across the required torque area. Set the values desired in the manual mode by pressing buttons ▲▼ and read and write down the corresponding torque values via parameter r0031.
   Factory setting: 5;30;50 Hz.

2. Set the desired **reaction of drive belt failure detection** via parameter **P2181**.
   Possible settings for P2181:
   - 0 Belt failure detection disabled (factory setting).
   - 1 Warn low torque/speed.
   - 2 Warn high torque/speed.
   - 3 Warn high/low torque/speed.
   - 4 Trip low torque/speed.
   - 5 Trip high torque/speed.
   - 6 Trip high/low torque/speed.

Note

P2181 must be set before P2185 to P2190 (not to 0).

3. Set the **torque limit value parameters P2185 to P2190** as follows:
   Add ±15% to the torque derived from the setting of the frequency limit values to define a permissible tolerance band for the torque values.
   For allocation of variables, refer to the frequency/torque curve.

   Factory setting: 99999.0.

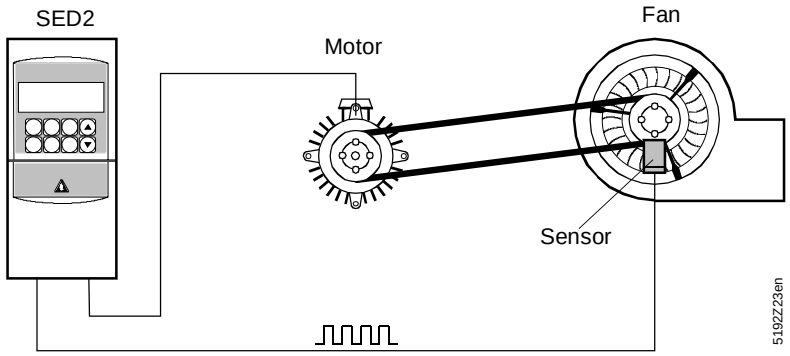
4. Set the **alarm delay parameter P2192**:
   P2192 allows for setting a delay (between 0 to 65 sec) before a warning or error message is generated. The parameter helps avoid false alarms caused by temporary transition states. This delay can also be used for belt failure detection via sensor.

   Factory setting: 10 s.

5. In manual mode, vary the torque frequency in the selected range to check the function.

6. Changeover to automatic control.

6.4.3 Belt failure detection with sensor (P0400)



A simple sensor (inductive sensor) mounted to the drive unit (e.g. for a fan) supplies one pulse for each rotation. The pulse train generated this way—which can vary from 1 to 20,000 pulses per minute—is sent to the digital input DIN5 of the VSD. The frequency resulting from the pulse train is compared to the present output frequency of the VSD.
Parameter P0400 defines the encoder type.
If parameter P0400 = 0 (factory setting), this type of belt failure detection is disabled and the variant "belt failure detection without sensor (P2182)“ is used instead.

Note ☞ Only digital input DIN5 works with a counter signal!

Parameterizing belt failure detection with sensor
(commissioning)

1. Determine the speed transformation ratio between the motor and the shaft driven by the belt.

2. Define the **encoder type** using parameter **P0400**.

   Possible settings for P0400:

   0 Disabled (factory setting).
   1 Single channel encoder.
   2 Quadrature encoder without zero pulse.
   3 External pulse train.
   12 Quadrature encoder with zero pulse.

3. Use parameter **P0409** to set the **pulse rate** (number of pulses/sec) generated by the **sensor** at **nominal frequency** (nominal speed) by including the transmission ratio determined in point 1.

   Setting range: 1 to 500
   Factory setting: 25

4. Set the desired **reaction of drive belt failure detection** via parameter **P2181**. Possible settings for P2181:

   0 Belt failure detection disabled (factory setting).
   1 Warn low torque/speed.
   2 Warn high torque/speed.
   3 Warn high/low torque/speed.
   4 Trip low torque/speed.
   5 Trip high torque/speed.
   6 Trip high/low torque/speed.

   Suggested setting: 1 Warn low torque/speed.

5. Use parameter **P2191** to set the **maximum permissible deviation** of the pulse train frequency (actual value) generated by the sensor from the VSD output frequency (setpoint). If the tolerance band for frequency is exceeded, a warning or trip is generated.

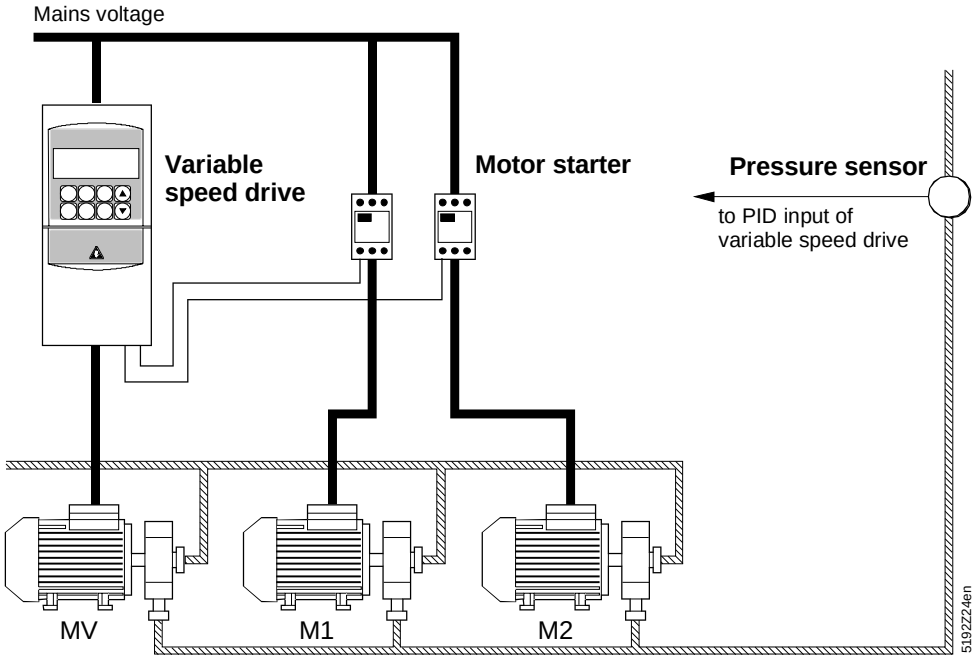
   Setting range: 0 to 20 Hz.
   Factory setting: 3 Hz.

6. In manual mode, vary the torque frequency in the selected range to check the function.

7. Changeover to automatic control.

6.4.4 Staging pumps or fans

The motor control staging allows to control up to two additional pumps or fans based on the integrated PID control system. The complete system comprises a pump (fan) controlled by the VSD, and up to two additional pumps (fans) switched by contactors or motor starters. The contactors or motor starters are controlled by relay switching contacts integrated in the VSD. The diagram below shows a typical pump system. A similar system comprising fans could be used for ventilating systems.



MV: Motor, speed-controlled by SED2.
M1: Motor, controlled by relay 1 DOUT1.
M2: Motor, controlled by relay 2 DOUT2.

If MV runs at maximum frequency and the PID feedback shows that a higher speed is demanded in accordance with the staging, the VSD switches on one of the relay-controlled motors M1 or M2 (staging). To keep the controlled variable as constant as possible, and to compensate for the difference in output, the VSD must be decreased to minimum frequency. See the illustration below. During the staging process, PID control is suppressed.

If MV runs in parallel to M1 and M2 at a minimum frequency, and if the PID feedback demands an even lower speed, the VSD switches off one of the relay-controlled motors M1 or M2 (destaging). In this case, the VSD must increase the ramp from the minimum to the maximum frequency. In this phase, PID control is suppressed.

Motor staging on output demand

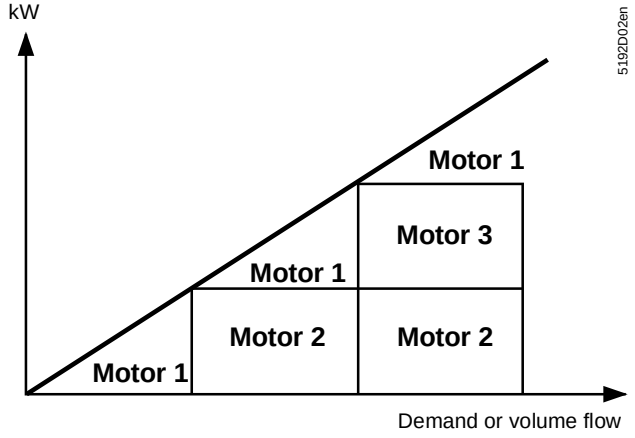
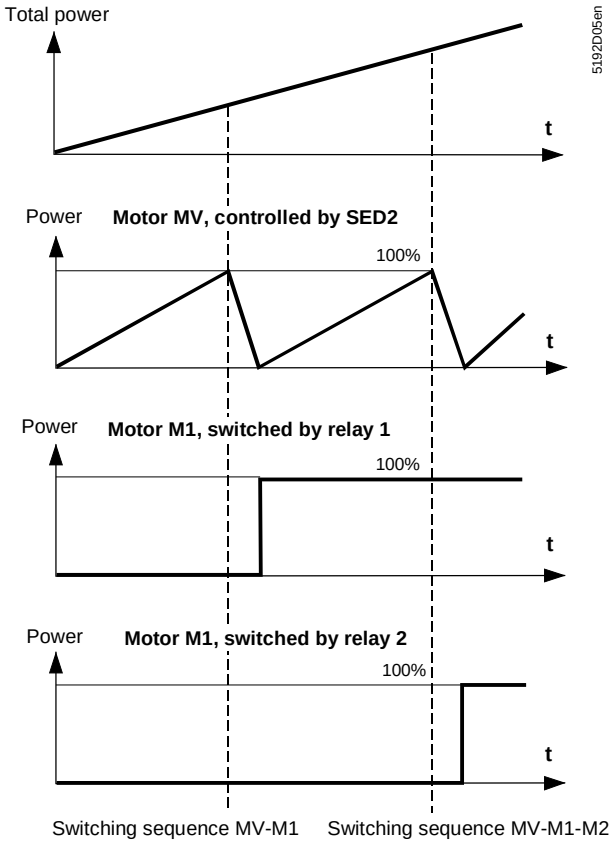


Diagram from motor staging



Parameterizing motor staging
(commissioning)

As a rule, the factory settings can be used.

P2371
Defines the **configuration of additional pumps** or **fans**.
Max. 2 pumps can be added.
Factory setting: 0
Maximum setting: 2

P2372
Enable motor cycling
If this parameter is enabled, one or two motors are switched on or off—during staging, in addition to the speed-controlled motor—in a specified sequence based on the motor operating hours (parameter 2380). During staging, the motor having the lowest number of operating hours is first switched on. During destaging, the motor having the highest number of operating hours is first switched off.

In the case of different output of the motors to be switched on, the motor promising to best satisfy the demanded output is switched on first, regardless of its operating hours.

Factory setting: 0 (disabled).

P2373
Defines the **staging hysteresis**: Value in % of the PID setpoint.

Setting range: 0 to 200 %
Factory setting: 20 %

P2374
Delay on staging

Setting range: 0 to 650 s
Factory setting: 30 s

P2375
Delay on destaging

Setting range: 0 to 650 s
Factory setting: 30 s

P2376
Overriding the delay on staging/destaging
The value of P2376 is set as a percentage of the PID setpoint. If the PID fault (P2273) exceeds this value, a motor is switched on or off, regardless of the delay time set in P2374 and P2375.

Setting range: 0 to 200 %
Factory setting: 25 %

P2377
This parameter is used to lock the **delay override (P2376)** after staging or destaging for a specified period of time. This prevents a second staging immediately following the first staging, that, for example, could have been triggered by the first staging.

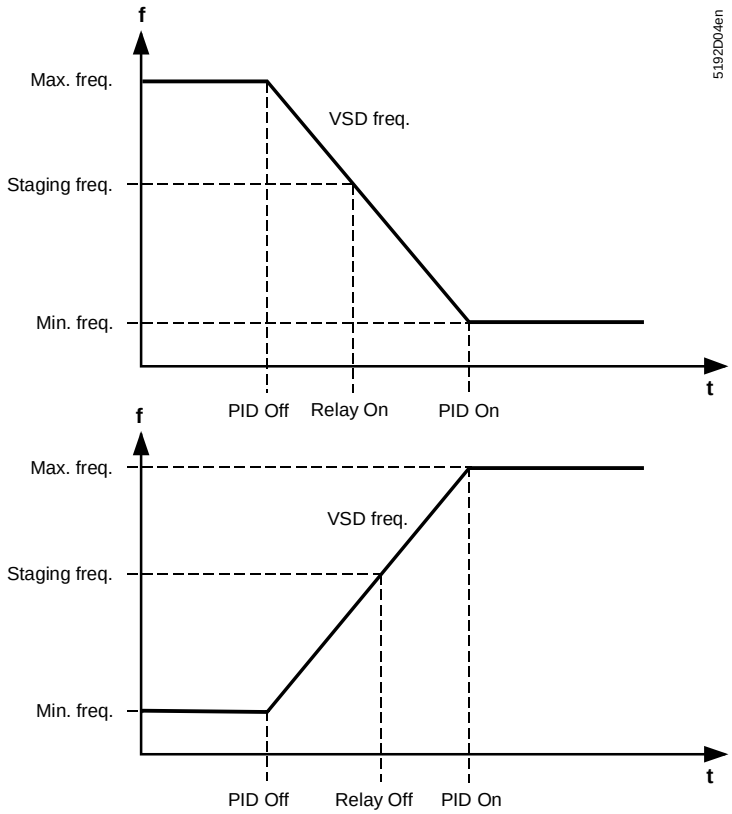
Setting range: 0 to 650 s
Factory setting: 30 s

P2378

Staging frequency

This parameter is defined as a particular percentage of the maximum output frequency. This determines the frequency used to switch on or off the relay (DOUT1 or DOUT2) during staging or destaging.

See the diagram below.



Factory setting: = 50 % (defined as a percentage = 100%, at fmax = 50 Hz).

P0731 (DOUT1)

Function of the digital output 1 (relay 1)

Set parameter to **2379[0]** (relay 1 to motor 1).

Factory setting: 52.3 = VSD fault enabled.

P0732 (DOUT2)

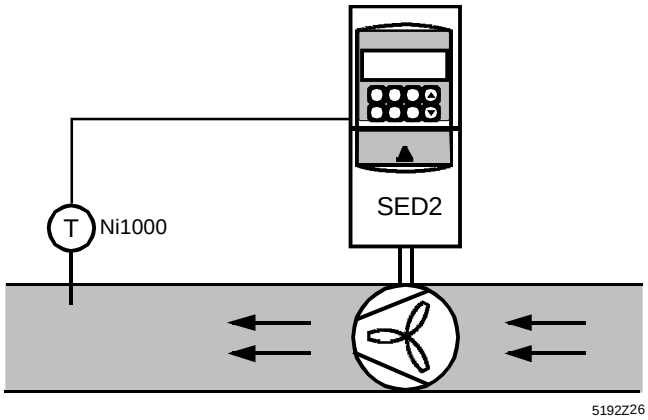
Function of the digital output 2 (relay 2)

Set parameter to **2379[1]** (relay 2 to motor 2).

Factory setting: 52.2 = VSD in operation.

Complete parameter setting by changing over to automatic control.

6.4.5 Temperature control with LG-Ni 1000 sensor



Use the SED2 to directly measure the temperature by means of a passive temperature sensor of type LG-Ni 1000. Simple temperature control is possible accordingly.
The sensor is connected to the VSD. The signal can be scaled according to requirements.

Parameterization temperature control
(Commissioning notes)

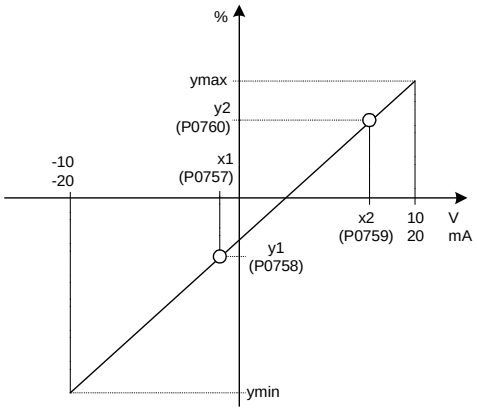
Same procedure as for commissioning analog inputs.
The temperature sensor can be connected as follows to the analog inputs:

LG-Ni 1000 on AIN 1
Connection terminals: **2 / 4**

LG-Ni 1000 on AIN 2
Connection terminals: **2 / 11**

Note: When connecting a LG-Ni 1000 sensor, no other input signal can be processed on the same channel, even if terminals 3 / 10 for an analog signal of 0 to 10 V are free.

P0757 to P0760, scaling
During scaling, the LG-Ni 1000 sensor's temperature range of –50 to 150 °C can be converted to %.



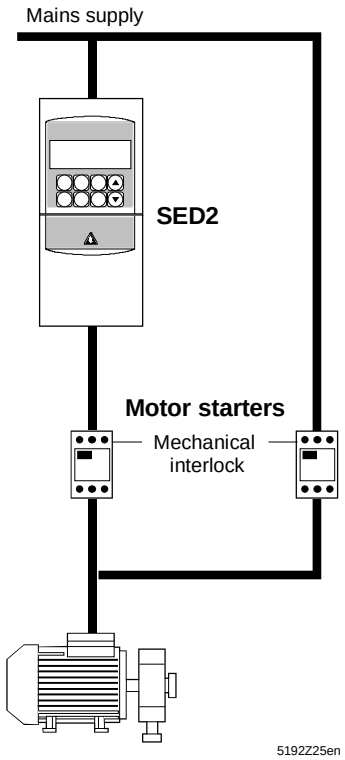
Example: LG-Ni 1000 on AIN1:

P0757[0] = –50 °C
P0758[0] = –50%
P0759[0] = 150 °C
P0760[0] = 150%

Factory settings: P0757 = 0
P0758 = 0.0
P0759 = 10
P0760 = 100

6.4.6 Bypassing the VSD

There are applications demanding maximum motor output. Additionally, there are applications requiring a VSD bypass system for safety reasons. For these cases, the SED2 has an integrated bypass function.



Parameterizing the bypass function (commissioning)

P1260

Defines the possible **triggers for changing over to bypass operating mode.**
The following settings are possible:

0 Bypass disabled (factory setting).
1 Controlled by VSD trip.
2 Controlled by DIN, see P1266.
3 Controlled by DIN and VSD trip.
4 Controlled by VSD frequency.
5 Controlled by VSD frequency and VSD trip.
6 Controlled by VSD frequency and DIN.
7 Controlled by VSD frequency and DIN and VSD trip.

r1261

Read parameter for the bypass function showing how the motor is driven:
The following states are possible:

Bit 00	Motor supplied by drive	0	Yes
		1	No
Bit 01	Motor supplied by mains	0	Yes
		1	No

P1262

Defines the time delay between changing over the VSD to bypass and vice-versa to demagnetize the motor.
See bypass diagram below.

Setting range: 0 to 20 s
Recommended setting: 1 s (factory setting).

P1263

Defines the time delay between the bypass alarm OFF and the bypass switching contactor OFF. See bypass diagram below.

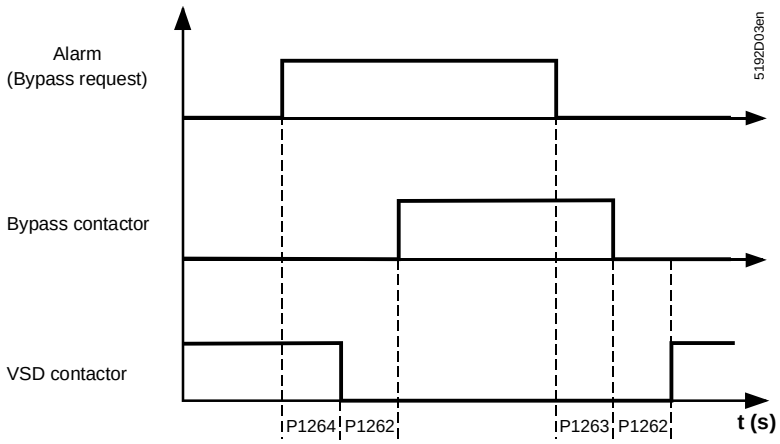
Setting range: 0 to 300 s
Recommended setting: 1 s (factory setting).

P1264

Defines the time delay between the bypass alarm ON and the VSD switching contactor OFF.
See bypass diagram below.

Setting range: 0 to 300 s
Recommended setting: 1 s (factory setting).

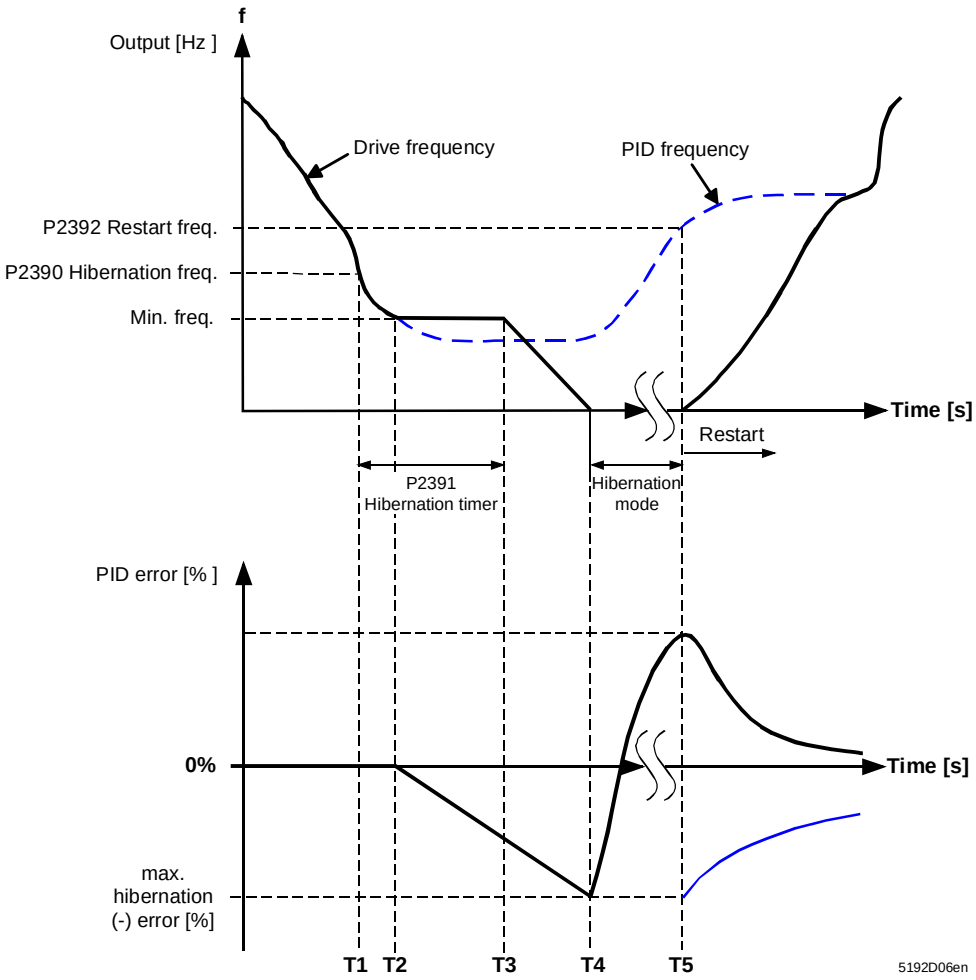
Bypass time diagram



Complete parameter setting by changing over to automatic control.

6.4.7 Hibernation mode

If the VSD reaches the hibernation setpoint in PID operating mode, the hibernation timer **P2391** starts. After the timer has expired, the VSD drives the output frequency of the ramp to 0 Hz. See illustration below.



T1	– Hibernation frequency reached. – Start of hibernation timer.
T2	Minimum output frequency reached.
T3	– Output frequency decreased in accordance with the set ramp. – **PID control of the output frequency is interrupted.**
T4	Output frequency = zero (motor standstill).
T3 to T5	The PID fault signal [%] is monitored. Note: – The polarity of the PID fault signal. – The polarity of the PID fault signal must match the sequence of the controlled functions (cooling/heating or vice-versa). – The temperature setpoint can be below 0 °C. – The PID fault signal can be positive or negative.
T5	– The VSD output frequency is again increased. – The PID control of the output frequency is again enabled.

Parameterizing the hibernation function (commissioning)

P2390
Hibernation frequency setpoint [%]

Setting range: ± 200 %
Recommended setting: Value 15 to 20% greater than the minimum frequency.

Note: The hibernation function is disabled if the hibernation setpoint is set to 0 (corresponds to the factory setting).

P2391
Hibernation timer [s]

Set the desired time T1 to T3 (before hibernation mode kicks in) (see diagram above).
Setting range: 0 to 254 s

P2392
Restart PID controller deviation [%]

This parameter defines the PID controller deviation at which the motor is to restart.

Setting range: ± 200 %

Note ☞

Note the signs according to the application (heating or cooling sequence).

Complete parameter setting by changing over to automatic control.

6.5 System parameter list for levels 1 to 3

r0000	Drive display		Level 1
	Displays the user selected output as defined in P0005.		
Unit: -	Min: -	Def: -	Max: -
Note:	Pressing the "Fn" button for 2 seconds allows the user to view the values of DC link voltage, output current, output frequency, and chosen r0000 setting (defined in P0005).		

r0002	Drive state		Level 3
	Displays actual drive state.		
Unit: -	Min: -	Def: -	Max: -
Settings:	0=Commissioning mode (P0010=0) 1=Drive ready 2=Drive fault active	3=Drive starting (DC link precharging) 4=Drive running 5=Stopping (ramping down)	
Dependency:	State 3 visible only while precharging DC link, and when externally powered communications board is fitted.		

P0003	User access level		Level 1
	Defines user access level to parameter sets. The default setting (standard) is sufficient for most simple applications.		
Unit: --	Min: 0	Def: 1	Max: 4
Settings:	0=User defined parameter list - see P0013 for details 1=Standard: Access into frequently used parameters. 2=Extended: Access to e.g. variable speed drive I/O functions.	3=Expert: For experienced users only 4=Service: Only for use by authorized service personal -	

P0004	Parameter filter			Level 1
	Filters available parameters according to functionality to enable a more focussed approach to commissioning.			
Unit: -	Min: 0	Def: 0	Max: 22	
Example:	P0004=22 specifies that only PID parameters will be visible.			
Settings:	0=All parameters 2=Variable speed drive 3=Motor 4=Speed sensor	5=Technol. application/units 7=Commands, binary I/O 8=ADC and DAC 10 =Setpoint channel / RFG	12 =Drive features 13 =Motor control 20 =Communication	21 =Alarms / warnings / monitoring 22 =Technology controller (e.g. PID)
Dependency:	Parameters marked "Quick Comm: Yes" in the parameter header can only be set when P0010=1 (Quick Commissioning).			
Note:	The variable speed drive will start with any setting of P0004.			

P0005	Display selection			Level 2
	Selects display for parameter r0000 (drive display).			
Unit: -	Min: 2	Def: 21	Max: 2294	
Settings:	21=Actual frequency	25=Output voltage	26=DC link voltage	27=Output current
Note:	These settings refer to read only parameter numbers ("rxxxx").			
Details:	See relevant "rxxxx" parameter descriptions.			

P0006	Display mode		Level 3
	Defines mode of display for r0000 (drive display).		
Unit: -	Min: 0	Def: 2	Max: 4
Settings:	0=In Ready state alternate between setpoint and output frequency. During run, display output frequency. 1=In Ready state display setpoint. In run display output freq. 2=In Ready state alternate between P0005 value and r0020 value. In run display P0005 value	3=In Ready state alternate between r0002 value and r0020 value. In run display r0002 value 4=In all states just display P0005	
Note:	When variable speed drive is not running, the display alternates between the values for "Not Running" and "Running". Per default, the setpoint and actual frequency values are displayed alternately.		

P0010	Commissioning parameter filter		Level 1
	Filters parameters so that only those related to a particular functional group are selected.		
Unit: -	Min: 0	Def: 0	Max: 30
Settings:	0=Ready 1=Quick commissioning 2=Variable speed drive	29 =Download 30 =Factory setting	
Dependency:	Reset to 0 for variable speed drive to run. P0003 (user access level) also determines access to parameters.		
Note:	If P3900 is not 0 (0 is the default value), this parameter is automatically reset to 0.		

P0011	Lock for user-defined parameter		Level 3
Unit: -	Min: 0	Def: 0	Max: 65535
Details:	See P0013 (user-defined parameter).		

P0012	Key for user-defined parameter		Level 3
Unit: -	Min: 0	Def: 0	Max: 65535
Details:	See P0013 (user-defined parameter).		

P0013[20]	User-defined parameter		Level 3
	Defines a limited set of parameters to which the end user will have access.		
Unit: -	Min: 0	Def: 0	Max: 65535

Instructions:	1. Step 1: Set P0003=3 (expert user) 2. Step 2: Go to P0013 indices 0 to 16 (user list) 3. Step 3: Enter into P0013 index 0 to 16 the parameters required to be visible in the user-defined list. The following values are fixed and cannot be changed: - P0013 index 19=12 (key for user defined parameter) - P0013 index 18=10 (commissioning parameter filter) - P0013 index 17= 3 (user access level) 4. Step 4: Set P0003=0 to activate the user defined parameter.
Dependency:	First, set P0011 ("lock") to a different value than P0012 ("key") to prevent changes to user-defined parameter. Then, set P0003 to 0 to activate the user-defined list. When locked and the user-defined parameter is activated, the only way to exit the user-defined parameter (and view other parameters) is to set P0012 ("key") to the value in P0011 ("lock").
Note:	Alternatively, set P0010=30 (commissioning parameter filter=factory setting) and P0970=1 (factory reset) to perform a complete factory reset. The default values of P0011 ("lock") and P0012 ("key") are the same.

r0018	**Firmware version**			**Level 3**
	Displays version number of installed firmware.			
Unit: -	**Min: -**	**Def: -**	**Max: -**	

r0019	**CO/BO: BOP control word**			**Level 3**
	Displays status of operator panel commands. The settings below are used as the "source" codes for keypad control when connecting to BICO input parameters.			
Unit: -	**Min: -**	**Def: -**	**Max: -**	
Bit fields:	Bit00 ON/OFF1 0 NO, 1 YES Bit01 OFF2: Electrical stop 0 YES, 1 NO Bit08 not used 0 NO, 1 YES Bit11 not used 0 NO, 1 YES Bit12 Hand Operation 0 NO, 1 YES Bit13 Motor potentiometer MOP up 0 NO, 1 YES Bit14 Motor potentiometer MOP down 0 NO, 1 YES Bit15 Auto Operation 0 NO, 1 YES			
Note:	When BICO technology is used to allocate functions to panel buttons, this parameter displays the actual status of the relevant command. The following functions can be "connected" to individual buttons: - ON/OFF1 - JOG - INCREASE - OFF2 - REVERSE - DECREASE			

r0020	**CO: Act. frequency setpoint**			**Level 3**
	Displays actual frequency setpoint (output from ramp function generator).			
Unit: Hz	**Min: -**	**Def: -**	**Max: -**	

r0021	**CO: Act. frequency**			**Level 3**
	Displays actual variable speed drive output frequency (r0024) excluding slip compensation, resonance damping and frequency limitation.			
Unit: Hz	**Min: -**	**Def: -**	**Max: -**	

r0022	**Act. rotor speed**			**Level 3**
	Displays calculated rotor speed based on variable speed drive output frequency [Hz] x 120 / number of poles.			
Unit: 1/min	**Min: -**	**Def: -**	**Max: -**	
Note:	This calculation makes no allowance for load-dependent slip.			

r0024	**CO: Act. output frequency**			**Level 3**
	Displays actual output frequency (slip compensation, resonance damping and frequency limitation are included).			
Unit: Hz	**Min: -**	**Def: -**	**Max: -**	

r0025	**CO: Act. output voltage**			**Level 3**
	Displays [rms] voltage applied to motor.			
Unit: V	**Min: -**	**Def: -**	**Max: -**	

r0026[2]	**CO: Act. DC-link voltage**			**Level 3**
	Displays DC-link voltage.			
Unit: V	**Min: -**	**Def: -**	**Max: -**	

r0027	**CO: Act. output current**			**Level 3**
	Displays [rms] value of motor current [A].			
Unit: A	**Min: -**	**Def: -**	**Max: -**	

r0031	**CO: Act. torque**			**Level 3**
	Displays motor torque.			
Unit: Nm	**Min: -**	**Def: -**	**Max: -**	

r0032	**CO: Act. power**			**Level 3**
	Displays motor power.			
Unit: -	**Min: -**	**Def: -**	**Max: -**	
Dependency:	Value is displayed in [kW] or [hp] depending on setting for P0100 (operation for Europe / North America).			

r0035	CO: Act. motor temperature		Level 3
	Displays measured motor temperature.		
Unit: °C	Min: -	Def: -	Max: -

r0039	CO: Energy consumption meter [kWh]		Level 3
	Displays electrical energy used by variable speed drive since display was last reset (see P0040 - reset energy consumption meter).		
Unit: kWh	Min: -	Def: -	Max: -
Dependency:	Value is reset when P3900=1 (end quick commissioning), P0970=1 (factory reset) or P0040=1 (reset energy consumption meter).		

P0040	Reset energy consumption meter		Level 3
	Resets value of parameter r0039 (energy consumption meter) to zero.		
Unit: -	Min: 0	Def: 0	Max: 1
Settings:	0=No reset	1=Reset r0039 to 0.	
Dependency:	No reset until "P" is pressed.		

r0052	CO/BO: Act. status word 1		Level 3
	Displays first active status word of variable speed drive (bit format) and can be used to diagnose variable speed drive status.		
Unit: -	Min: -	Def: -	Max: -
Bit fields:	Bit00 Drive ready 0 NO, 1 YES Bit01 Drive ready to run 0 NO, 1 YES Bit02 Drive running 0 NO, 1 YES Bit03 Drive fault active 0 NO, 1 YES Bit04 OFF2 active 0 YES, 1 NO Bit05 OFF3 active 0 YES, 1 NO Bit06 ON inhibit active 0 NO, 1 YES Bit07 Drive warning active 0 NO, 1 YES Bit08 Deviation setp/act value 0 YES, 1 NO Bit09 PZD control 0 NO, 1 YES Bit10 Maximum frequency reached 0 NO, 1 YES Bit11 Warning: Motor current limit 0 YES, 1 NO Bit12 Motor holding brake active 0 NO, 1 YES Bit13 Motor overload 0 YES, 1 NO Bit14 Motor runs direction right 0 NO, 1 YES Bit15 VSD drive overload 0 YES, 1 NO		
Note:	Output of Bit3 (Fault) will be inverted on digital output high=No Fault).		

r0053	CO/BO: Act. status word 2		Level 3
	Displays second status word of variable speed drive (in bit format).		
Unit: -	Min: -	Def: -	Max: -
Bit fields:	Bit00 DC brake active 0 NO, 1 YES Bit01 Act. freq. r0024 > P2167 0 NO, 1 YES Bit02 Act. freq. r0024 > P1080 0 NO, 1 YES Bit03 Act. current r0027 >= P2170 0 NO, 1 YES Bit04 Act. freq. r0024 > P2155 0 NO, 1 YES Bit05 Act. freq. r0024 <= P2155 0 NO, 1 YES Bit06 Act. freq. r0024 >= setpoint 0 NO, 1 YES Bit07 Act. Vdc r0026 < P2172 0 NO, 1 YES Bit08 Act. Vdc r0026 > P2172 0 NO, 1 YES Bit09 Ramping finished 0 NO, 1 YES Bit10 PID output r2294 < P2291 0 NO, 1 YES Bit11 PID output r2294 >= P2291 0 NO, 1 YES Bit14 Download data set 0 from AOP 0 NO, 1 YES Bit15 Download data set 1 from AOP 0 NO, 1 YES		

r0054	CO/BO: Act. control word 1		Level 3
	Displays first control word of variable speed drive and can be used to diagnose which commands are active.		
Unit: -	Min: -	Def: -	Max: -
Bit fields:	Bit00 ON/OFF1 0 NO, 1 YES Bit01 OFF2: Electrical stop 0 YES, 1 NO Bit02 OFF3: Fast stop 0 YES, 1 NO Bit03 Pulse enable 0 NO, 1 YES Bit04 RFG enable 0 NO, 1 YES Bit05 RFG start 0 NO, 1 YES Bit06 Setpoint enable 0 NO, 1 YES Bit07 Fault acknowledge 0 NO, 1 YES Bit08 JOG right 0 NO, 1 YES Bit09 JOG left 0 NO, 1 YES Bit10 Control from PLC 0 NO, 1 YES Bit11 Reverse (setpoint inversion) 0 NO, 1 YES Bit13 Motor potentiometer MOP up 0 NO, 1 YES Bit14 Motor potentiometer MOP down 0 NO, 1 YES Bit15 CDS Bit 0 (Local/Remote-Hand/Auto) 0 NO, 1 YES		

r 0055	CO/BO: Add. act. control word	Level 3
	Displays additional control word of variable speed drive and can be used to diagnose which commands are active.	

Unit: -	Min: -	Def: -	Max: -	

Bit fields:				
Bit00	Fixed frequency Bit 0	0	NO, 1	YES
Bit01	Fixed frequency Bit 1	0	NO, 1	YES
Bit02	Fixed frequency Bit 2	0	NO, 1	YES
Bit03	Fixed frequency Bit 3	0	NO, 1	YES
Bit08	PID enabled	0	NO, 1	YES
Bit09	DC brake enabled	0	NO, 1	YES
Bit11	Droop	0	NO, 1	YES
Bit12	Not Used	0	NO, 1	YES
Bit13	External fault 1	0	YES, 0	NO

r0056	CO/BO: Status of motor control			Level 3
	Displays status of motor control (V/f status), which can be used to diagnose variable speed drive status.			
Unit: -	Min: -	Def: -	Max: -	

Bit fields:				
Bit00	Init. control finished	0	NO, 1	YES
Bit01	Motor demagnetizing finished	0	NO, 1	YES
Bit02	Pulses enabled	0	NO, 1	YES
Bit03	Voltage soft start select	0	NO, 1	YES
Bit04	Motor excitation finished	0	NO, 1	YES
Bit05	Starting boost active	0	NO, 1	YES
Bit06	Acceleration boost active	0	NO, 1	YES
Bit07	Frequency is negative	0	NO, 1	YES
Bit08	Field weakening active	0	NO, 1	YES
Bit09	Volts setpoint limited	0	NO, 1	YES
Bit10	Slip frequency limited	0	NO, 1	YES
Bit11	F_out > F_max Freq. limited	0	NO, 1	YES
Bit12	Phase reversal selected	0	NO, 1	YES
Bit13	I-max controller active	0	NO, 1	YES
Bit14	Vdc-max controller active	0	NO, 1	YES
Bit15	Vdc-min controller active	0	NO, 1	YES

r0061	CO: Act. rotor speed			Level 3
	Displays current speed detected by encoder.			
Unit: Hz	Min: -	Def: -	Max: -	

r0086	CO: Act. active current			Level 3
	Displays active (real part) of motor current.			
Unit: A	Min: -	Def: -	Max: -	
Dependency:	Applies when V/f control is selected in P1300 (control mode); otherwise, the display shows the value zero.			

P0100	Europe / North America			Level 1
	Determines whether power settings (e.g. nominal rating plate power - P0307) are expressed in [kW] or [hp]. The default settings for the nominal rating plate frequency (P0310) and maximum motor frequency (P1082) are also set automatically here, in addition to reference frequency (P2000).			
Unit: -	Min: 0	Def: 0	Max: 2	
Settings:	0=Europe [kW], frequency default 50 Hz 1=North America [hp], frequency default 60 Hz 2=North America [kW], frequency default 60 Hz			
Dependency:	The setting of DIP switch 2 under the I/O board determines the validity of settings 0 and 1 for P0100 according to the following table:			

DIP 2 Setting	Meaning		P0100 Setting	Meaning
Off	[kW], frequency default 50 [Hz]	Overwrites	1	[hp], frequency default 60 [Hz]
On	[hp], frequency default 60 [Hz]	Overwrites	0	[kW], frequency default 50 [Hz]

Stop drive first (i.e. disable all pulses) before you change this parameter.
P0010=1 (commissioning mode) enables changes to be made.
Changing P0100 resets all rated motor parameters as well as other parameters that depend on the rated motor parameters (see P0340 - calculation of motor parameters).

Note:	P0100 setting 2 (==> [kW], frequency default 60 [Hz]) is not overwritten by the setting of DIP switch 2 (see table above).

r0200	Act. power stack code number			Level 3
	Identifies hardware variant			
Unit: -	Min: -	Def: -	Max: -	
Note:	Parameter r0200=0 indicates that no power stack has been identified.			

r0206	Rated variable speed drive power [kW] / [hp]			Level 3
	Displays nominal rated motor power from the variable speed drive.			
Unit: -	Min: -	Def: -	Max: -	
Dependency:	Value is displayed in [kW] or [hp] depending on setting for P0100 (operation for Europe / North America).			

r0207	Rated variable speed drive current			Level 3
	Displays maximum continuous output current of the variable speed drive.			
Unit: A	Min: -	Def: -	Max: -	

r0208	Rated variable speed drive voltage			Level 3
	Displays nominal AC supply voltage of the variable speed drive.			
Unit: V	Min: -	Def: -	Max: -	
Value:	r0208=230 : 200 - 240 V +/- 10 %	r0208=400 : 380 - 480 V +/- 10 %	r0208=575 : 500 - 600 V +/- 10 %	

r0209	Maximum variable speed drive current			Level 3
	Displays maximum output current of the variable speed drive.			
Unit: A	Min: -	Def: -	Max: -	

P0304	Rated motor voltage			Level 1
	Nominal motor voltage [V] from rating plate. The following diagram shows a typical rating plate with the locations of the relevant motor data.			
Unit: V	Min: 10	Def: 230	Max: 2000	
Dependency:	Changeable only when P0010=1 (quick commissioning).			

P0305	Rated motor current			Level 1
	Nominal motor current [A] from rating plate.			
Unit: A	Min: 0.01	Def: 3.25	Max: 10000.00	
Dependency:	Changeable only when P0010=1 (quick commissioning). Depends also on P0320 (motor magnetization current).			
Note:	For asynchronous motors, the maximum value is defined as the maximum variable speed drive current (r0209). For synchronous motors, the maximum value is defined as twice the maximum variable speed drive current (r0209). The minimum value is defined as 1/32 times variable speed drive rated current (r0207).			

P0307	Rated motor power			Level 1
	Nominal motor power [kW/hp] from rating plate.			
Unit: -	Min: 0.01	Def: 0.75	Max: 2000.00	
Dependency:	If P0100=1 ([kW],frequency default 50 Hz), values will be in [hp]. Changeable only when P0010=1 (quick commissioning).			

P0308	Rated motor cosPhi			Level 3
	Nominal motor power factor (cosPhi) from rating plate.			
Unit: -	Min: 0.000	Def: 0.000	Max: 1.000	
Dependency:	Changeable only when P0010=1 (quick commissioning). Visible only when P0100=0 or 2, (motor power entered in [kW]). Setting 0 causes internal calculation of value (see r0332).			

P0309	Rated motor efficiency			Level 3
	Nominal motor efficiency in [%] from rating plate.			
Unit: %	Min: 0.0	Def: 0.0	Max: 99.9	
Dependency:	Changeable only when P0010=1 (quick commissioning). Visible only when P0100=1, (i.e. motor power entered in [hp]). Setting 0 causes internal calculation of value (see r0332).			
Note:	P0309=100 % corresponds to superconducting			

P0310	Rated motor frequency			Level 1
	Nominal motor frequency [Hz] from rating plate.			
Unit: Hz	Min: 12.00	Def: 50.00	Max: 650.00	
Dependency:	Changeable only when P0010=1 (quick commissioning). The pole pair number is recalculated automatically if parameter is changed.			

P0311	Rated motor speed			Level 1
	Nominal motor speed [rpm] from rating plate.			
Unit: 1/min	Min: 0	Def: 0	Max: 40000	
Dependency:	Changeable only when P0010=1 (quick commissioning). Setting 0 causes an internal calculation of value. Required for V/f control with speed controller. Slip compensation in V/f control requires the rated motor speed for correct operation. The pole pair number is recalculated automatically if the parameter is changed.			

r0313	Motor pole pairs			Level 3
	Displays the number of motor pole pairs that the variable speed drive is currently using for internal calculations.			
Unit: -	Min: -	Def: -	Max: -	
Value:	r0313=1 : 2-pole motor	r0313=2 : 4-pole motor, etc.		
Dependency:	Recalculated automatically when P0310 (rated motor frequency) or P0311 (rated motor speed) is changed.			

P0340	Calculation of motor parameters			Level 3
	Calculates various motor parameters, including:			
Unit: -	Min: 0	Def: 0	Max: 4	
Data:	Calculates various motor parameters, including:			
	• Motor weight P0344 (Level 3) • Magnetization time P0346 (Level 3) • Demagnetization time P0347 (Level 3)		• Stator resistance P0350 (Level 2) • Reference frequency P2000 (Level 2) • Reference current P2002 (Level 3).	
Settings:	0=No calculation 1=Complete parameterization 2=Calc. equivalent circuit data		3=Calc. V/f 4=Calc. only controller setting	
Note:	This parameter is required during commissioning to optimize the variable speed drive performance.			

P0350	Stator resistance (line-to-line)			Level 3
	Stator resistance value in [Ohms] for the connected motor (from line-to-line). The parameter value includes the cable resistance.			
Unit: Ohm	Min: 0.00001	Def: 4.0	Max: 2000.0	

Data:	Stator resistance value in [Ohms] for the connected motor (from line-to-line). The parameter value includes the cable resistance. There are three ways to determine the value for this parameter: 1. Calculate using P0340=1 (data entered from rating plate) or P3900=1,2 or 3 (end of quick commissioning). 2. Measure using P1910=1 (motor data identification - value for stator resistance is overwritten). 3. Measure manually using an Ohmmeter.
Note:	Since measured line-to-line, this value may appear to be higher (up to 2 times higher) than expected. The value entered in P0350 (stator resistance) is the one obtained by the method last used.

r0395	**CO: Total stator resistance [%]**		**Level 3**
	Displays stator resistance of motor as [%] of combined stator/cable resistance.		
Unit: %	**Min: -**	**Def: -**	**Max: -**
Note:	100% means: Z rated motor = $\frac{\text{P0304 (rated motor voltage)}}{\text{P0305 (rated motor current)}}$		

P0400	**Select encoder type**		**Level 3**
	Selects encoder type.		
Unit: -	**Min: 0**	**Def: 0**	**Max: 12**
Settings:	0=disabled 1=Single channel encoder 2=Quadrature encoder without zero pulse	3=External pulse train 12=Quadrature encoder with zero pulse	
Note:	The term “quadrature” in settings 2 and 12 refers to 2 periodic functions separated by a quarter cycle or 90 degrees.		

P0409	**Pulses per second at rated frequency**		**Level 3**
	Sets number of pulses per second at rated speed.		
Unit: -	**Min: 1**	**Def: 25**	**Max: 500**

P0501[2]	**Type of sensor**			**Level 2**
	Defines type of process variable sensor that each analog input is to be configured for. Note that setting this parameter will in turn set P0756 (analog input mode). To switch between voltage and current analog input modes also requires the DIP switches on the terminal board to be set correctly. See description for P0756.			
Unit: -	**Min: 0**	**Def: 0**	**Max: 51**	
Settings:	0=No sensor selected 1=Sensor type QBE620 P1 2=Sensor type QBE620 P10 3=Sensor type QBE620 P16 4=Sensor type QBE620 P25 5=Sensor type QBE620 P40 6=Sensor type QBE620 P4 7=Sensor type QBE620 P5 8=Sensor type QBE621 P10U 9=Sensor type QBE621 P25U	10=Sensor type QBE63 DP01 11=Sensor type QBE63 DP02 12=Sensor type QBE63 DP05 13=Sensor type QBE63 DP1 14=Sensor type QBE64 DP4 15=Sensor type 0 TO 1 INCH WC 16=Sensor type 0 TO 2 INCH WC 17=Sensor type 0 TO 2.5 INCH WC 18=Sensor type 0 TO 3 INCH WC 19=Sensor type 0 TO 5 INCH WC	20=Sensor type 0 TO 10 INCH WC 21=Sensor type 0 TO 10 PSI 22=Sensor type 0 TO 15 PSI 23=Sensor type 0 TO 25 PSI 24=Sensor type 0 TO 30 PSI 25=Sensor type 0 TO 50 PSI 26=Sensor type 0 TO 60 PSI 27=Sensor type 0 TO 100 PSI 28=Sensor type 0 TO 150 PSI 29=Sensor type Al Ni 1000: -50 to 150 °C	
Details:	See P0753 and P0756 to P0762 (ADC conditioning).			

P0506[10]	**Parameter list**			**Level 3**
	This parameter performs no function within the variable speed drive. It is a storage place for use with the AOP for a list of parameters to scale.			
Unit: -	**Min: 0**	**Def: 754**	**Max: 4000**	
Index:	P0506[0] : Parameter 1 P0506[1] : Parameter 2 P0506[2] : Parameter 3	P0506[3] : Parameter 4 P0506[4] : Parameter 5 P0506[5] : Parameter 6	P0506[6] : Parameter 7 P0506[7] : Parameter 8 P0506[8] : Parameter 9	P0506[9] : Parameter 10

P0507[3]	**Scalar values**			**Level 3**
	This parameter performs no function within the variable speed drive. It is a storage place for use with the AOP to scale particular parameters.			
Unit: -	**Min: 0**	**Def: 1.0**	**Max: 9999.9**	
Index:	P0507[0] : Scalar numerator	P0507[1] : Scalar denominator	P0507[2] : Scalar offset	

P0508[4]	**Unit**			**Level 3**
	This parameter performs no function within the variable speed drive. It is a storage place for use with the AOP to store a string for unit.			
Unit: -	**Min: 0**	**Def: 0**	**Max: 65535**	
Index:	P0508[0] : Unit character 1	P0508[1] : Unit character 2	P0508[2] : Unit character 3	P0508[3] : Unit character 4

P0509[12]	**String**			**Level 3**
	This parameter performs no function within the variable speed drive. It is a storage place for use with the AOP to store a string for parameter unit description			
Unit: -	**Min: 0**	**Def: 0**	**Max: 65535**	
Index:	P0509[0] : String char 1 P0509[1] : String char 2 P0509[2] : String char 3	P0509[3] : String char 4 P0509[4] : String char 5 P0509[5] : String char 6	P0509[6] : String char 7 P0509[7] : String char 8 P0509[8] : String char 9	P0509[9] : String char 10 P0509[10] : String char 11 P0509[11] : String char 12

P0601	**Motor temperature sensor**			**Level 3**
	Selects motor temperature sensor.			
Unit: -	**Min: 0**	**Def: 0**	**Max: 2**	
Settings:	0=No sensor	1=PTC thermistor	2=KTY84	
Dependency:	If “no sensor” is selected, motor temperature monitoring occurs based on the estimated value of the thermal motor model.			

P0610	Motor I2t temperature reaction			Level 3
	Defines reaction when motor temperature reaches warning threshold.			
Unit: -	Min: 0	Def: 2	Max: 2	
Settings:	0=No reaction, warning only	1=Warning and Imax reduction (results in reduced output freq.)		2=Warning and trip (F0010)

P0640	Motor overload factor [%]		Level 3
	Defines reaction when motor temperature reaches warning threshold.		
Unit: %	Min: 10.0	Def: 110.0	Max: 400.0
Dependency:	Limited to maximum variable speed drive current or to 400 % of rated motor current (P0305), whichever is lower.		

P0700[2]	Selection of command source			Level 1
	Selects digital command source.			
Unit: -	Min: 0	Def: 2	Max: 6	
Settings:	0=Factory default setting 1=BOP (keypad)	2=Terminal 4=USS on BOP link	5=USS on COM link 6=CB on COM link	
Index:	P0700[0] : 1st command data set (CDS)	P0700[1] : 2nd command data set (CDS)		
Note:	Changing this parameter resets (to default) all settings on item selected. For example: Changing form 1 to 2 resets all digital inputs to default settings.			

P0701[2]	Function of digital input 1			Level 2
	Selects function of digital input 1.			
Unit: -	Min: 0	Def: 1	Max: 99	
Settings:	0=Digital input disabled 1=ON/OFF1 2=ON reverse /OFF1 3=OFF2 - coast to standstill 4=OFF3 - quick ramp-down 9=Fault acknowledge 10 =JOG right	11 =JOG left 12 =Reverse 13 =MOP up (increase freq.) 14 =MOP down (decrease freq.) 15 =Fixed setpoint (direct selection) 16 =Fixed setpoint (direct selection + ON) 17 =Fixed setpoint (binary coded selection+ON)	25 =DC brake enable 26 =Enable Essential Service 27 =Enable PID 29 =External trip 33 =Disable additional freq setpoint 99 =Enable BICO parameterization	
Index:	P0701[0] : 1st command data set (CDS)	P0701[1] : 2nd command data set (CDS)		
Dependency:	Setting 99 (enable BICO parameterization) requires P0700 (command source) or P3900 (end of quick commissioning)=1, 2 or P0970 (factory reset)=1 in order to reset.			
Note:	Setting 99 (BICO) for expert use only			

P0702[2]	Function of digital input 2			Level 2
	Selects function of digital input 2.			
Unit: -	Min: 0	Def: 12	Max: 99	
Detail:	See P0701 (function of digital input1).			

P0703[2]	Function of digital input 3			Level 2
	Selects function of digital input 3.			
Unit: -	Min: 0	Def: 9	Max: 99	
Detail:	See P0701 (function of digital input1).			

P0704[2]	Function of digital input 4			Level 2
	Selects function of digital input 4.			
Unit: -	Min: 0	Def: 15	Max: 99	
Detail:	See P0701 (function of digital input1).			

P0705[2]	Function of digital input 5			Level 2
	Selects function of digital input 5 (via analog input)			
Unit:	Min: 0	Def: 15	Max: 99	
Detail:	See P0701 (function of digital input1).			

P0706[2]	Function of digital input 6			Level 2
	Selects function of digital input 6 (via analog input)			
Unit: _	Min: 0	Def: 29	Max: 99	
Detail:	See P0701 (function of digital input1).			

P0707[2]	Function of digital input 7			Level 3
	Selects function of digital input 7 (via analog input)			
Unit: -	Min: 0	Def: 0	Max: 99	
Settings:	0=Digital input disabled 1=ON/OFF1 2=ON reverse /OFF1 3=OFF2 - coast to standstill 4=OFF3 - quick ramp-down 9=Fault acknowledge	10 =JOG right 11 =JOG left 12 =Reverse 13 =MOP up (increase freq.) 14 =MOP down (decrease freq.)	25 =DC brake enable 26 =Enable Essential Service 29 =External trip 33 =Disable additional freq setpoint 99 =Enable BICO parameterization	
Index:	P0707[0] : 1st command data set (CDS)	P0707[1] : 2nd command data set (CDS)		
Dependency:	Signals about 4V are active, signals below 1.6 V are inactive.			
Note:	Signals above 4 V are active, signals below 1.6 V are inactive.			
Details:	See P0701 (function of digital input 1).			

P0708[2]	Function of digital input 8			Level 3
	Selects function of digital input 8 (via analog input)			
Unit: -	Min: 0	Def: 0	Max: 99	
Detail:	See P0707 (function of digital input7).			

P0718	CO/BO: Hand / Auto		Level 3
	Selects function of digital input 8 (via analog input)		
Unit: -	Min: 0	Def: 0	Max: 1

r0722	CO/BO: Binary input values			Level 3
	Displays status of digital inputs.			
Unit: -	Min: -	Def: -	Max: -	
Bit fields:	Bit00 Digital input 1	0	OFF, 1 ON	
	Bit01 Digital input 2	0	OFF, 1 ON	
	Bit02 Digital input 3	0	OFF, 1 ON	
	Bit03 Digital input 4	0	OFF, 1 ON	
	Bit04 Digital input 5	0	OFF, 1 ON	
	Bit05 Digital input 6	0	OFF, 1 ON	
	Bit06 Digital input 7 (via ADC 1)	0	OFF, 1 ON	
	Bit07 Digital input 8 (via ADC 2)	0	OFF, 1 ON	
Note:	Segment is lit when signal is active.			

P0725	PNP / NPN digital inputs		Level 3
	Switches between active high (PNP) and active low (NPN). This is valid for all digital inputs simultaneously. The following is valid by using the internal supply:		
Unit: -	Min: 0	Def: 1	Max: 1
Settings:	0=NPN mode ==> low active	1=PNP mode ==> high active	

P0731[2]	BI: Function of digital output 1				Level 2
	Defines source of digital output 1.				
Unit: -	Min: 0.0	Def: 52.3		Max: 4000.0	
Settings:	52.0 Drive ready	0 Closed	52.E Motor running direction right	0 Closed	
	52.1 Drive ready to run	0 Closed	52.F VSD drive overload	1 Closed	
	52.2 Drive running	0 Closed	53.0 DC brake active	0 Closed	
	52.3 Drive fault active	0 Closed	53.1 VSD frequency less switch off limit	0 Closed	
	52.4 OFF2 active	1 Closed	53.2 VSD frequency less minimum freq.	0 Closed	
	52.5 OFF3 active	1 Closed	53.3 Current greater or equal than limit	0 Closed	
	52.6 Switch on inhibit active	0 Closed	53.4 Act. freq. greater comparison freq.	0 Closed	
	52.7 Drive warning active	0 Closed	53.5 Act. freq. less comparison freq.	0 Closed	
	52.8 Deviation setpoint/actual value	1 Closed	53.6 Act. freq. greater/equal setpoint	0 Closed	
	52.9 PZD control (Process Data Control)	0 Closed	53.7 Voltage less than threshold	0 Closed	
	52.A Maximum frequency reached	0 Closed	53.8 Voltage greater than threshold	0 Closed	
	52.B Warning: Motor current limit	1 Closed	53.A PID output at lower limit (P2292)	0 Closed	
	52.C Motor holding brake (MHB) active	0 Closed	53.B PID output at upper limit (P2291)	0 Closed	
	52.D Motor overload	1 Closed			
Index:	P0731[0] : 1st command data set (CDS)		P0731[1] : 2nd command data set (CDS)		

P0732[2]	BI: Function of digital output 2		Level 2
	Defines source of digital output 2.		
Unit: -	Min: 0.0	Def: 52.2	Max: 4000.0
Details:	See P0731 (function of digital output 1).		

r0747	CO/BO: State of digital outputs			Level 3
	Displays status of digital outputs (also includes inversion of digital outputs via P0748).			
Unit: -	Min: -	Def: -	Max: -	
Bit fields:	Bit00 Digital output 1 energized	0	NO, 1 YES	
	Bit01 Digital output 2 energized	0	NO, 1 YES	
Dependency:	Bit 0= Relay de-energized / contacts open Bit 1= Relay energized / contacts closed			

P0748	Invert digital outputs		Level 3
	Defines high and low states of relay for a given function.		
Unit: -	Min: 0	Def: 0	Max: 7
Bit fields:	Bit00 Invert digital output 1	0	NO, 1 YES
	Bit01 Invert digital output 2	0	NO, 1 YES

r0752[2]	Act. input of ADC [V] or [mA]		Level 2
	Displays smoothed analog input value in volts before the characteristic block.		
Unit: -	Min: -	Def: -	Max: -
Index:	r0752[0] : Analog input 1 (ADC 1)	r0752[1] : Analog input 2 (ADC 2)	

P0753[2]	Smooth time ADC		Level 3
	Defines filter time (PT1 filter) in [ms] for analog input.		
Unit: ms	Min: 0	Def: 100	Max: 10000
Index:	P0753[0] : Analog input 1 (ADC 1)	P0753[1] : Analog input 2 (ADC	
Note:	Increasing this time (smooth) reduces jitter but slows down response to the analog input.		

r0754[2]	Act. ADC value after scaling [%]		Level 2
	Shows smoothed value of analog input in [%] after scaling block.		
Unit: %	Min: -	Def: -	Max: -
Index:	r0754[0] : Analog input 1 (ADC 1)	r0754[1] : Analog input 2 (ADC 2)	
Dependency:	P0757 to P0760 define range (ADC scaling)		

r0755[2]	CO: Act. ADC after scaling [4000h]			Level 3
	Displays analog input, scaled using ASPmin and ASPmax.			
Unit: -	Min: -	Def: -	Max: -	
Data:	The analog setpoint (ASP) from the analog scaling block can vary from min. analog setpoint (ASPmin) to a max. analog setpoint (ASPmax) as shown in P0757 (ADC scaling). The largest magnitude (value without sign) of ASPmin and ASPmax defines the scaling of 16384.			
Example:	ASPmin=300 %, ASPmax=100 % then 16384 represents 300 %. This parameter will vary from 5461 to 16364 ASPmin=-200 %, ASPmax=100 % then 16384 represents 200 %. This parameter will vary from –16384 to +8192			
Index:	r0755[0] : Analog input 1 (ADC 1)	r0755[1] : Analog input 2 (ADC 2)		
Note:	This value is used as an input to analog BICO connectors. ASPmax represents the highest analog setpoint (this may be at 10 V) ASPmin represents the lowest analog setpoint (this may be at 0 V)			
Details:	See parameters P0757 to P0760 (ADC scaling)			

P0756[2]	Type of ADC			Level 2
	Defines type of analog input and also enables analog input monitoring.			
Unit: -	Min: 0	Def: 0	Max: 5	
Data:	Defines type of analog input and also enables analog input monitoring. To switch over from voltage to current analog input it is not sufficient to merely modify parameter P0756. Rather, the DIPs on the terminal board must also be set to the correct position. The DIP settings are as follows: - OFF=voltage input (10 V) - ON =current input (20 mA) Allocation of DIPs to analog inputs is as follows: - DIP on left (DIP 1)= Analog input 1 - DIP on right (DIP 2)= Analog input 2			
Settings:	0=Unipolar voltage input (0 to +10 V) 1=Unipolar voltage input with monitoring (0 to 10 V) 2=Unipolar current input (0 to 20 mA)	3=Unipolar current input with monitoring (0 to 20 mA) 4=Bipolar voltage input (-10 V to +10 V) 5=LG-Ni 1000 sensor input		
Index:	P0756[0] : Analog input 1 (ADC 1)	P0756[1] : Analog input 2 (ADC 2)		
Dependency:	Function disabled if analog scaling block programmed to output negative setpoints (see P0757 to P0760).			
Note:	When monitoring is enabled and a deadband defined (P0761), a fault condition will be generated (F0080) if the analog input voltage falls below 50 % of the deadband voltage.			
Details:	See P0757 to P0760 (ADC scaling).			

P0757[2]	Value x1 of ADC scaling [V / mA]			Level 2
	Parameters P0757 - P0760 configure the input scaling			
Unit: -	Min: -50.0	Def: 0	Max: 150.0	
Data:	Parameters P0757 - P0760 configure the input scaling where: • Analog setpoints represent a [%] of the normalized frequency in P2000. • Analog setpoints may be larger than 100 % • ASP max represents highest analog setpoint (this may be at 10 V). • ASP min represents lowest analog setpoint (this may be at 0 V). • Default values provide a scaling of 0 V=0 %, and 10 V=100 %.			
Index:	P0757[0] : Analog input 1 (ADC 1)	P0757[1] : Analog input 2 (ADC 2		

P0758[2]	Value y1 of ADC scaling			Level 2
	Sets value of Y1 in [%] as described in P0757 (ADC scaling)			
Unit: %	Min: -99999.9	Def: 0.0	Max: 99999.9	
Index:	P0758[0] : Analog input 1 (ADC 1)	P0758[1] : Analog input 2 (ADC 2)		
Dependency:	Affects P2000 to P2003 (reference frequency, voltage, current or torque) depending on which setpoint is to be generated.			

P0759[2]	Value x2 of ADC scaling [V / mA]			Level 2
	Sets value of X2 as described in P0757 (ADC scaling)			
Unit: -	Min: -50.0	Def: 10	Max: 150.0	
Index:	P0759[0] : Analog input 1 (ADC 1)	P0759[1] : Analog input 2 (ADC 2		

P0760[2]	Value y2 of ADC scaling			Level 2
	Sets value of Y2 in [%] as described in P0757 (ADC scaling)			
Unit: %	Min: -99999.9	Def: 100.0	Max: 99999.9	
Index:	P0760[0] : Analog input 1 (ADC 1)	P0760[1] : Analog input 2 (ADC 2)		
Dependency:	Affects P2000 to P2003 (reference frequency, voltage, current or torque) depending on which setpoint is to be generated.			

P0761[2]	Width of ADC deadband [V / mA]			Level 3
	Defines width of deadband on analog input. The diagrams below explain its use			
Unit: -	Min: 0	Def: 0	Max: 150.0	
Index:	P0761[0] : Analog input 1 (ADC 1)	P0761[1] : Analog input 2 (ADC 2)		
Note:	P0761[x]=0 : No deadband active. Deadband starts from 0 V to value of P0761, if both values of P0758 and P0760 (y coordinates of ADC scaling) are positive or negative respectively. However, deadband is active in both directions from point of intersection (x axis with ADC scaling curve), if sign of P0758 and P0760 are opposite. Fmin (P1080) should be zero when using center zero setup. There is no hysteresis at the end of the deadband.			

P0771[2]	CI: DAC	Level 2
	Defines function of the 0 - 20 mA analog output.	

Unit: -	Min: 0:0	Def: 21:0	Max: 4000:0	
Settings:	21 CO: Act. frequency (scaled to P2000) 24 CO: Act. output frequency (scaled to P2000) 25 CO: Act. output voltage (scaled to P2001)		26 CO: Act. DC-link voltage (scaled to P2001) 27 CO: Act. output current (scaled to P2002)	
Index:	P0771[0] : Analog output 1 (DAC 1)		P0771[1] : Analog output 2 (DAC 2)	

P0773[2]	Smooth time DAC			Level 3
	Defines smoothing time [ms] for analog output signal. This parameter enables smoothing for DAC input using a PT1 filter.			
Unit: ms	Min: 0	Def: 100	Max: 1000	
Index:	P0773[0] : Analog output 1 (DAC 1)		P0773[1] : Analog output 2 (DAC 2)	
Dependency:	P0773=0: Deactivates filter.			

R0774[2]	Act. DAC value [V] or [mA]			Level 3
	Shows value of analog output in [V] or [mA] after filtering and scaling.			
Unit: -	Min: -	Def: -	Max: -	
Index:	r0774[0] : Analog output 1 (DAC 1)		r0774[1] : Analog output 2 (DAC 2)	

P0776	Type of DAC			Level 3
	Defines type of analog output.			
Unit: -	Min: 0	Def: 1	Max: 1	
Settings:	0 Current output 1 Voltage output			
Note:	The analog output is designed as a current output with a range of 0...20 mA. For the ECB variant, the two analog output channels must be of the same type i.e. both channels are current outputs with a range of 0...20 mA or both channels are defined as voltage outputs with a range of 0...10 V.			

P0777[2]	Value x1 of DAC scaling			Level 2
	Defines x1 output characteristic in [%]. Scaling block is responsible for adjustment of output value defined in P0771 (DAC connector input). Parameters of DAC scaling block (P0777 ... P0781) work as follows:			
Unit: %	Min: -99999.0	Def: 0.0	Max: 99999.0	
Data:	Defines x1 output characteristic in [%]. Scaling block is responsible for adjustment of output value defined in P0771 (DAC connector input).			
Index:	P0777[0] : Analog output 1 (DAC 1)		P0777[1] : Analog output 2 (DAC 2)	
Dependency:	Affects P2000 to P2003 (reference frequency, voltage, current or torque) depending on which setpoint is to be generated.			

P0778[2]	Value y1 of DAC scaling			Level 2
	Defines y1 of output characteristic.			
Unit: -	Min: 0	Def: 0	Max: 20	
Index:	P0778[0] : Analog output 1 (DAC 1)		P0778[1] : Analog output 2 (DAC 2)	

P0779[2]	Value x2 of DAC scaling			Level 2
	Defines x2 of output characteristic in [%].			
Unit: %	Min: -99999.0	Def: 100.0	Max: 99999.0	
Index:	P0779[0] : Analog output 1 (DAC 1)		P0779[1] : Analog output 2 (DAC 2)	
Dependency:	Affects P2000 to P2003 (reference frequency, voltage, current or torque) depending on which setpoint is to be generated.			

P0780[2]	Value y2 of DAC scaling			Level 2
	Defines y2 of output characteristic.			
Unit: -	Min: 0	Def: 10	Max: 20	
Index:	P0780[0] : Analog output 1 (DAC 1)		P0780[1] : Analog output 2 (DAC 2)	

P0781[2]	Width of DAC deadband			Level 3
	Sets width of dead-band in [mA] or [V] for analog output.			
Unit: -	Min: 0	Def: 0	Max: 20	
Index:	P0781[0] : Analog output 1 (DAC 1)		P0781[1] : Analog output 2 (DAC 2)	

P0809[3]	Copy Command Data Set				Level 3
	Calls 'Copy command data set' function.				
Unit: -	Min: 0	Def: 0	Max: 2		
Index:	P0809[0] : Copy from CDS	P0809[1] : Copy to DDS		P0809[2] : Start copy	
Note:	Start value in index 2 is automatically reset to '0' after execution of function				

P0810	BI: CDS bit 0 (Local / Remote)			Level 3
	Selects command source from which to read Bit 0 for selecting a BICO data set (see control word 1, Bit 15).			
Unit: -	Min: 0:0	Def: 718:0	Max: 4095:0	
Note:	Bit 1 is also relevant for BICO data set selection.			

P0918	CB address			Level 3
	Defines address of CB (communication board) or address of the other option modules.			
Unit: -	Min: 0	Def: 3	Max: 65535	
Data:	Defines address of CB (communication board) or address of the other option modules. There are two ways to set the bus address: 1 via DIP switches on the PROFIBUS module 2 via a user-entered value			

Note:	Possible PROFIBUS settings: 1 ... 125 0, 126, 127 are not allowed The following applies when a PROFIBUS module is used: DIP switch =0 Address defined in P0918 (CB address) is valid DIP switch not=0 DIP switch setting has priority and P0918 indicates DIP switch setting.

P0927	**Parameter changeable via**			**Level 3**
	Specifies the interfaces which can be used to change parameters.			
Unit: -	**Min: 0**	**Def: 15**	**Max: 15**	
Example:	b - - n n" (bits 0, 1, 2 and 3 set) in the default setting means that parameters can be changed via any interface. "b - - r n" (bits 0, 1 and 3 set) would specify that parameters can be changed via PROFIBUS/CB, BOP and USS on COM link (RS485 USS) but not via USS on BOP link (RS232)			
Bit fields:	Bit00 PROFIBUS / CB 0 NO, 1 YES Bit01 BOP 0 NO, 1 YES		Bit02 USS on BOP link 0 NO, 1 YES Bit03 USS on COM link 0 NO, 1 YES	

r0947[8]	**Last fault code**			**Level 3**
	Displays fault history according to the diagram below			
Unit: -	**Min: -**	**Def: -**	**Max: -**	
Data:	Displays fault history, where: "F1" is the first active fault (not yet acknowledged). "F2" is the second active fault (not yet acknowledged). "F1e" is the occurrence of the fault acknowledgement for F1 & F2. This moves the value in the 2 indices down to the next pair of indices, where they are stored. Indices 0 & 1 contain the active faults. When faults are acknowledged, indices 0 & 1 are reset to 0.			
Example:	If the variable speed drive trips on undervoltage and then receives an external trip before the undervoltage is acknowledged, you will obtain: Index 0=3 Undervoltage Index 1=85 External trip Whenever a fault in index 0 is acknowledged (F1e), the fault history shifts as indicated in the diagram above.			
Index:	r0947[0] : Recent fault trip --, fault 1 r0947[1] : Recent fault trip --, fault 2 r0947[2] : Recent fault trip -1, fault 3	r0947[3] : Recent fault trip -1, fault 4 r0947[4] : Recent fault trip -2, fault 5 r0947[5] : Recent fault trip -2, fault 6	r0947[6] : Recent fault trip -3, fault 7 r0947[7] : Recent fault trip -3, fault 8	
Dependency:	Index 2 used only if second fault occurs before first fault is acknowledged.			

r0948[12]	**Fault time**			**Level 3**
	Time stamp to indicate when the fault has occurred. P2114 (run-time counter) or P2115 (real time clock) are the possible sources of the time stamp.			
Unit: -	**Min: -**	**Def: -**	**Max: -**	
Data:	Time stamp to indicate when the fault has occurred. P2114 (run-time counter) or P2115 (real time clock) are the possible sources of the time stamp.			
Example:	The time is taken from P2115 if this parameter has been updated with the real time. If not, P2114 is used			
Index:	r0948[0] : Recent fault trip --, fault time seconds+minutes r0948[1] : Recent fault trip –, fault time hours+days r0948[2] : Recent fault trip --, fault time month+year r0948[3] : Recent fault trip --1, fault time seconds+minutes r0948[4] : Recent fault trip --1, fault time hours+days r0948[5] : Recent fault trip --1, fault time month+year		r0948[6] : Recent fault trip -2, fault time seconds+minutes r0948[7] : Recent fault trip -2, fault time hours+days r0948[8] : Recent fault trip -2, fault time month+year r0948[9] : Recent fault trip -3, fault time seconds+minutes r0948[10] : Recent fault trip -3, fault time hours+days r0948[11] : Recent fault trip -3, fault time month+year`	
Note:	P2115 can be updated via AOP, Starter, Drive Monitor, etc.			

r0949[8]	**Fault value**			**Level 3**
	Displays drive fault values. It is for service purposes and indicate the type of fault reported. The values are not documented. They are listed in the code where faults are reported.			
Unit: -	**Min: -**	**Def: -**	**Max: -**	
Index:	r0949[0] : Recent fault trip --, fault value 1 r0949[1] : Recent fault trip --, fault value 2 r0949[2] : Recent fault trip -1, fault value 3 r0949[3] : Recent fault trip -1, fault value 4		r0949[4] : Recent fault trip -2, fault value 5 r0949[5] : Recent fault trip -2, fault value 6 r0949[6] : Recent fault trip -3, fault value 7 r0949[7] : Recent fault trip -3, fault value 8	

P0952	**Total number of faults**			**Level 3**
	Displays number of faults stored in P0947 (last fault code).			
Unit: -	**Min: 0**	**Def: 0**	**Max: 8**	
Dependency:	Setting 0 resets fault history (changing to 0 also resets parameter P0948 - fault time).			

r0967	**Control word 1**			**Level 3**
	Displays control word 1.			
Unit: -	**Min: -**	**Def: -**	**Max: -**	
Bit fields:	Bit00 ON/OFF1 0 NO, 1 YES Bit01 OFF2: Electrical stop 0 YES, 1 NO Bit02 OFF3: Fast stop 0 YES, 1 NO Bit03 Pulse enable 0 NO, 1 YES Bit04 RFG enable 0 NO, 1 YES Bit05 RFG start 0 NO, 1 YES Bit06 Setpoint enable 0 NO, 1 YES Bit07 Fault acknowledge 0 NO, 1 YES Bit08 JOG right 0 NO, 1 YES Bit09 JOG left 0 NO, 1 YES Bit10 Control from PLC 0 NO, 1 YES Bit11 Reverse (setpoint inversion) 0 NO, 1 YES			

	Bit13	Motor potentiometer MOP up	0	NO, 1 YES
	Bit14	Motor potentiometer MOP down	0	NO, 1 YES
	Bit15	CDS Bit 0 (Local/Remote-Hand/Auto)	0	NO, 1 YES

r0968	Status word 1			Level 3
	Displays active status word of variable speed drive (in binary) and can be used to diagnose which commands are active.			
Unit: -	Min: -	Def: -	Max: -	

Bit fields:				
	Bit00	Drive ready	0	NO, 1 YES
	Bit01	Drive ready to run	0	NO, 1 YES
	Bit02	Drive running	0	NO, 1 YES
	Bit03	Drive fault active	0	NO, 1 YES
	Bit04	OFF2 active	0	YES, 1 NO
	Bit05	OFF3 active	0	YES, 1 NO
	Bit06	ON inhibit active	0	NO, 1 YES
	Bit07	Drive warning active	0	NO, 1 YES
	Bit08	Deviation setp. / act. value	0	YES, 1 NO
	Bit09	PZD control	0	NO, 1 YES
	Bit10	Maximum frequency reached	0	NO, 1 YES
	Bit11	Warning: Motor current limit	0	YES, 1 NO
	Bit12	Motor holding brake active	0	NO, 1 YES
	Bit13	Motor overload	0	YES, 1 NO
	Bit14	Motor runs direction right	0	NO, 1 YES
	Bit15	VSD drive overload	0	YES, 1 NO

P0970	Factory reset			Level 1
	P0970 = 1 resets all parameters to their default values.			
Unit: -	Min: 0	Def: 0	Max: 1	
Settings:	0=Disabled	1=Parameter reset		
Dependency:	First set P0010=30 (factory settings) Stop drive (i.e. disable all pulses) before you can reset parameters to default values.			
Note:	The following parameters retain their values after a factory reset: P0918 (CB address), P2010 (USS baud rate) and P2011 (USS address)			

P0971	Transfer data from RAM to EEPROM			Level 3
	Transfers values from RAM to EEPROM when set to 1.			
Unit: -	Min: 0	Def: 0	Max: 1	
Settings:	0=Disabled	1=Start transfer		
Note:	All values in RAM are transferred to EEPROM. Parameter is automatically reset to 0 (default) after successful transfer.			

P1000[2]	Selection of frequency setpoint			Level 1
	Selects frequency setpoint source. In the table of possible settings below, the main setpoint is selected from the least significant digit (i.e., 0 to 6) and any additional setpoint from the most significant digit (i.e., x0 through to x6).			
Unit: -	Min: 0	Def: 2	Max: 77	
Data:	Selects frequency setpoint source. In the table of possible settings below, the main setpoint is selected from the least significant digit (i.e., 0 to 6) and any additional setpoint from the most significant digit (i.e., x0 through to x6).			
Example:	Setting 12 selects main setpoint (2) derived from analog input with additional setpoint (1) taken from the motor potentiometer.			
Settings:	1 Motor potentiometer setpoint 2 Analog input	3 Fixed frequency setpoint 4 USS on BOP link	5 USS on COM link 6 Communication board (CB) on COM link	

Settings:		
	0=No main setpoint	40=No main setpoint + USS on BOP link
	1=MOP setpoint	41=MOP setpoint + USS on BOP link
	2=Analog setpoint	42=Analog setpoint + USS on BOP link
	3=Fixed frequency	43=Fixed frequency + USS on BOP link
	4=USS on BOP link	44=USS on BOP link + USS on BOP link
	5=USS on COM link	45=USS on COM link + USS on BOP link
	6=CB on COM link	46=CB on COM link + USS on BOP link
	7=Analog setpoint 2	47=Analog setpoint 2 + USS on BOP link
	10=No main setpoint + MOP setpoint	50=No main setpoint + USS on COM link
	11=MOP setpoint + MOP setpoint	51=MOP setpoint + USS on COM link
	12=Analog setpoint + MOP setpoint	52=Analog setpoint + USS on COM link
	13=Fixed frequency + MOP setpoint	53=Fixed frequency + USS on COM link
	14=USS on BOP link + MOP setpoint	54=USS on BOP link + USS on COM link
	15=USS on COM link + MOP setpoint	55=USS on COM link + USS on COM link
	16=CB on COM link + MOP setpoint	56=CB on COM link + USS on COM link
	17=Analog setpoint 2 + MOP setpoint	57=Analog setpoint 2 + USS on COM link
	20=No main setpoint + Analog setpoint	60=No main setpoint + CB on COM link
	21=MOP setpoint + Analog setpoint	61=MOP setpoint + CB on COM link
	22=Analog setpoint + Analog setpoint	62=Analog setpoint + CB on COM link
	23=Fixed frequency + Analog setpoint	63=Fixed frequency + CB on COM link
	24=USS on BOP link + Analog setpoint	64=USS on BOP link + CB on COM link
	25=USS on COM link + Analog setpoint	65=USS on COM link + CB on COM link
	26=CB on COM link + Analog setpoint	66=CB on COM link + CB on COM link
	27=Analog setpoint 2 + Analog setpoint	67=Analog setpoint 2 + CB on COM link
	30=No main setpoint + Fixed frequency	70=No main setpoint + Analog setpoint 2

	31=MOP setpoint + Fixed frequency 32=Analog setpoint + Fixed frequency 33=Fixed frequency + Fixed frequency 34=USS on BOP link + Fixed frequency 35=USS on COM link + Fixed frequency 36=CB on COM link + Fixed frequency 37=Analog setpoint 2 + Fixed frequency	71=MOP setpoint + Analog setpoint 2 72=Analog setpoint + Analog setpoint 2 73=Fixed frequency + Analog setpoint 2 74=USS on BOP link + Analog setpoint 2 75=USS on COM link + Analog setpoint 2 76=CB on COM link + Analog setpoint 2 77=Analog setpoint 2 + Analog setpoint 2
Index:	P1000[0] : 1st command data set (CDS) P1000[1] : 2nd command data set (CDS)	
Note:	Single digits denote main setpoints that have no additional setpoint.	

P1001	**Fixed frequency 1**			**Level 3**
	Defines fixed frequency setpoint 1.			
Unit: Hz	**Min: -650.0**	**Def: 0.00**	**Max: 650.00**	

Data: There are 3 types of fixed frequencies:

1. Direct selection (P0701 - P0706=15)
   In this mode of operation 1 digital input selects 1 fixed frequency. If several inputs are active together, the selected frequencies are summed, e.g., FF1 + FF2 + FF3 + FF4 + FF5 + FF6.
2. Direct selection + ON command (P0701 - P0706=16)
   The fixed frequency selection combines the fixed frequencies with an ON command. In this mode of operation 1 digital input selects 1 fixed frequency. If several inputs are active together, the selected frequencies are summed, e.g., FF1 + FF2 + FF3 + FF4 + FF5 + FF6.
3. Binary coded selection + ON command (P0701 - P0706=17)
   Select up to 16 fixed frequencies using this method. Select the fixed frequencies according to the following table:

		DIN4	**DIN3**	**DIN2**	**DIN1**
	OFF	Inactive	Inactive	Inactive	Inactive
P1001	FF1	Inactive	Inactive	Inactive	**Active**
P1002	FF2	Inactive	Inactive	**Active**	Inactive
P1003	FF3	Inactive	Inactive	**Active**	**Active**
P1004	FF4	Inactive	**Active**	Inactive	Inactive
P1005	FF5	Inactive	**Active**	Inactive	**Active**
P1006	FF6	Inactive	**Active**	**Active**	Inactive
P1007	FF7	Inactive	**Active**	**Active**	**Active**
P1008	FF8	**Active**	Inactive	Inactive	Inactive
P1009	FF9	**Active**	Inactive	Inactive	**Active**
P1010	FF10	**Active**	Inactive	**Active**	Inactive
P1011	FF11	**Active**	Inactive	**Active**	**Active**
P1012	FF12	**Active**	**Active**	Inactive	Inactive
P1013	FF13	**Active**	**Active**	Inactive	**Active**
P1014	FF14	**Active**	**Active**	**Active**	**Active**
P1015	FF15	**Active**	**Active**	**Active**	**Active**

Dependency:	Select fixed frequency operation (using P1000). Variable speed drive requires ON command to start in the case of direct selection (P0701 to P0706=15).
Note:	Fixed frequencies can be selected using the digital inputs, and can also be combined with an ON command.

P1002-P1015	**Fixed frequency 2 through 15**			**Level 3**
	Defines fixed frequency setpoint 2.			
Unit: Hz	**Min: -650.00**	**Def: See Note below**	**Max: 650.00**	
Details:	See P1001 (fixed frequency 1).			

Note: Default fixed frequency setpoint values are as follows:

Fixed Frequency	**Default**	**Fixed Frequency**	**Default**	**Fixed Frequency**	**Default**
1	0.00	6	25.00	11	50.00
2	5.00	7	30.00	12	55.00
3	10.00	8	35.00	13	60.00
4	15.00	9	40.00	14	65.00
5	20.00	10	45.00	15	65.00

P1016 to P1019	**Fixed frequency mode - Bit 0 through 3**			**Level 3**
	Fixed frequencies can be selected in three different modes. Parameter P1016 defines the mode of selection Bit 0.			
Unit: -	**Min: 1**	**Def: 1**	**Max: 3**	
Details:	Parameter P1016 defines the mode of Bit 0, Parameter P1017 defines the mode of Bit 1, Parameter P1018 defines the mode of Bit 2, and Parameter P1019 defines the mode of Bit 3.			
Settings:	1=Direct selection	2=Direct selection + ON command	3=Binary coded selection + ON command	
Note:	See table in P1001 (fixed frequency 1) for a description of how to use fixed frequencies.			

P1020[2] to P1023[2]	**BI: Fixed frequency selection Bit 0**			**Level 3**
	Defines origin of fixed frequency selection.			
Unit: -	**Min: 0:0**	**Def: 0:0 (P1023 = 722:3)**	**Max: 4000:0**	

Settings:	P1020= 722.0 ==> Digital input 1 P1021= 722.1 ==> Digital input 2	P1022= 722.2 ==> Digital input 3 P1023= 722.3 ==> Digital input 4	P1026= 722.4 ==> Digital input 5 P1028= 722.5 ==> Digital input 6
Index:	P1020[0] : 1st command data set (CDS) for Bit 0 P1021[0] : 1st command data set (CDS) for Bit 1 P1022[0] : 1st command data set (CDS) for Bit 2 P1023[0] : 1st command data set (CDS) for Bit 3	P1020[1] : 2nd command data set (CDS) for Bit 0 P1021[1] : 2nd command data set (CDS) for Bit 1 P1022[1] : 2nd command data set (CDS) for Bit 2 P1023[1] : 2nd command data set (CDS) for Bit 3	

Dependency:	Accessible only if P0701 - P0706=99 (function of digital inputs=BICO)

r1024	**CO: Act. fixed frequency**		**Level 3**
	Displays sum total of selected fixed frequencies.		
Unit: Hz	**Min: -**	**Def: -**	**Max: -**

P1025	**Fixed frequency mode - Bit 4**		**Level 3**
	Direct selection or direct selection + ON for bit 4.		
Unit: -	**Min: 1**	**Def: 1**	**Max: 2**
Settings:	1=Direct selection	2=Direct selection + ON command	3=Binary coded selection + ON command
Details:	See parameter P1001 for description of how to use fixed frequencies.		

P1026[2]	**BI: Fixed frequency selection Bit 4**		**Level 3**
	Defines origin of fixed frequency selection.		
Unit: -	**Min: 0:0**	**Def: 722:4**	**Max: 4000:0**
Index:	P1026[0] : 1st command data set (CDS)	P1026[1] : 2nd command data set (CDS)	
Dependency:	Accessible only if P0701 - P0706=99 (function of digital inputs=BICO).		
Details:	See P1020 (fixed frequency selection Bit 0) for most common settings.		

P1027	**Fixed frequency mode - Bit 5**		**Level 3**
	Direct selection or direct selection + ON for bit 5.		
Unit: -	**Min: 1**	**Def: 1**	**Max: 2**
Settings:	1=Direct selection	2=Direct selection + ON command	3=Binary coded selection + ON command
Details:	See parameter P1001 for description of how to use fixed frequencies.		

P1028[2]	**BI: Fixed frequency selection Bit 5**		**Level 3**
	Defines origin of fixed frequency selection.		
Unit: -	**Min: 0:0**	**Def: 722:5**	**Max: 4000:0**
Index:	P1028[0] : 1st command data set (CDS)	P1028[1] : 2nd command data set (CDS)	
Dependency:	Accessible only if P0701 - P0706=99 (function of digital inputs=BICO).		
Details:	See P1020 (fixed frequency selection Bit 0) for most common settings.		

P1031	**Setpoint memory of the MOP**		**Level 3**
	Saves last motor potentiometer setpoint (MOP) that was active before OFF command or power down.		
Unit: -	**Min: 0**	**Def: 1**	**Max: 1**
Settings:	0=PID-MOP setpoint will not be stored	1=PID-MOP setpoint will be stored (P2240 is updated)	
Note:	On next ON command, motor potentiometer setpoint will be the saved value in parameter P1040 (setpoint of the MOP).		

P1032	**Inhibit reverse direction of MOP**		**Level 3**
	Inhibits reverse setpoint selection.		
Unit: -	**Min: 0**	**Def: 1**	**Max: 1**
Settings:	0=Reserve direction is allowed	1=Reserve direction inhibited	
Dependency:	Motor potentiometer (P1040) must be chosen as main setpoint or additional setpoint (using P1000).		
Note:	It is possible to change motor direction using the motor potentiometer setpoint (increase / decrease frequency either by using digital inputs or BOP/AOP keypad up / down).		

P1040	**Setpoint of the MOP**		**Level 2**
	Determines setpoint for motor potentiometer control (P1000 = 1).		
Unit: Hz	**Min: -650.00**	**Def: 10.00**	**Max: 650.00**
Note:	If motor potentiometer setpoint is selected either as main setpoint or additional setpoint, the reverse direction will be inhibited by default of P1032 (inhibit reverse direction of MOP). To re-enable reverse direction, set P1032=0		

r1050	**CO: Act. Output frequency of the MOP**		**Level 3**
	Display output frequency of motor potentiometer setpoint ([Hz]).		
Unit: Hz	**Min: -**	**Def: -**	**Max: -**

r1078	**CO: Total frequency setpoint**		**Level 3**
	Displays sum of main and additional setpoints in [Hz].		
Unit: Hz	**Min: -**	**Def: -**	**Max: -**

P1080	**Min. Frequency**		**Level 1**
	Sets minimum motor frequency [Hz] at which motor will run irrespective of frequency setpoint.		
Unit: Hz	**Min: 0.00**	**Def: 10.00**	**Max: 650.00**
Note:	Value set here is valid both for clockwise and for counter-clockwise rotation. Under certain conditions (e.g. ramping, current limiting), motor can run below minimum frequency.		

P1082	**Max. Frequency**		**Level 1**
	Sets maximum motor frequency [Hz] at which motor will run irrespective of the frequency setpoint.		
Unit: Hz	**Min: 0.00**	**Def: 50.00**	**Max: 150.00**
Dependency:	Limited internally to 200 Hz or 5 * rated motor frequency (P0305) when P1300 >= 20 (control mode=vector control). The value is displayed in r0209 (maximum frequency).		
Note:	The value set here is valid for both clockwise and counter-clockwise rotation. The maximum output frequency of variable speed drive can be exceeded if one of the following is active: Slip compensation=$f_{max} + f_{slip\ comp\ max}$, or Flying restart=$f_{max} + f_{slip\ nom}$ Maximum motor speed is subject to mechanical limitations.		

P1091 to P1094	Skip frequency 1 through 4			Level 3
	Defines skip frequency 1 which avoids effects of mechanical resonance and suppresses frequencies within +/- P1101 (skip frequency bandwidth).			
Unit: Hz	Min: 0.00	Def: 0.00	Max: 650.00	
Details:	Defines the skip frequency which avoids effects of mechanical resonance and suppresses frequencies within +/- P1101 (skip frequency bandwidth). P1091 defines skip frequency 1, P1092 defines skip frequency 2, P1093 defines skip frequency 3, and P1094 defines skip frequency 4.			
Note:	Stationary operation is not possible within the suppressed frequency range; the range is merely passed through (on the ramp). For example, if P1091=10 Hz and P1101=2 Hz, it is not possible to operate continuously between 10 Hz +/- 2 Hz (i.e. between 8 and 12 Hz)			

P1101	Skip frequency bandwidth			Level 3
	Delivers frequency bandwidth to be applied to skip frequencies (in [Hz]).			
Unit: Hz	Min: 0.00	Def: 2.00	Max: 10.00	
Details:	Delivers frequency bandwidth to be applied to skip frequencies (in [Hz]).			
Note:	See P1091 through P1094 (skip frequencies 1 through 4).			

P1110[2]	BI: Inhibit neg. freq. setpoint			Level 3
	Inhibits direction reversal, thus preventing a negative setpoint from causing motor from running in reverse. Instead, it will run at minimum frequency (P1080) in the normal direction.			
Unit: -	Min: 0:0	Def: 1:0	Max: 4000:0	
Details:	Inhibits direction reversal, thus preventing a negative setpoint from causing motor from running in reverse. Instead, it will run at minimum frequency (P1080) in the normal direction			
Settings:	0=Disabled		1=Enabled	
Index:	P1110[0] : 1st command data set (CDS)		P1110[1] : 2nd command data set (CDS)	
Note:	It is possible to disable all reverse commands (i.e. the command is ignored). To do this, set P0719=0 (remote selection of command/setpoint source) and define the command sources (P1113) individually. This function does not disable the "reverse" command function; rather, a reverse command causes motor to run in the normal direction as described above.			

P1120	Ramp-up time			Level 1
	Time taken for motor to accelerate from standstill up to maximum motor frequency (P1082) when no rounding is used.			
Unit: s	Min: 0.00	Def: 10.00	Max: 650.00	
Details:	Setting the ramp-up time too short can cause the variable speed drive to trip (overcurrent). If an external frequency setpoint with set ramp rates is used (e.g. from a PLC), the best way to achieve optimum drive performance is to set ramp times in P1120 and P1121 slightly shorter than those of the PLC.			

P1121	Ramp-down time			Level 1
	Time taken for motor to decelerate from maximum motor frequency (P1082) down to standstill when no rounding is used.			
Unit: s	Min: 0.00	Def: 30.00	Max: 650.00	
Details:	Setting the ramp-down time too short can cause the variable speed drive to trip (overcurrent (F0001) / overvoltage (F0002)).			

P1135	OFF3 ramp-down time			Level 3
	Defines ramp-down time from maximum frequency to standstill for OFF3 command.			
Unit: s	Min: 0.00	Def: 5.00	Max: 650.00	
Details:	Defines ramp-down time from maximum frequency to standstill for OFF3 command.			
Note:	This time may be exceeded if the VDC_max. level is reached.			

P1140[2]	BI: RFG enable			Level 3
	Defines command source of RFG enable command (RFG: ramp function generator).			
Unit: -	Min: 0.00	Def: 1.0	Max: 4000.0	
Index:	. P1140[0] : 1st command data set (CDS) P1140[1] : 2nd command data set (CDS)			

P1141[2]	BI: RFG start			Level 3
	Defines command source of RFG start command (RFG: ramp function generator).			
Unit: -	Min: 0.00	Def: 1.0	Max: 4000.0	
Index:	. P1141[0] : 1st command data set (CDS) P1141[1] : 2nd command data set (CDS)			

P1142[2]	BI: RFG enable setpoint			Level 3
	Defines command source of RFG enable setpoint command (RFG: ramp function generator).			
Unit: -	Min: 0.00	Def: 1.0	Max: 4000.0	
Index:	. P1142[0] : 1st command data set (CDS) P1142[1] : 2nd command data set (CDS)			

P1200	Flying start			Level 3
	Starts variable speed drive onto a spinning motor by rapidly changing the output frequency of the variable speed drive until the actual motor speed has been found. Then, the motor runs up to setpoint using the normal ramp time.			
Unit: -	Min: 0	Def: 0	Max: 6	
Details:	Starts variable speed drive onto a spinning motor by rapidly changing the output frequency of the variable speed drive until the actual motor speed has been found. Then, the motor runs up to setpoint using the normal ramp time.			

Settings:	0 =Flying start disabled 1 =Flying start is always active, start in direction of setpoint 2 =Flying start is active if power on, fault, OFF2, start in direction of setpoint 3 =Flying start is active if fault, OFF2, start in direction of setpoint	4 =Flying start is always active, only in direction of setpoint 5 =Flying start is active if power on, fault, OFF2, only in direction of setpoint 6 =Flying start is active if fault, OFF2, only in direction of setpoint
Note:	Useful for motors with high inertia loads. Settings 1 to 3 search in both directions. Settings 4 to 6 search only in direction of setpoint. Flying start must be used in cases where the motor may still be turning (e.g. after a short mains break) or can be driven by the load. Otherwise, overcurrent trips will occur	

P1202	**Motor-current: Flying start**			**Level 3**
	Defines search current used for flying start.			
Unit: %	**Min: 10**	**Def: 100**	**Max: 200**	
Details:	Defines search current used for flying start. Value is in [%] based on rated motor current (P0305).			
Note:	Reducing the search current may improve performance for flying start if the inertia of the system is not very high.			

P1203	**Search rate: Flying start**			**Level 3**
	Sets factor by which the output frequency changes during flying start to synchronize with turning motor. This value is entered in [%] relative to the default time factor defines the initial gradient in the curve below (and thus influences the time taken to search for the motor frequency): fmax + 2 f slip			
Unit: %	**Min: 10**	**Def: 100**	**Max: 200**	
Details:	Sets factor by which output frequency changes during flying start to synchronize with turning motor. Enter this value in [%] relative to default time factor (which defines the initial gradient and influences time taken to search for motor frequency). The search time is the time taken to search through all possible frequencies (between [f_max+2*f_slip] and 0 Hz). P1203=100 % is defined as giving a rate of 2 % of f_slip,nom / [ms]. P1203=200 % would result in a rate of frequency change of 1 % of f_slip,nom / [ms].			
Example:	For a motor with 50 Hz, 1350 rpm, 100 % would produce a maximum search time of 600 ms. If the motor is turning, the motor frequency is found in a shorter time.			
Note:	A higher value produces a flatter gradient and thus a longer search time. A lower value has the opposite effect.			

P1210	**Automatic restart**			**Level 3**
	Enables restart after a mains break or after a fault.			
Unit: -	**Min: 0**	**Def: 1**	**Max: 5**	
Settings:	0=Disabled 1 =Trip reset after power on: P1211 disabled 2 =Restart mains break; power on: P1211 disabled	3 =Restart after fault/mains break: P1211 enabled 4 =Restart after mains break: P1211 enabled 5 =Restart mains break/fault/power on: P1211 disabled		
Dependency:	Auto restart requires constant ON command (e.g. via a digital input wire link).			
Caution:	Settings 2 to 5 can cause the motor to restart unexpectedly			
Note:	Flying start must be used in cases where the motor may still be turning (e.g. after a short mains break) or can be driven by the load (P1200).			

P1211	**Number of restart attempts**			**Level 3**
	Specifies number of times the variable speed drive will attempt to restart if P1210 (flying start) is activated.			
Unit: -	**Min: 0**	**Def: 3**	**Max: 10**	

P1212	**Time to first restart**			**Level 3**
	Selects the time before the variable speed drive is restarted for the first time if P1210 is activated.			
Unit: s	**Min: 0**	**Def: 30**	**Max: 1000**	

P1213	**Restart time increment**			**Level 3**
	Selects the amount the restart time is increment for each restart of the variable speed drive if P1210 is activated.			
Unit: s	**Min: 0**	**Def: 30**	**Max: 1000**	

P1230[2]	**BI: Enable DC braking**			**Level 3**
	Enables DC braking via a signal applied from an external source. Function remains active while external input signal is active. DC braking causes the motor to stop rapidly by applying a DC braking current (current applied also holds shaft stationary). When the DC braking signal is applied, the variable speed drive output pulses are blocked and the DC current is not applied until the motor has been sufficiently demagnetized.			
Unit: -	**Min: 0:0**	**Def: 0:0**	**Max: 4000:0**	
Details:	Enables DC braking via a signal applied from an external source. Function remains active while external input signal is active. DC braking causes the motor to stop rapidly by applying a DC braking current (current applied also holds shaft stationary). When the DC braking signal is applied, the variable speed drive output pulses are blocked and the DC current is not applied until the motor has been sufficiently demagnetized.			
Settings:	722.0=Digital input 1 (requires P0701 set to 99, BICO) 722.1=Digital input 2 (requires P0702 set to 99, BICO) 722.2=Digital input 3 (requires P0703 set to 99, BICO) 722.3=Digital input 4 (requires P0704 set to 99, BICO) 722.4=Digital input 5 (requires P0705 set to 99, BICO)			

	722.5=Digital input 6 (requires P0706 set to 99, BICO) 722.6=Digital input 7 (via analog input 1, requires P0707 set to 99) 722.7=Digital input 8 (via analog input 2, requires P0708 set to 99)	
Index:	P1230[0] : 1st command data set (CDS)	P1230[1] : 2nd command data set (CDS)
Caution2:	Frequent use of long periods of DC braking can cause the motor to overheat.	
Note:	This delay time is set in P0347 (demagnetization time). If this delay is too short, overcurrent trips can occur.	

P1232	**DC braking current**		**Level 3**
	Defines the level of DC current in [%] relative to the rated motor current (P0305).		
Unit: %	**Min: 0**	**Def: 100**	**Max: 250**

P1233	**Duration of DC braking**		**Level 3**
	Defines duration for which DC injection braking is to be active following an OFF1 command.		
Unit: s	**Min: 0**	**Def: 0**	**Max: 250**
Value:	P1233=0 : Not active following OFF1.	P1233=1 - 250 : Active for the specified duration.	
Caution	Frequent use of long periods of DC braking can cause the motor to overheat.		
Note:	The DC braking function causes the motor to stop rapidly by applying a DC braking current (the current applied also holds the shaft stationary). When the DC braking signal is applied, the variable speed drive output pulses are blocked and the DC current not applied until the motor has been sufficiently demagnetized (demagnetization time is calculated automatically from motor data).		

P1236	**Compound braking current**		**Level 3**
	Defines DC level superimposed on AC waveform. The value is entered in [%] relative to rated motor current (P0305)..		
Unit: %	**Min: 0**	**Def: 0**	**Max: 250**
Value:	P1236=0 : Compound braking disabled. P1236=1 - 250 : Level of DC braking current defined as a [%] of rated motor current (P0305).		
Dependency:	Active after OFF1 / OFF3 command.		
Note:	Increasing the value will generally improve braking performance; however, if you set the value too high, an overcurrent trip may result.		

P1240	**Configuration of Vdc controller**		**Level 3**
	Enables / disables Vdc controller.		
Unit: -	**Min: 0**	**Def: 0**	**Max: 3**
Details:	The Vdc controller dynamically controls the DC link voltage to prevent overvoltage trips on high inertia systems.		
Settings:	0 =Vdc controller disabled 1 =Vdc-max controller enabled	2 =Vdc-min controller (Kinetic buffering) enabled 3 =Vdc-max and Vdc-min controller enabled	
Note:	Vdc max automatically increases ramp-down times to keep the DC-link voltage (r0026) within limits (P2172) Vdc min is activated if DC-link voltage falls below minimum level. The kinetic energy of the motor is then used to buffer the DC-link voltage, thus causing deceleration of the drive.		

P1260	**Source of changeover control**		**Level 2**
	Selects the possible sources for contactor changeover control		
Unit: -	**Min: 0**	**Def: 0**	**Max: 7**
Settings:	0 Bypass disabled 1 Controlled by variable speed drive trip 2 Controlled by DIN - see P1266 3 Controlled by DIN & variable speed drive trip 4 Controlled by variable speed drive frequency 5 Controlled by variable speed drive frequency & variable speed drive trip 6 Controlled by variable speed drive frequency & DIN 7 Controlled by variable speed drive frequency & DIN & variable speed drive trip		

r1261	**BO: Contactor control word**		**Level 2**
	Output word from the bypass feature that allows external connections to be made.		
Unit: -	**Min: -**	**Def: -**	**Max: -**
Bit fields:	Bit00 Motor supplied by drive 0 YES, 1 NO Bit01 Motor supplied by mains 0 YES, 1 NO		

P1262	**Bypass dead time**		**Level 2**
	Time delay between switching contactors to allow motor to allow motor to demagnetize.		
Unit: s	**Min: 0**	**Def: 1.000**	**Max: 20.000**

P1263	**De-Bypass time**		**Level 2**
	Time delay before a request to switch back to the variable speed drive is acted on.		
Unit: s	**Min: 0**	**Def: 1.0**	**Max: 300.0**

P1264	**Bypass time**		**Level 2**
	Time delay before a request to switch to mains is acted on.		
Unit: s	**Min: 0**	**Def: 1.0**	**Max: 300.0**

P1265	**Mains frequency**		**Level 2**
	Mains frequency.		
Unit: Hz	**Min: 12.00**	**Def: 50.00**	**Max: 650.00**

P1266	**BI: Bypass command**		**Level 2**
	Mains frequency.		
Unit: -	**Min: 0:0**	**Def: 0:0**	**Max: 4000:0**

P1270[2]	BI: Enable essential service			Level 3
Unit: -	Min: 0:0	Def: 0:0	Max: 4000:0	

P1300	Control mode			Level 3
	Controls relationship between speed of motor and voltage supplied by the variable speed drive as illustrated in the diagram below			
Unit: -	Min: 0	Def: 1	Max: 23	
Details:	Controls relationship between speed of motor and voltage supplied by variable speed drive.			
Settings:	0 =V/f with linear charac. 1 =V/f with FCC 2 =V/f with parabolic charac. 3 =V/f with programmable charac.	4 =V/f with ECO mode 5 =V/f for textile applications 6 =V/f with FCC for textile applications 19 =V/f control with independent voltage setpoint	20 =not used 21 =not used 22 =not used 23 =not used	
Dependency:	The value is displayed in r0209 (maximum frequency).			
Note:	P1300=1 : V/f with FCC * Maintains motor flux current for improved efficiency * If FCC is chosen, linear V/f is active at low frequencies. P1300=2 : V/f with a quadratic curve * Suitable for centrifugal fans / pumps			

P1310	Continuous boost			Level 3
	Defines the boost level in [%] relative to P0305 (rated motor current) applicable to both linear and quadratic V/f curves according to the diagram below:			
Unit: %	Min: 0.0	Def: 50.0	Max: 250.0	
Details:	Defines boost level in [%] relative to P0305 (rated motor current) applicable to both linear and quadratic V/f curves.			
Dependency:	Setting in P0640 (motor overload factor [%]) limits the boost.			
Note:	The boost values are combined when continuous boost (P1310) used in conjunction with other boost parameters (acceleration boost P1311 and starting boost P1312). However priorities are allocated to these parameters as follows: P1310 > P1311 > P1312 Increasing the boost levels increases motor heating (especially at standstill).			

P1311	Acceleration boost			Level 3
	Applies boost in [%] relative to P0305 (rated motor current) following a positive setpoint change and drops back out once the setpoint is reached.			
Unit: %	Min: 0.0	Def: 0.0	Max: 250.0	
Details:	Applies boost in [%] relative to P0305 (rated motor current) following a positive setpoint change and drops back out once the setpoint is reached.			
Dependency:	Setting in P0640 (motor overload factor [%]) limits boost.			
Note:	Acceleration boost can help to improve response to small positive setpoint changes.			

P1312	Starting boost			Level 3
	Applies a constant linear offset (in [%] relative to P0305 (rated motor current)) to active V/f curve (either linear or quadratic) after an ON command and is active until setpoint is reached for the first time. This is useful for starting loads with high inertia.			
Unit: %	Min: 0.0	Def: 0.0	Max: 250.0	
Details:	Applies a constant linear offset (in [%] relative to P0305 (rated motor current)) to active V/f curve (either linear or quadratic) after an ON command and is active until setpoint is reached for the first time. This is useful for starting loads with high inertia. Setting the starting boost (P1312) too high will cause the variable speed drive to limit the current, which will in turn restrict the output frequency to below the setpoint frequency.			
Dependency:	Setting in P0640 (motor overload factor [%]) limits boost.			
Note:	Increasing the boost levels increases motor heating. Σ *Boosts* = 300 / I_{mot} * R_S Priorities are allocated to the boost parameters as follows: P1310 > P1311 > P1312			

P1335	Slip compensation			Level 3
	Dynamically adjusts output frequency of variable speed drive so that motor speed is kept constant independent of motor load.			
Unit: %	Min: 0.0	Def: 0.0	Max: 600.0	
Details:	Dynamically adjusts output frequency of variable speed drive so that motor speed is kept constant independent of motor load.			
Value:	P1335= 0 % : Slip compensation disabled. P1335=100 % : This uses the motor data and motor model to add the rated slip frequency rated motor speed and rated motor current.			
Note:	Gain adjustment enables fine-tuning of the actual motor speed (see P1460 - gain speed control). 100%=standard setting for warm stator			

P1336	Slip limit			Level 3
	Compensation slip limit in [%] relative to r0330 (rated motor slip), which is added to frequency setpoint.			
Unit: %	Min: 0	Def: 250	Max: 600	
Details:	Compensation slip limit in [%] relative to r0330 (rated motor slip), which is added to frequency setpoint.			
Dependency:	Slip compensation (P1335) active.			

r1337	CO: V/f slip frequency			Level 3
	Displays actual compensated motor slip as [%]			
Unit: %	Min: -	Def: -	Max: -	

Details:	Displays actual compensated motor slip as [%
Dependency:	Slip compensation (P1335) active.

P1499	**Scaling acceleration torque control**		**Level 3**
	Enters scaling of acceleration in [%] for sensorless torque control (SLVC) at low frequencies.		
Unit: %	**Min: 0.0**	**Def: 100.0**	**Max: 400.0**
Details:	Enters scaling of acceleration in [%] for sensorless torque control (SLVC) at low frequencies.		

P1800	**Pulse frequency**		**Level 2**
	Sets pulse frequency of power switches in the variable speed drive. The frequency can be changed in steps of 2 kHz. Pulse frequencies > 4 kHz selected on 380-480 V units reduce the maximum continuous motor current.		
Unit: kHz	**Min: 2**	**Def: 4**	**Max: 16**
Details:	Sets pulse frequency of power switches in variable speed drive. The frequency can be changed in steps of 2 kHz. Pulse frequencies > 4 kHz selected on 380-480 V units reduce the maximum continuous motor current.		
Dependency:	Minimum pulse frequency depends on P1082 (maximum frequency) and P0310 (rated motor frequency).		
Note:	At 4 kHz, full output current is obtained up to 50 degrees C (CT mode);over 50 degrees C, full output may be obtained at 8 kHz. If silent operation is not absolutely necessary, lower pulse frequencies may be selected to reduce variable speed drive losses and radio-frequency emissions. Under certain circumstances, the variable speed drive may reduce the switching frequency to provide protection against over-temperature (see P0290, Level 3).		

r1801	**CO: Act. switching frequency**		**Level 3**
	Actual pulse frequency of power switches in variable speed drive.		
Unit: kHz	**Min: -**	**Def: -**	**Max: -**
Note:	Actual pulse frequency of power switches in variable speed drive. Under certain conditions (variable speed drive overtemperature, see P0290), this can differ from the values selected in P1800 (pulse frequency).		

P1820	**Reverse output phase sequence**		**Level 3**
	Changes direction of motor rotation without changing setpoint polarity.		
Unit: -	**Min: 0**	**Def: 0**	**Max: 1**
Settings:	0=OFF 1=ON		
Dependency:	If positive and negative revolution is enabled, frequency setpoint is directly used. If both positive and negative revolution are disabled, reference value is set to zero.		
Details:	See P1000 (select frequency setpoint).		

P1910	**Select motor data identification**		**Level 3**
	Performs stator resistance measuring.		
Unit: -	**Min: 0**	**Def: 0**	**Max: 20**
Settings:	0=Disabled 1=Identification of all parameters with parameter change	2=Identification of all parameters without parameter change 20=Set voltage vector	
Dependency:	N o measurement if motor data incorrect. P1910=1 : Calculated value for stator resistance (see P0350) is overwritten. P1910=2 : Values already calculated are not overwritten.		
Note:	Before selecting motor data identification, "Quick commissioning" has to be performed in advance. Once enabled (P1910=1), A0541 generates a warning that the next ON command will initiate measurement of motor parameters. When choosing the setting for measurement, observe the following: 1. "With parameter change" means that the value is actually adopted as P0350 parameter setting and applied to the control as well as being shown in the read-only parameters below. 2. "Without parameter change" means that the value is only displayed, i.e. shown for checking purposes in the read-only parameter r1912 (identified stator resistance). The value is not applied to the control.		

r1912[3]	**Identified stator resistance**			**Level 3**
	Displays measured stator resistance value (line-to-line) in [ohm].			
Unit: Ohm	**Min: -**	**Def: -**	**Max: -**	
Index:	r1912[0] : U_phase	r1912[1] : V_phase	r1912[2] : W_phase	
Note:	This value is measured using P1910=1 or 2 , i.e., identification of all parameters with/without change.			

P2000	**Reference frequency**		**Level 2**
	Full-scale frequency setting used by serial link (corresponds to 4000H), analog I/O and P/D controller.		
Unit: Hz	**Min: 1.00**	**Def: 50.00**	**Max: 650.00**

P2001	**Reference voltage**		**Level 3**
	Full-scale output voltage (i.e. 100 %) used over serial link (corresponds to 4000H).		
Unit: V	**Min: 10**	**Def: 1000**	**Max: 2000**
Example:	P0201=230 specifies that 4000H received via USS denotes 230 V.		

P2002	**Reference current**		**Level 3**
	Full-scale output current used over serial link (corresponds to 4000H).		
Unit: A	**Min: 0.10**	**Def: 0.10**	**Max: 10000.00**

r2004	**Reference power**		**Level 3**
	Full-scale reference power used over the serial link (corresponds to 4000H).		
Unit: -	**Min: -**	**Def: -**	**Max: -**

P2009[2]	USS normalization			Level 3
	Min: 0	Def: 0	Max: 1	
Settings:	0=Disabled		1=Enabled	
Index:	P2009[0] : Serial interface COM link		P2009[1] : Serial interface BOP link	
Note:	If enabled, the main setpoint (word 2 in PZD) is not interpreted as 100 %=4000H, but as "absolute" instead (e.g. 4000H=16384 means 163.84 Hz).			

P2010[2]	USS baudrate			Level 3
	Sets baud rate for USS communication.			
Unit: -	Min: 4	Def: 6	Max: 12	
Settings:	4= 2400 baud 5= 4800 baud 6= 9600 baud	7= 19200 baud 8= 38400 baud	9= 57600 baud 10=76800 baud	11= 93750 baud 12= 115200 baud
Index:	P2010[0] : Serial interface COM link		P2010[1] : Serial interface BOP link	

P2011[2]	USS address			Level 3
	Sets a unique address for variable speed drive.			
Unit: -	Min: 0	Def: 0	Max: 31	
Index:	P2011[0] : Serial interface COM link		P2011[1] : Serial interface BOP link	
Note:	You can connect up to a further 30 variable speed drives via the serial link (i.e. 31 variable speed drives in total) and control them with the USS serial bus protocol.			

P2014[2]	USS telegram off time			Level 3
	Defines a time T_off after which a fault will be generated (F0070) if no telegram is received via the USS channels.			
Unit: ms	Min: 0	Def: 0	Max: 65535	
Index:	P2014[0] : Serial interface COM link		P2014[1] : Serial interface BOP link	
Note:	By default (time set to 0), no fault is generated (i.e. watchdog disabled).			

P2040	CB telegram off time			Level 3
	Defines time after which a fault will be generated (F0070) if no telegram is received via the link (SOL).			
Unit: ms	Min: 0	Def: 20	Max: 65535	
Dependency:	Setting 0=watchdog disabled			

P2041[5]	CB parameter			Level 3
	Configures a communication board (CB).			
Unit: -	Min: 0	Def: 0	Max: 65535	
Index:	P2041[0] : CB parameter 0 P2041[1] : CB parameter 1	P2041[2] : CB parameter 2 P2041[3] : CB parameter 3	P2041[4] : CB parameter 4	
Note:	See relevant communication board manual for protocol definition and appropriate settings			

r2050[8]	CO: PZD from CB			Level 3
	Displays PZD received from communication board (CB).			
Unit: -	Min: -	Def: -	Max: -	
Index:	r2050[0] : Received word 0 r2050[1] : Received word 1 r2050[2] : Received word 2	r2050[3] : Received word 3 r2050[4] : Received word 4 r2050[5] : Received word 5	r2050[6] : Received word 6 r2050[7] : Received word 7	
Note:	The control words can be viewed as bit parameters r2032 and r2033.			

P2051[8]	CI: PZD to CB			Level 3
	Connects PZD to CB. This parameter allows the user to define the source of status words and actual values for the reply PZD.			
Unit: -	Min: 0:0	Def: 52:0	Max: 4000:0	
Settings:	Status word 1=52 CO/BO: Act. status word 1 (see r0052) Actual value 1= 21 variable speed drive output frequency (see r0021) Other BICO settings are possible			
Index:	P2051[0] : Transmitted word 0 P2051[1] : Transmitted word 1 P2051[2] : Transmitted word 2	P2051[3] : Transmitted word 3 P2051[4] : Transmitted word 4 P2051[5] : Transmitted word 5	P2051[6] : Transmitted word 6 P2051[7] : Transmitted word 7	

r2053[5]	CB identification			Level 3
	Displays identification data of the communication board (CB). The different CB types (r2053[0]) are given in the Enum declaration.			
Unit: -	Min: -	Def: -	Max: -	
Settings:	0=No CB option board 1=PROFIBUS DP		2=DeviceNet 56 not defined	
Index:	r2053[0] : CB type (PROFIBUS=1) r2053[1] : Firmware version r2053[2] : Firmware version detail		r2053[3] : Firmware date (year) r2053[4] : Firmware date (day/month)	

r2054[7]	CB diagnosis			Level 3
	Displays diagnostic information of communication board (CB).			
Unit: -	Min: -	Def: -	Max: -	
Index:	r2054[0] : CB diagnosis 0 r2054[1] : CB diagnosis 1 r2054[2] : CB diagnosis 2	r2054[3] : CB diagnosis 3 r2054[4] : CB diagnosis 4	r2054[5] : CB diagnosis 5 r2054[6] : CB diagnosis 6	

P2100[3]	Alarm number selection			Level 3
	Selects up to 3 faults or warnings for non-default reactions.			
Unit: -	Min: 0	Def: 0	Max: 65535	
Example:	If you want F0005 to perform an OFF3 instead of an OFF2, set P2100[0]=5, then select the desired reaction in P2101[0] (in this case, set P2101[0]=3).			
Note:	All fault codes have a default reaction to OFF2. Some fault codes caused by hardware trips (e.g. overcurrent) cannot be changed from the default reactions.			

P2101[3]	Stop reaction value			Level 3
	Sets drive stop reaction values for fault selected by P2100 (alarm number stop reaction). This indexed parameter specifies the special reaction to the faults/warnings defined in P2100 indices 0 to 2.			
Unit: -	Min: 0	Def: 0	Max: 5	
Details:	Sets drive stop reaction values for fault selected by P2100 (alarm number stop reaction). This indexed parameter specifies the special reaction to the faults/warnings defined in P2100 indices 0 to 2.			
Settings:	0=No reaction, no display 1=OFF1 stop reaction	2=OFF2 stop reaction 3=OFF3 stop reaction	4=No reaction warning only 5=Goto fixed frequency 15	
Note:	Settings 0 - 3 only are available for fault codes. Settings 0 and 4 only are available for warnings. Index 0 (P2101) refers to fault/warning in index 0 (P2100).			

r2110[4]	Warning number			Level 3
	Displays warning information.			
Unit: -	Min: -	Def: -	Max: -	
Details	Displays warning information. A maximum of 2 active warnings (indices 0 and 1) and 2 historical warnings (indices 2 and 3) may be viewed.			
Index:	r2110[0] : Recent Warnings --, warning 1 r2110[1] : Recent Warnings --, warning 2	r2110[2] : Recent Warnings -1, warning 3 r2110[3] : Recent Warnings -1, warning 4		
Note:	The keypad will flash while a warning is active. The LEDs indicate the warning status in this case. If an AOP is in use, the display will show number and text of the active warning. Indices 0 and 1 are not stored.			

P2111	Total number of warnings			Level 3
	Displays number of warning (up to 4) since last reset. Set to 0 to reset the warning history.			
Unit: -	Min: 0	Def: 0	Max: 4	
Details:	Displays number of warning (up to 4) since last reset. Set to 0 to reset the warning history.			

r2114[2]	Run time counter			Level 3
	Displays run time counter. It is the total time the drive has been powered up. Every time you do power cycle, it will save the value then restore it and the counter carries on ticking.			
Unit: -	Min: -	Def: -	Max: -	
Details:	Displays run time counter. See P0948 (fault time).			

P2115[3]	AOP real time clock			Level 3
	Displays AOP real time.			
Unit: -	Min: 0	Def: 0	Max: 65535	
Details:	Displays run time counter. See P0948 (fault time).			

P2181	Belt failure detection mode			Level 3
	Sets belt failure detection mode. This function allows detection of mechanical failure of the drive train, e.g. a broken drive belt. It can also detect conditions which cause an overload, such as a jam.			
Unit: -	Min: 0	Def: 0	Max: 6	
Details:	Sets belt failure detection mode. This function allows detection of mechanical failure of the drive train, e.g. a broken drive belt. It can also detect conditions which cause an overload, such as a jam.			
Settings:	0=Belt failure detection disabled 1=Warn low torque/speed 2=Warn high torque/speed	3=Warn high/low torque/speed 4=Trip low torque/speed	5=Trip high torque/speed 6=Trip high/low torque/speed	

P2182	Belt threshold frequency 1			Level 3
	Sets a frequency threshold 1 for comparing actual torque to torque the envelope for belt failure detection.			
Unit: Hz	Min: 0.00	Def: 5.00	Max: 650.00	
Details:	Sets a frequency threshold F1 for comparing actual torque to torque the envelope for belt failure detection. The frequency torque envelope is defined by 9 parameters - 3 are frequency parameters (P2182 - P2184), and the other 6 define the low and high torque limits (P2185 - P2190) for each frequency.			
Note:	The torque is unlimited below P2182, and above P2184. Normally P2182 <= lower torque limit (P1521), and P2184 >=upper torque limit (P1520).			

P2183	Belt threshold frequency 2			Level 3
	Sets a threshold F2 for comparing actual torque to torque the envelope for belt failure detection.			
Unit: Hz	Min: 0.00	Def: 30.00	Max: 650.00	
Details:	Sets a threshold F2 for comparing actual torque to torque the envelope for belt failure detection.			
Note:	See P2182 (belt threshold frequency 1).			

P2184	Belt threshold frequency 3	Level 3
	Sets a threshold F3 for comparing actual torque to torque the envelope for belt failure detection.	

Unit: Hz	Min: 0.00	Def: 50.00	Max: 650.00	
Details:	Sets a threshold F3 for comparing actual torque to torque the envelope for belt failure detection.			
Note:	See P2182 (belt threshold frequency 1).			

P2185, P2187, P2189	Upper torque threshold 1, 2, and 3			Level 3
	Upper limit threshold value 1 for comparing actual torque.			
Unit: Nm	Min: 0.0	Def: 99999.0	Max: 99999.0	
Details:	Upper limit threshold value for comparing actual torque.			
Note:	See P2182 (belt threshold frequency).			

P2186, P2188, P2190	Lower torque threshold 1, 2, and 3			Level 3
	Lower limit threshold value 1 for comparing actual torque.			
Unit: Nm	Min: 0.0	Def: 0.0	Max: 99999.0	
Details:	Lower limit threshold value for comparing actual torque.			
Note:	See P2182 (belt threshold frequency).			

P2191	Belt failure speed tolerance			Level 3
	P2191 defines the allowed speed variation bandwidth between the variable speed drive frequency, and the speed reference from the pulse train. When the speed of the driven machine varies by more than this amount, a trip or warning is given.			
Unit: Hz	Min: 0.00	Def: 3.00	Max: 20.00	
Details:	P2191 defines the allowed speed variation bandwidth between the variable speed drive frequency, and the speed reference from the pulse train. When the speed of the driven machine varies by more than this amount, a trip or warning is given.			

P2192	Time delay for belt failure			Level 3
	P2192 defines a delay before warning/trip becomes active. It is used to eliminate events caused by transient conditions. It is used for both methods of fault detection.			
Unit: s	Min: 0	Def: 10	Max: 65	
Details:	P2192 defines a delay before warning/trip becomes active. It is used to eliminate events caused by transient conditions. It is used for both methods of fault detection.			

r2197	CO/BO: Monitoring word 1			Level 3
	Monitoring word 1 which indicates the state of monitor functions. Each bit represents one monitor function.			
Unit: -	Min: -	Def: -	Max: -	
Bit fields:	Bit00 Act. freq. r0024 <= P1080 0 NO, 1 YES Bit01 Act. freq. r0024 <= P2155 0 NO, 1 YES Bit02 Act. freq. r0024 > P2155 0 NO, 1 YES Bit03 Act. freq. r0024 > zero 0 NO, 1 YES Bit04 Act. freq. r0024 >= setp. 0 NO, 1 YES Bit05 Act. freq. r0024 <= P2167 0 NO, 1 YES Bit06 Act. freq. r0024 >= P1082 0 NO, 1 YES Bit07 Act. freq. r0024 == setp. 0 NO, 1 YES Bit08 Act. current r0068 >= P2170 0 NO, 1 YES Bit09 Act. unfilt. Vdc < P2172 0 NO, 1 YES Bit10 Act. unfilt. Vdc > P2172 0 NO, 1 YES Bit11 No load condition 0 NO, 1 YES			

r2198	CO/BO: Monitoring word 2			Level 3
	Monitoring word 2 which indicates the state of monitor functions. Each bit represents one monitor function.			
Unit: -	Min: -	Def: -	Max: -	
Bit fields:	Bit00 | n,filtered r2169 | < P2157 0 NO, 1 YES Bit01 | n,filtered r2169 | > P2157 0 NO, 1 YES Bit02 | n,filtered r2169 | < P2159 0 NO, 1 YES Bit03 | n,filtered r2169 | > P2159 0 NO, 1 YES Bit04 | n,set | < P2161 0 NO, 1 YES Bit05 n,set > 0 0 NO, 1 YES Bit06 Motor blocked 0 NO, 1 YES Bit07 Motor stalled 0 NO, 1 YES Bit08 | I,act r0068 | < P2170 0 NO, 1 YES Bit09 |T,act| > P2174 & setpoint reached 0 NO, 1 YES Bit10 | T,act | > P2174 0 NO, 1 YES Bit11 Belt failure warning 0 NO, 1 YES Bit12 Belt failure trip 0 NO, 1 YES			

P2200[2]	BI: Enable PID controller			Level 2
	The PID mode allows the user to enable/disable the PID controller. Setting to 1 enables the PID closed-loop controller.			
Unit: -	Min: 0:0	Def: 0:0	Max: 4000:0	
Details:	PID mode Allows user to enable/disable the PID controller. Setting to 1 enables the PID closed-loop controller.			
Index:	P2200[0] : 1st command data set (CDS)	P2200[1] : 2nd command data set (CDS)		
Dependency:	Setting 1 automatically disables normal ramp times set in P1120 and P1121 and the normal frequency setpoints. Following an OFF1 or OFF3 command, however, the variable speed drive frequency will ramp down to zero using the ramp time set in P1121 (P1135 for OFF3).			

Note:	The PID setpoint source is selected using P2253. The PID setpoint and the PID feedback signal are interpreted as [%] values (not [Hz]). The output of the PID controller is displayed as [%] and then normalized into [Hz] through P2000 (reference frequency) when PID is enabled. In level 3, the PID controller source enable can also come from the digital inputs in settings 722.0 to 722.2 for DIN1 to DIN3 or from any other BiCo source. The minimum and maximum motor frequencies (P1080 and P1082) as well as the skip frequencies (P1091 to P1094) remain active on the variable speed drive output. However, enabling skip frequencies with PID control can produce instabilities.

P2201 through P2215	**Fixed PID setpoint 1 through 15**			**Level 3**
	Defines fixed PID setpoint 1			
Unit: %	**Min: -200.00**	**Def: See Note Below**	**Max: 200.00**	

Details: Defines fixed PID setpoint 1. In addition, you can set any of the digital input parameters to fixed PID setpoint via the digital inputs (P0701 - P0706).

There are three selection modes for the PID fixed setpoint:

1. Direct selection (P0701=15 or P0702=15, etc)
   In this mode of operation, 1 digital input selects one PID fixed setpoint.
2. Direct selection with ON command (P0701=16 or P0702=16, etc.)
   Description as for 1), except that this type of selection issues an ON command concurrent with any setpoint selection.
3. Binary Coded Decimal selection with ON command (P0701 - P0706=17)
   Using this method to select the PID Fixed Setpoint allows you to choose up to 16 different PID setpoints. The setpoints are selected according to the following table:

		DIN4	**DIN3**	**DIN2**	**DIN1**
	OFF	Inactive	Inactive	Inactive	Inactive
P2201	FF1	Inactive	Inactive	Inactive	**Active**
P2202	FF2	Inactive	Inactive	**Active**	Inactive
P2203	FF3	Inactive	Inactive	**Active**	**Active**
P2204	FF4	Inactive	**Active**	Inactive	Inactive
P2205	FF5	Inactive	**Active**	Inactive	**Active**
P2206	FF6	Inactive	**Active**	**Active**	Inactive
P2207	FF7	Inactive	**Active**	**Active**	**Active**
P2208	FF8	**Active**	Inactive	Inactive	Inactive
P2209	FF9	**Active**	Inactive	Inactive	**Active**
P2210	FF10	**Active**	Inactive	**Active**	Inactive
P2211	FF11	**Active**	Inactive	**Active**	**Active**
P2212	FF12	**Active**	**Active**	Inactive	Inactive
P2213	FF13	**Active**	**Active**	Inactive	**Active**
P2214	FF14	**Active**	**Active**	**Active**	**Active**
P2215	FF15	**Active**	**Active**	**Active**	**Active**

Dependency: P2000=1 required in user access level 2 to enable setpoint source.
In mode 1 (above):
ON command required to start motor (enable pulses).
In mode 2 (above):
If inputs programmed to PID fixed setpoint and selected together, the selected setpoints are summed.

Note: You may mix different types of frequencies; however, remember that they will be summed if selected together.
P2201=100 % corresponds to 4000 hex.
Default fixed PID setpoint values are as follows:

Fixed PID	**Default**	**Fixed PID**	**Default**	**Fixed PID**	**Default**
1	0.00	6	50.00	11	100.00
2	10.00	7	60.00	12	110.00
3	20.00	8	70.00	13	120.00
4	30.00	9	80.00	14	130.00
5	40.00	10	90.00	15	130.00

P2216, P2217, P2218, P2219	**Fixed PID setpoint mode - Bit 0, Bit 1, Bit 2, and Bit 3**			**Level 3**
	Fixed frequencies for PID setpoint can be selected in three different modes. Parameter P1016 defines the mode of selection bit 0.			
Unit: -	**Min: 1**	**Def: 1**	**Max: 3**	
Settings:	1=Direct selection	2=Direct selection + ON command	3=Binary coded selection + ON command	

P2220[2]	**BI: Fixed PID setpoint select Bit 0**			**Level 3**
	Defines command source of fixed PID setpoint selection bit 0.			
Unit: -	**Min: 0:0**	**Def: 0:0**	**Max: 4000:0**	
Settings:	722.0=Digital input 1 (requires P0701 set to 99, BICO) 722.1=Digital input 2 (requires P0702 set to 99, BICO) 722.2=Digital input 3 (requires P0703 set to 99, BICO) 722.3=Digital input 4 (requires P0704 set to 99, BICO) 722.4=Digital input 5 (requires P0705 set to 99, BICO) 722.5=Digital input 6 (requires P0706 set to 99, BICO) 722.6=Digital input 7 (via analog input 1, requires P0707 set to 99) 722.7=Digital input 8 (via analog input 2, requires P0708 set to 99)			
Index:	P2220[0] : 1st command data set (CDS)		P2220[1] : 2nd command data set (CDS)	

P2221[2]. P2222[2], P2223[2]	BI: Fixed PID setpoint select Bit 1, Bit 2, and Bit 3			Level 3
	Defines command source of fixed PID setpoint selection bit 1.			
Unit: -	Min: 0:0	Def: 0:0 (P2223[2]:722.3	Max: 4000:0	
Settings:	722.0=Digital input 1 (requires P0701 set to 99, BICO) 722.1=Digital input 2 (requires P0702 set to 99, BICO) 722.2=Digital input 3 (requires P0703 set to 99, BICO) 722.3=Digital input 4 (requires P0704 set to 99, BICO) 722.4=Digital input 5 (requires P0705 set to 99, BICO) 722.5=Digital input 6 (requires P0706 set to 99, BICO)			
Index:	For P2221:	For P2222:	For P2223:	
	P2221[0]: 1st command data set (CDS) P2221[1]: 2nd command data set (CDS)	P2222[0]: 1st command data set (CDS) P2222[1]: 2nd command data set (CDS)	P2223[0]: 1st command data set (CDS) P2223[1]: 2nd command data set (CDS)	

r2224	CO: Act. fixed PID setpoint			Level 3
	Displays total output of PID fixed setpoint selection.			
Unit: %	Min: -	Def: -	Max: -	
Note:	r2224=100 % corresponds to 4000 hex.			

P2225, P2227	Fixed PID setpoint mode - Bit 4 and Bit 5			Level 3
	Direct selection or direct selection + ON Bit 4 for PID setpoint.			
Unit: -	Min: 1	Def: 1	Max: 2	
Settings:	1=Direct selection	2=Direct selection + ON command	3=Binary coded selection + ON command	

P2226[2]-P2228[2]	BI: Fixed PID setpoint select Bit 4 and Bit 5			Level 3
P2226[2]	Min: 0:0	Def: 722:4	Max: 4000:0	
P2227	Min: 1	Def: 1	Max: 2	
P2228[2]	Min: 0	Def: 722:5	Max: 4000:0	
Settings:	722.0=Digital input 1 (requires P0701 set to 99, BICO) 722.1=Digital input 2 (requires P0702 set to 99, BICO) 722.2=Digital input 3 (requires P0703 set to 99, BICO) 722.3=Digital input 4 (requires P0704 set to 99, BICO) 722.4=Digital input 5 (requires P0705 set to 99, BICO) 722.5=Digital input 6 (requires P0706 set to 99, BICO)			
Index:	For P2226:		For P2228:	
	P2226[0]: 1st command data set (CDS) P2226[1]: 2nd command data set (CDS)		P2228[0]: 1st command data set (CDS) P2228[1]: 2nd command data set (CDS)	

P2231	Setpoint memory of PID-MOP			Level 3
	Setpoint memory.			
Unit: -	Min: 0	Def: 1	Max: 1	
Settings:	0=PID-MOP setpoint will not be stored		1=PID-MOP setpoint will be stored (P2240 is updated)	
Dependency:	If 0 selected, setpoint returns to value set in P2240 (setpoint of PID-MOP) after an OFF command If 1 is selected, active setpoint is 'remembered' and P2240 updated with current value.			
Note:	See P2240 (setpoint of PID-MOP).			

P2232	Inhibit rev. direct. of PID-MOP			Level 3
	Inhibits reverse setpoint selection when PID motor potentiometer is chosen either as a main setpoint of additional setpoint (using P1000).			
Unit: -	Min: 0	Def: 1	Max: 1	
Details:	Inhibits reverse setpoint selection when PID motor potentiometer is chosen either as a main setpoint of additional setpoint (using P1000)			
Settings:	0=Reserve direction is allowed		1=Reserve direction inhibited	
Note:	Setting 0 enables a change of motor direction using the motor potentiometer setpoint (increase/decrease frequency either by using digital inputs or motor potentiometer up/down buttons.			

P2240[2]	Setpoint of PID-MOP			Level 3
	Setpoint of the motor potentiometer. Allows user to set a digital PID setpoint in [%].			
Unit: %	Min: -200.00	Def: 10.00	Max: 200.00	
Settings:	722.0=Digital input 1 (requires P0701 set to 99, BICO) 722.1=Digital input 2 (requires P0702 set to 99, BICO) 722.2=Digital input 3 (requires P0703 set to 99, BICO) 722.3=Digital input 4 (requires P0704 set to 99, BICO) 722.4=Digital input 5 (requires P0705 set to 99, BICO) 722.5=Digital input 6 (requires P0706 set to 99, BICO) 722.6=Digital input 7 (via analog input 1, requires P0707 set to 99) 722.7=Digital input 8 (via analog input 2, requires P0708 set to 99) 19.D =Keypad UP cursor			
Dependency:	To change setpoint: 1. Use UP / DOWN key on BOP or 2. Set P0702/P0703=13/14 (function of digital inputs 2 and 3)			
Note:	P2240=100 % corresponds to 4000 hex.			

r2250	CO: Output setpoint of PID-MOP	Level 3
	Displays output setpoint of motor potentiometer in [%].	

Unit: %	Min: -	Def: -	Max: -	
Note:	r2250=100 % corresponds to 4000 hex.			

P2253[2]	CI: PID setpoint			Level 2
	Defines setpoint source for PID setpoint input. This parameter allows the user to select the source of the PID setpoint. Normally, a digital setpoint is selected either using a fixed PID setpoint or an active setpoint.			
Unit: -	Min: 0:0	Def: 2250:0	Max: 4000:0	
Details:	This parameter allows the user to select the source of the PID setpoint. Normally, a digital setpoint is selected either using a fixed PID setpoint or an active setpoint.			
Settings:	755= Analog input 1	2224 =Fixed PI setpoint (see P2201 to P2207)	2250 =Active PI setpoint (see P2240)	
Index;	P2253[0] : 1st command data set (CDS)	P2253[1] : 2nd command data set (CDS)		

P2254[2]	CI: PID trim source			Level 3
	Selects trim source for PID setpoint. This signal is multiplied by the trim gain and added to the PID setpoint.			
Unit: -	Min: 0:0	Def: 0:0	Max: 4000:0	
Details:	This parameter allows the user to select the source of the PID setpoint. Normally, a digital setpoint is selected either using a fixed PID setpoint or an active setpoint.			
Settings:	755= Analog input 1	2224 =Fixed PI setpoint (see P2201 to P2207)	2250 =Active PI setpoint (see P2240)	
Index;	P2254[0] : 1st command data set (CDS)	P2254[1] : 2nd command data set (CDS)		

P2261	PID setpoint filter time constant			Level 3
	Sets a time constant for smoothing the PID setpoint.			
Unit: s	Min: 0.00	Def: 0.00	Max: 60.00	
Note:	0 = no smoothing.			

r2262	CO: Filtered PID setp. after RFG			Level 3
	Displays filtered PID setpoint after PID-RFG in [%].			
Unit: %	Min: -	Def: -	Max: -	
Details:	Displays filtered PID setpoint after PID-RFG in [%].			
Note:	r2262=100 % corresponds to 4000 hex.			

P2264[2]	CI: PID feedback			Level 2
	Selects the source of the PID feedback signal.			
Unit: -	Min: 0:0	Def: 755:1	Max: 4000:0	
Settings:	755= Analog input 1 setpoint	2224 =Fixed PID setpoint	2250 =Output setpoint of PID-MOP	
Index:	P2264[0] : 1st command data set (CDS)	P2264[1] : 2nd command data set (CDS)		
Note:	When analog input is selected, offset and gain can be implemented using parameters P0756 to P0760.			

P2265	PID feedback filter time constant			Level 3
	Defines time constant for PID feedback filter.			
Unit: s	Min: 0.00	Def: 0.00	Max: 60.00	

P2267	Max. value for PID feedback			Level 3
	Sets the upper limit for the value of the feedback signal in [%].			
Unit: %	Min: -200.00	Def: 100.00	Max: 200.00	
Note:	P2267=100 % corresponds to 4000 hex. When PID is enabled (P2200=1) and the signal rises above this value, the variable speed drive will trip with P0222.			

P2268	Min. value for PID feedback			Level 3
	Sets lower limit for value of feedback signal in [%].			
Unit: %	Min: -200.00	Def: 0.00	Max: 200.00	
Note:	P2268=100 % corresponds to 4000 hex. When PID is enabled (P2200=1) and the signal rises above this value, the variable speed drive will trip with P0221.			

P2269	Gain applied to PID feedback			Level 3
	Allows the user to scale the PID feedback as a percentage value [%]. A gain of 100 % means that the feedback signal has not changed from its default value.			
Unit: -	Min: 0.00	Def: 100.00	Max: 500.00	
Note:	Allows the user to scale the PID feedback as a percentage value [%]. A gain of 100.0 % means that feedback signal has not changed from its default value.			

P2270	PID feedback function selector			Level 3
	Applies mathematical functions to the PID feedback signal, allowing multiplication of the result by P2269 (gain applied to PID feedback).			
Unit: -	Min: 0	Def: 0	Max: 3	
Details:	Applies mathematical functions to the PID feedback signal, allowing multiplication of the result by P2269 (gain applied to PID feedback).			
Settings:	0=Disabled	1=Square root (root(x))	2=Square (x*x)	3=Cube (x*x*x)

P2271	PID transducer type			Level 3
	Allows the user to select the transducer type for the PID feedback signal.			
Unit: -	Min: 0	Def: 0	Max: 1	
Value:	0 : [default] If the feedback signal is less than the PID setpoint, the PID controller will increase motor speed to correct this. 1 : If the feedback signal is greater than the PID setpoint, the PID controller will reduce motor speed to correct this.			
Settings:	0=Disabled	1=Inversion of PID feedback signal		

Note:	It is essential that you select the correct transducer type. If you are unsure whether 0 or 1 is applicable, you can determine the correct type as follows: 1 Disable the PID function (P2200=0). 2 Increase the motor frequency while measuring the feedback signal. 3 If the feedback signal increases with an increase in motor frequency, the PID transducer type should be 0. 4 If the feedback signal decreases with an increase in motor frequency the PID transducer type should be set to 1.

r2272	**CO: PID scaled feedback**			**Level 3**
	Displays PID scaled feedback signal in [%].			
Unit: %	**Min: -**	**Def: -**	**Max: -**	
Note:	r2272=100 % corresponds to 4000 hex.			

r2273	**CO: PID error**			**Level 3**
	Displays PID error (difference) signal between setpoint and feedback signals in [%].			
Unit: %	**Min: -**	**Def: -**	**Max: -**	
Note:	r2273=100 % corresponds to 4000 hex.			

P2274	**PID derivative time**			**Level 2**
	Sets PID derivative time.			
Unit: s	**Min: 0**	**Def: 0**	**Max: 65535**	
Note:	Set PID derivative time			

P2279	**PID Neutral zone**			**Level 3**
	Sets PID derivative time.			
Unit: %	**Min: 0.00**	**Def: 0.00**	**Max: 100.00**	
Note:	Set PID derivative time			

P2280	**PID proportional gain**			**Level 2**
	Allows user to set proportional gain for PID controller. The PID controller is implemented using the standard model.			
Unit:	**Min: 0.000**	**Def: 1.200**	**Max: 65.000**	
Details:	Allows user to set proportional gain for standard PID controller. For best results, enable both P and I terms.			
Dependency:	If P term=0, I term acts on the square of the error signal.			
Note:	If the system is prone to sudden step changes in the feedback signal, P term should normally be set to a small value (0.5) with a faster I term for optimum performance. The D term (P2274) multiplies the difference between the present and previous feedback signal thus accelerating the controller reaction to an error that appears suddenly. The D term should be used carefully, since it can cause the controller output to fluctuate as every change in the feedback signal is amplified by the controller derivative action.			

P2285	**PID integral time**			**Level 2**
	Sets integral time constant for PID controller.			
Unit: s	**Min: 0.000**	**Def: 30**	**Max: 65535**	
Note:	See P2280 (PID proportional gain).			

P2291	**PID output upper limit**			**Level 2**
	Sets the upper limit for PID controller output in [%].			
Unit: %	**Min: 0.00**	**Def: 100.00**	**Max: 100.00**	
Dependency:	If F max (P1082) is greater than P2000 (reference frequency), either P2000 or P2291 (PID output upper limit) must be changed to achieve F max.			
Note:	P2291=100 % corresponds to 4000 hex (as defined by P2000 [reference frequency]).			

P2292	**PID output lower limit**			**Level 2**
	Sets the lower limit for the PID controller output in [%].			
Unit: %	**Min: -0.00**	**Def: 0.00**	**Max: 100.00**	
Dependency:	A negative value allows bipolar operation of PID controller.			
Note:	P2292=100 % corresponds to 4000 hex.			

P2293	**Ramp-up /-down time of PID limit**			**Level 3**
	Sets maximum ramp rate on output of PID. When PI is enabled, the output limits are ramped up from 0 to the limits set in P2291 (PID output upper limit) and P2292 (PID output lower limit). Limits prevent large step changes appearing on the output of the PID when the variable speed drive is started. Once the limits have been reached, the PID controller output is instantaneous. These ramp times are used whenever a RUN command is issued.			
Unit: s	**Min: 0.00**	**Def: 0.00**	**Max: 100.00**	
Note:	If an OFF1 or OFF3 are issued, the variable speed drive output frequency ramps down as set in P1121 (ramp-down time) or P1135 (OFF3 ramp-down time).			

r2294	**CO: Act. PID output**			**Level 3**
	Displays the PID output in [%].			
Unit: %	**Min: -**	**Def: -**	**Max: -**	
Details	When PI is enabled, the output limits are ramped up from 0 to the limits set in P2291 (PID output upper limit) and P2292 (PID output lower limit). Limits prevent large step changes appearing on the output of the PID when the variable speed drive is started. Once the limits have been reached, the PID controller output is instantaneous. These ramp times are used whenever a RUN command is issued.			
Note:	r2294=100 % corresponds to 4000 hex.			

P2303[2]	CI: PID o/p offset			Level 3
	Selects the source of the PID output offset signal.			
Unit: -	Min: 0:0	Def: 0:0	Max: 4000:0	
Settings:	755 = Analog input 1 setpoint	2224 = Fixed PID setpoint	2250 = Output setpoint of PID-MOP	
Index:	P2303[0] : 1st command data set (CDS)	P2303[1] : 2nd command data set (CDS		
Note:	When analog input is selected, offset and gain can be implemented using parameters P0756 to P0760 (ADC scaling).			

P2304	PID opening time			Level 2
	Sets actuator opening time constant for PID controller.			
Unit: s	Min: 0	Def: 60	Max: 65535	
Details:	See P2304 (PID actuator closing time).			

P2305	PID closing time			Level 2
	Sets actuator opening time constant for PID controller.			
Unit: s	Min: 0	Def: 60	Max: 65535	
Details:	See P2304 (PID actuator closing time).			

P2306	PID Acting Dir			Level 2
	Direct = 0 = increasing plant output causes increasing controller output Indirect = 1 =increasing plant output causes decreasing controller output.			
Unit: -	Min: 0	Def: 1	Max: 1	
Settings:	0 Indirect Acting (Cooling Sequence) 1 Direct Acting (Heating Sequence)			

P2370	Motor staging stop mode			Level 3
	Selects stop mode for external motors when motor staging is in use.			
Unit: -	Min: 0	Def: 0	Max: 1	
Settings:	0=Normal stop	1=Sequence stop		

P2371	Selection motor configuration			Level 3
	Selects configuration of external motors used for motor staging feature.			
Unit: -	Min: 0	Def: 0	Max: 8	
Settings:	0=Motor staging Disabled 1=M1=1X, M2=	2=M1=1X, M2=1X 3=M1=1X, M2=2X		
Details	Motor staging allows the control of up to 2 additional staged pumps or fans, based on a PID control system. The complete system consists of one pump controlled by the variable speed drive with up to 2 further pumps / fans controlled from contactors or motor starters. The contactors or motor starter are controlled by outputs from the variable speed drive. The diagram below shows a typical pumping system. A similar system could be set up using fans and air ducts, instead of pumps and pipes.			

P2372	Enable motor cycling			Level 3
	Enables motor cycling for the motor staging feature. When enabled, the motor selected for staging/destaging is based on the hours run counter P2380. When staging, the motor with the least hours is switched on. When destaging, the motor with most hours is switched off. If staged motors are different sizes, the choice of motor is first based on required motor size, and then if there is still a choice, on hours run.			
Unit: -	Min: 0	Def: 0	Max: 1	
Settings:	0=Disabled	1=Enabled		

P2373	Motor staging hysteresis			Level 3
	P2373 as a percentage of the PID setpoint that PID error P2294 must exceed before the staging delay starts.			
Unit: %	Min: 0.0	Def: 20.0	Max: 200.0	
Details:	Error as a percentage of setpoint that must be exceeded before staging delay starts.			

P2374	Motor staging delay			Level 3
	Time that PID error P2273 must exceed motor staging hysteresis P2373 before staging occurs.			
Unit: s	Min: 0	Def: 30	Max: 650	
Details:	Time that error must exceed hysteresis before *staging* occurs.			

P2375	Motor destaging delay			Level 3
	Time that PID error P2273 must exceed motor staging hysteresis P2373 before destaging occurs.			
Unit: s	Min: 0	Def: 30	Max: 650	
Details:	Time that error must exceed hysteresis before *destaging* occurs.			

P2376	Delay override			Level 3
	P2376 as a percentage of PID setpoint. When the PID error P2273 exceeds this value, a motor is staged / destaged irrespective of the delay timers.			
Unit: %	Min: 0.0	Def: 25.0	Max: 200.0	
Details:	Error as a percentage of setpoint that if exceeded will begin staging without delay.			

P2377	Delay override lockout timer			Level 3
	Time for which delay override is prevented after a motor has been staged or destaged. This prevents a second staging event immediately after a first, being caused by the transient conditions after the first staging event.			
Unit: s	Min: 0	Def: 30	Max: 650	
Details:	Time for which delay override is prevented after a motor has been staged or destaged.			

P2378	Staging frequency f, %fMax			Level 3
	The frequency as a percentage of max. frequency. During a (de) staging event, as the variable speed drive ramps from maximum to minimum frequency (or vice versa) this is the frequency at which the relay (DOUT) is switched. This is illustrated by the following diagrams.			
Unit: %	**Min: 0.0**	**Def: 50.0**	**Max: 120.0**	
Details:	The frequency as a percentage of fMax at which an external motor will be started or stopped			

r2379	CO/BO: Status of motor staging			Level 3
	Output word from the motor staging feature that allows external connections to be made.			
Unit: -	**Min: -**	**Def: -**	**Max: -**	
Bit fields:	Bit00 Start motor 1 0 YES, 1 NO Bit01 Start motor 2 0 YES, 1 NO			

P2380[3]	Motor hours run			Level 3
	Displays hours run for external motors. To reset the running hours, set the value to zero, any other value is ignored.			
Unit: h	**Min: 0**	**Def: 0**	**Max: 100000**	
Index:	P2380[0] : Motor 1 hrs run	P2380[1] : Motor 2 hrs run	P2380[2] : not used	
Note:	To reset the running hours, set the value to zero, any other value is ignored.			

P2390	Hibernation frequency			Level 3
	When the variable speed drive under PID control drops below hibernation setpoint, the hibernation timer P2391 is started. When the hibernation timer has expired, the variable speed drive is ramped down to stop and enters hibernation mode (see diagram below).			
Unit: %	**Min: 0**	**Def: 0**	**Max: 200.00**	
Details:	Hibernation frequency setpoint (frequency the motor output will turn off).			

P2391	Hibernation timer			Level 3
	When the hibernation timer P2391 has expired, the variable speed drive is ramped down to stop and enters hibernation mode (see description and diagram of P2390).			
Unit: s	**Min: 0**	**Def: 0**	**Max: 254**	
Details:	Hibernation restart frequency (frequency the motor output will turn on).			

P2392	Restart PID controller deviation [%]			Level 3
	While in hibernation mode, the PID controller continues to generate the error P2294 - once this reaches the restart point P2392, the variable speed drive immediately ramps to the setpoint calculated by the PID controller (see description and diagram of P2390). Once the variable speed drive has left hibernation mode, it is not possible to go back into hibernation mode, until the variable speed drive output setpoint has reached the restart setpoint.			
Unit: %	**Min: -200.00**	**Def: 0**	**Max: 200.00**	
Details:	Hibernation restart frequency (frequency the motor output will turn on).			

P3900	End of quick commissioning			Level 1
	Performs calculations necessary for optimized motor operation. After completion of calculation, P3900 and P0010 (parameter groups for commissioning) are automatically reset to their original value 0.			
Unit: -	**Min: 0**	**Def: 0**	**Max: 3**	
Details:	Performs calculations necessary for optimized motor operation. After completion of calculation, P3900 and P0010 (parameter groups for commissioning) are automatically reset to their original value 0.			
Settings:	0=No quick commissioning 1=Start quick commissioning with factory reset 2=Start quick commissioning 3=Start quick commissioning only for motor data			
Dependency:	Changeable only when P0010=1 (quick commissioning)			
Note:	When setting 1 is selected, only the parameter settings carried out via the commissioning menu "Quick commissioning", are retained; all other parameter changes, including the I/O settings, are lost. Motor calculations are also performed. When setting 2 is selected, only those parameters, which depend on the parameters in the commissioning menu "Quick commissioning" (P0010=1) are calculated. The I/O settings are also reset to default and the motor calculations performed. When setting 3 is selected, only the motor and controller calculations are performed. Exiting quick commissioning with this setting saves time (for example, if only motor rating plate data have been changed). Calculates a variety of motor parameters, overwriting previous values. These include P0344 (Level 3, motor weight), P0350 (Level 3, demagnetization time), P2000 (reference frequency), P2002 (Level 3, reference current).			

6.6 Overview of factory and user parameter settings

Please enter your parameter settings in the table below.

Parameter number	User settings	Factory settings
P0003		1
P0004		0
P0005		21
P0006		2
P0010		0
P0011		0
P0012		0
P0013		0
P0040		0
P0054		-
P0055		-
P0056		-
P0086		-
P0100		0
P0304		230
P0305		3.25
P0307		0.75
P0308		0.000
P0309		0.0
P0310		50.00
P0311		0
P0340		0
P0350		4.0
P0400		0
P0409		25
P0501		0
P0506		754
P0507		1.0
P0508		0
P0509		0
P0601		0
P0610		2
P0640		110.0
P0700		2
P0701		1
P0702		12
P0703		9
P0704		15
P0705		15
P0706		29
P0707		0
P0708		0
P0718		0
P0725		1
P0731		52:3
P0732		52.2
P0733		0.0
P0748		0
P0753		100
P0756		0
P0757		0
P0758		0.0
P0759		10
P0760		100
P0761		0
P0771		21

Parameter number	User settings	Factory settings
P0776		1
P0773		100
P0777		0.0
P0778		0
P0779		100.0
P0780		10
P0781		0
P0809		0
P0810		718:0
P0918		3
P0927		15
P0952		0
P0970		0
P0971		0
P1000		2
P1001		0.00
P1002		5.00
P1003		10.00
P1004		15.00
P1005		20.00
P1006		25.00
P1007		30.00
P1008		35.00
P1009		40.00
P1010		45.00
P1011		50.00
P1012		55.00
P1013		60.00
P1014		65.00
P1015		65.00
P1016		1
P1017		1
P1018		1
P1019		1
P1020		0:0
P1021		0:0
P1022		0:0
P1023		722:3
P1025		1
P1026		722:4
P1027		1
P1028		722:5
P1031		1
P1032		1
P1040		10
P1080		10
P1082		50
P1091		0.00
P1092		0.00
P1093		0.00
P1094		0.00
P1101		2
P1110		1:0
P1120		10.00
P1121		30.00
P1135		5.00

Parameter number	User settings	Factory settings
P1140		1.0
P1141		1.0
P1142		1.0
P1200		0
P1202		100
P1203		100
P1210		1
P1211		3
P1212		30
P1213		30
P1230		0:0
P1232		100
P1233		0
P1236		0
P1240		0
P1260		0
P1262		1.000
P1263		1.0
P1264		1.0
P1265		50.00
P1266		0:0
P1270		0:0
P1300		2
P1310		50.0
P1311		0.0
P1312		0.0
P1335		0.0
P1336		250
P1499		100.0
P1800		4
P1820		0
P1910		0
P2000		50.00
P2001		1000
P2002		0.10
P2009		0
P2010		6
P2011		0
P2014		0
P2040		20
P2041		0
P2051		52.0
P2100		0
P2101		0
P2111		0
P2115		0
P2181		0
P2182		5.00
P2183		30.00
P2184		50.00
P2185		99999.0
P2186		0.0
P2187		99999.0
P2188		0.0
P2189		99999.0
P2190		0.0

Continued: Overview of factory and user parameter settings

Parameter number	User settings	Factory settings
P2191		3.00
P2192		10
P2200		0.0
P2201		0.00
P2202		10.00
P2203		20.00
P2204		30.00
P2205		40.00
P2206		50.00
P2207		60.00
P2208		70.00
P2209		80.00
P2210		90.00
P2211		100.00
P2212		110.00
P2213		120.00
P2214		230.00
P2215		130.00
P2216		1
P2217		1
P2218		1
P2219		1
P2220		0.0
P2221		0.0
P2222		0.0
P2223		0.0
P2225		1
P2226		722:4
P2227		1
P2228		722.4
P2231		1
P2232		1
P2240		10.00
P2253		2250:0
P2254		0.0
P2261		0.00
P2264		755:1
P2265		0.00
P2267		100.0
P2268		0.00
P2269		100.0
P2270		0
P2271		0
P2274		0
P2279		0.00
P2280		1.200
P2285		30
P2291		100.00
P2292		0.00
P2293		0.00
P2303		0:0
P2304		60
P2305		60
P2306		1
P2307		0
P2371		0
P2372		0
P2373		20.0

Parameter number	User settings	Factory settings
P2374		30
P2375		30
P2376		25.0
P2377		30
P2378		50.0
P2380		0
P2390		0
P2391		0
P2392		0
P3900		0

7 Troubleshooting

7.1 Troubleshooting using the operator panel

If a warning or trip code appears on the display, refer to section **7.2.1 Error code list** or section **7.2.2 Warning code lists**.

If the motor does not start with the ON command:

- Check if P0010 = 0.
- Check if there is a valid ON signal.
- Check if P0700 = 2 (for digital input control) or
  P0700 = 1 (for BOP control).
- Check if the correct setpoint is available (0 to 10 V on terminal 3), or if the setpoint was entered in the correct location in dependence of the setpoint source (P1000). Refer to the parameter list for more detailed information.

If the motor does not start after changing the parameters, set P0010 = 30 and then P0970 = 1, and press **P** to reset the variable speed drive to the factory-set parameter default values.

Use a switch between terminals **5** and **8** on the control terminal bar. The drive should now run according to the default setpoint at the analog input.

Note ☞ The voltage and current range of the VSD must match the motor data.

7.2 Error messages

7.2.1 Error code list

Error	Cause	Diagnosis & Remedy	Reaction
F0001 Overcurrent	➢ Motor power (P0307) is greater than VSD power (P0206). ➢ Motor lead short circuit. ➢ Earth faults.	Check the following: 1. Motor power (P0307) ≤ VSD power (P0206). 2. Cable length limits must not be exceeded. 3. Motor cable and motor must not have short circuits or earth faults. 4. Motor parameters must match the motor in use. 5. Value of stator resistance (P0350) must be correct. 6. The motor must not be obstructed or overloaded. Increase ramp-up time. Reduce boost level.	Off2
F0002 Overvoltage	➢ DC link voltage (r0026) exceeds trip level (P2172). ➢ Overvoltage can be caused either by too high main supply voltage or if motor is in regenerative mode. ➢ Regenerative mode can be caused by fast ramp downs or if the motor is driven from an active load.	Check the following: 1. The supply voltage (P0210) must lie within the limits indicated on the rating plate. 2. The DC link voltage controller must be enabled (P1240) and parameterized correctly. 3. The ramp-down time (P1121) must match the inertia of load. 4. The required braking power must lie within the specified limits. Note: Higher inertia requires long ramp-up times; otherwise, apply braking resistor.	Off2
F0003 Undervoltage	➢ Mains supply failed. ➢ Shock load outside the specified limits.	Check the following: 1. The supply voltage (P0210) must lie within the limits indicated on the rating plate. 2. The supply voltage must not be susceptible to temporary failures or voltage reductions outside tolerance.	Off2
F0004 VSD overtemperature	➢ Ventilation is inadequate. ➢ The fan is inoperative. ➢ The ambient temperature is too high.	Check the following: 3. The fan must turn when the VSD is running. 4. The pulse frequency must be set to a lower value. 5. The ambient temperature could be higher than specified for the VSD.	Off2
F0005 VSD I2T	➢ The VSD is overloaded. ➢ The duty cycle is outside the tolerance. ➢ The Motor power (P0307) exceeds the VSD power (P0206).	Check the following: 1. The load cycle must lie within the limits specified. 2. Motor power (P0307) ≤ VSD power (P0206).	Off2
F0011 Motor overtemperature	➢ The motor is overloaded.	Check the following: Make sure that the load duty cycles (temporary overload) lie within the limits specified.	Off1
F0012 VSD temperature signal lost	➢ Wire breakage of the VSD temperature sensor (heatsink).		Off2
F0015 Motor temperature signal lost	➢ Breakage or short-circuit of the motor temperature sensor. If a signal loss is detected, temperature monitoring switches to monitoring the thermic motor image.		Off2
F0020 1 phase for mains supply missing	➢ One of the 3 phases for the mains supply voltage is missing.	Check the wiring of the 3 phases at the supply voltage input of the VSD.	Off2
F0021 Earth fault	➢ The fault occurs if the sum of the phase currents is higher than 5% of the nominal VSD current. **Note** This error message occurs on VSDs with 3 current sensors, i.e., for VSDs of frame sizes D to F.		Off2

Error	Cause	Diagnosis & Remedy	Reaction
F0022 **Power stack fault**	The fault is caused by the following events: ♦ (1) dc link overcurrent =short circuit of IGBT. ♦ (2) short circuit of dc link chopper. ♦ (3) earth fault. ➢ Frame sizes A to C (1),(2),(3). ➢ Frame sizes D to E (1),(2). ➢ Frame size F (2). Since all these faults are assigned to one signal on the power stack, it is not possible to establish which one actually occurred.		Off2
F0023 **Fault at VSD output**	The On-phase is interrupted at the VSD output.		Off2
F0024 **Rectifier overtemperature**	➢ The ventilation is inadequate. ➢ The fan is inoperative. ➢ The ambient temperature is too high.	Check the following: 1. The fan must turn when the VSD is running. 2. The pulse frequency (P1800) must be set to default value 4 kHz.	
F0030 **Fan fault**	➢ The fan no longer works.	The fault cannot be masked while the options module (AOP or BOP) is connected. Replace the fan.	Off2
F0041 **Motor data identification failure**	➢ Motor data identification failed. ➢ Alarm value = 0: Load is missing. ➢ Alarm value = 1: Current limit value reached during identification. ➢ Alarm value = 2: Identified stator resistance less than 0.1% or more than 100%. ➢ Alarm value = 3: Identified rotor resistance less than 0.1% or more than 100%. ➢ Alarm value = 4: Identified stator reactance less than 50% or more than 500%. ➢ Alarm value = 5: Identified main reactance less than 50% or more than 500%. ➢ Alarm value = 6: Identified rotor time constant less than 10 ms or more than 5s. ➢ Alarm value = 7: Identified total leakage reactance less than 5% or more than 50%. ➢ Alarm value = 8: Identified stator leakage reactance less than 25% or more than 250%. ➢ Alarm value = 9: Identified rotor leakage reactance less than 25% or more than 250%. ➢ Alarm value = 20: Identified IGBT ON-voltage less than 0.5 or more than 10 V. ➢ Alarm value = 30: Current controller at voltage limit. ➢ Alarm value = 40: Inconsistency of identified data set, at least one identification failed. Percentage values based on impedance Zb = Vmot,nom / sqrt(3) / Imot,nom.	0: Check if the motor is connect to the VSD. 1-40: Check if the motor data in P304-311 are correct. Check the type of motor wiring required (star, delta).	Off2
F0051 **Parameter EEPROM fault**	➢ Read or write failure while saving non-volatile parameter.	Reset VSD to factory setting and re-parameterize.	Off2
F0052 **Power stack fault**	➢ Read failure for power stack information or invalid data.	Exchange VSD.	Off2
F0053 **I/O EEPROM fault**	➢ Read failure for I/O EEPROM information or invalid data.	Check the data. Exchange the I/O module.	Off2
F0054 **Wrong I/O print**	➢ I/O print is not connected. ➢ Wrong I/O print is connected. ➢ NO ID found on I/O print, no data.	Check data flow. Exchange I/O module.	Off2
F0060 **ASIC timeout**	➢ Internal communication error.	If error reappears, exchange VSD. Contact customer service.	Off2
F0070 **CB setpoint fault**	➢ No setpoints from CB (communications board) during telegram off time.	Check communications module (CB) and communications partner.	Off2

Error	Cause	Diagnosis & Remedy	Reaction
F0071 **USS (BOP link) setpoint fault**	➢ No setpoints from USS during telegram off time.	Check communications to data transmission module. Check USS master.	Off2
F0072 **USS (COM link) setpoint fault**	➢ No setpoints from USS during telegram off time.	Check USS master.	Off2
F0080 **ADC input signal lost**	➢ Broken wire at analog input. ➢ Signal level outside defined limits.		Off2
F0085 **External fault**	➢ External fault triggered via input terminals.	Disable input terminals for fault trigger, or eliminate external fault. Check if DIN is set to ON.	Off2
F0101 **Stack overflow**	➢ Software or processor error	Run self-test routines.	Off2
F0221 **PID feedback below min. value**	PID feedback below min. value of P2268.	Change value of P2268. Adjust feedback amplification.	Off2
F0222 **PID feedback below max. value**	PID feedback below max. value of P2267.	Change value of P2267. Adjust feedback amplification.	Off2
F0450 **BIST tests failure**	Alarm value: 1. Some power section tests have failed. 2. Some control board tests have failed. 4. Some functional test have failed. 8. Some I/O module tests have failed. 16. Internal RAM failed on power-up check.	The drive may run, but some functions do not work properly. Replace the drive.	Off2
F0452 **Belt failure detected**	➢ Load condition changes at the motor indicate a belt failure or mechanical fault.	Check the following: 1. Drive belt ok. The drive is not obstructed or seized? 2. If external speed sensor is used, check proper function. Check the following parameters: P0409 (impulses/sec on nominal speed) P2191 (belt failure and speed monitoring) P2192 (delay time for P2191). 3. For belt failure detection without sensor, check the following parameters: P2182 (threshold frequency f1) P2183 (threshold frequency f2) P2184 (threshold frequency f3) P2185 (upper torque threshold 1) P2186 (lower torque threshold 1) P2187 (upper torque threshold 2) P2188 (lower torque threshold 2) P2189 (upper torque threshold 3) P2190 (lower torque threshold 3) P2192 (delay for belt failure). 4. Lubricate the drive if necessary.	Off2

7.2.2 Warning code lists

Error	Cause	Diagnosis & Remedy	Reaction
A0501 **Current limit**	➢ Motor power > VSD power. ➢ Motor cables are too long. ➢ Earth faults.	Check the following: 1. Motor power (P0307) ≤ VSD power (P0206). 2. Cable length limits must not be exceeded. 3. Motor cable and motor must not have short circuits or earth faults. 4. Motor parameters must match the motor in use. 5. Value of stator resistance (P0350) must be correct. 6. The motor must not be obstructed or overloaded. Increase ramp-up time. Reduce boost level.	--
A0502 **Overvoltage limit**	➢ The overvoltage limit is reached. This warning may appear on ramp-down if the dc link is disabled (P1240 = 0).	If this warning is displayed permanently, check the drive input voltage or extend the ramp-down time for the drive.	--
A0503 **Undervoltage limit**	➢ Main power supply failed. The main power supply (P0210) and consequently the DC link voltage (R0026) are below the defined threshold value (P2172).	Check the main supply voltage (P0210).	--
A0504 **VSD overtemperature**	➢ The warning level of the VSD heatsink temperature (r0037) is exceeded. This results in a reduced pulse frequency and/or a reduced output frequency (dependent on parameterization in (P0610).	Check the following: 1. The ambient temperature must lie within the limits specified. 2. The load conditions and duty cycle must lie within the specified conditions. 3. The fan must turn when the VSD is running.	--
A0505 **VSD I^2T**	➢ Warning level exceeded. The current supply is reduced if parameterized (P0610 = 1).	Check that the duty cycle lies within the limits specified. Motor power (P0307) > VSD power (P0206).	--
A0506 **VSD duty cycle**	➢ Difference between the heatsink temperature and the IGBT exceeds the warning levels.	Check the following: Make sure that the load duty cycles (temporary overload) lie within the limits specified.	--
A0511 **Motor over-temperature I^2T**	➢ The motor is overloaded. ➢ The duty cycle is outside the tolerance.		--
A0520 **Rectifier overtemperature**	➢ The warning level of the rectifier heatsink temperature is exceeded.	Check the following: 1. The ambient temperature must lie within the limits specified. 2. The load conditions and duty cycle must lie within the specified conditions. 3. The fan must turn when the VSD is running.	--
A0523 **VSD output fault**	➢ The On-phase is interrupted at the VSD output.		--
A0541 **Motor data identification enabled**	➢ Motor data identification (P1910) selected or running.		--
A0600 **RTOS data loss**			--
A0910 **Vdc (max.) controller disabled**	➢ Vdc max controller disabled as not able to keep the DC link voltage (r0026) within threshold limits (P2172). ➢ Permanent supply overvoltage. ➢ Occurs if the motor is driven by a load forcing the motor to go into energy recovery operation. ➢ Occurs during ramp-down of very high duty cycles.	Check the following: 1. Input voltage must lie within specified range. 2. The load must be adjusted. 3. In some cases, brake resistance must be applied.	--
A0911 **Vdc (max.) controller enabled**	➢ Vdc max controller is enabled. The ramp-down times are increased automatically to keep the DC link voltage (r0026) within the limits specified (P2172).		--

Error	Cause	Diagnosis & Remedy	Reaction
A0912 **Vdc (min) controller enabled**	➢ Vdc min controller enabled if the DC link voltage (r0026) drops below the min. value (P2172). ➢ The motor's kinetic energy is used to buffer the DC link voltage and thus slow the drive. ➢ Temporary supply failures do not automatically lead to undervoltage shutdown.		--
A0920 **ADC parameters not set properly**	➢ ADC parameters must not be set to identical values, as illogical values would result. ➢ Index 0: Parameter settings for output identical. ➢ Index 1: Parameter settings for input identical. ➢ Index 2: Parameter settings for input do not correspond to ADC type.		--
A0921 **DAC parameters not set properly**	➢ DAC parameters must not be set to identical values, as illogical values would result. ➢ Index 0: Parameter settings for output identical. ➢ Index 1: Parameter settings for input identical. ➢ Index 2: Parameter settings for output do not correspond to DAC type.		--
A0922 **No load applied to VSD**	➢ No load is applied to the VSD. Some functions may not work as under normal load conditions.		--
A0923 **Both JOG left and JOG right are requested**	➢ Both JOG right and JOG left (P1055/P1056) have been requested. This freezes the RFG output frequency at its current value.		--
A0924 **Belt failure detected**	➢ Load conditions at the motor indicate a belt failure or mechanical fault.	Check the following: 1. No breakage, seizure, or obstruction of drive train. 2. Correct operation of external speed sensor, if in use. 3. P0402 (pulse/min at rated speed), P2164 (hysteresis frequency deviation) and P2165 (delay time for permissible deviation) must have correct values: P2155 (threshold frequency f1) P2157 (threshold frequency f2) P2159 (threshold frequency f3) P2174 (upper torque threshold 1) P2175 (lower torque threshold 1) P2176 (delay T_Torque) P2182 (upper torque threshold 2) P2183 (lower torque threshold 2) P2184 (upper torque threshold 3) P2185 (lower torque threshold 3)	--

8 Technical data for the SED2

8.1 General technical data

Operating temperature ranges
IP 20: –10 °C to +40 °C.
IP 54: –10 °C to +40 °C.

Storage temperature
–40 °C to +70 °C.

Humidity
95% relative humidity — non-condensing.

Altitude
Up to 1000 meters above sea level without performance decrease.

Overload capacity
110 % periodic overload capacity for 60 s within 5 minutes relative to the nominal output current.

Protection functions
Protection against:

- Undervoltage
- Overvoltage
- Earth fault
- Short-circuit
- Stall
- Rotor jam
- Motor overtemperature
- VSD overtemperature

Electromagnetic compatibility
Integrated EMC filter as per EN 55011 class B (as footprint filter for frame sizes A to C / IP20). The filter is integrated in the VSD for frame sizes D to F/IP20 and for all IP54 devices. Satisfies the requirements of EMC product standard EN 61800-3.

Input frequency
47 to 63 Hz.

Setpoint resolution
0.01 Hz digital,
0.01 Hz serial,
10 bit analog.

Switching frequency
4 kHz to 16 kHz (2 kHz steps).

Fixed frequencies
15 programmable.

Masking frequencies
4 programmable.

Analog inputs
Number: 2 / can be changed over to 0/2 to 10 V (programmable scaling) or 0/4 to 20 mA (programmable scaling).
Terminals used: 3, 4, 10, 11 [#].
Resolution: 10 bits.
Read cycle: 10 ms.
Analog inputs AIN1/2 can be configured for direct connection of an LG-Ni 1000 temperature sensor.

Digital inputs
6 (potential-free) inputs extendable to 8 (see Analog inputs).
Freely programmable and possible changeover high-active/ low-active.
Terminals used: 5, 6, 7, 8, 16, 17 [#].

[#] Further information on terminals used: See diagram.

Min. input current: 6 mA (actual: 8 mA) at ≥15 V.
Logical 0 = <3 V, logical 1 = >13 V.
Max. input voltage: 33 V.

Analog outputs

Number:2
Can be changed over for 0 to 10 V or 0/4 to 20 mA, (programmable scaling/parameter).
Factory setting: 0 to 10 V.
Terminals used: 12, 13, 26, 27#.
Impedance on configuration 0 to 10 V: 1kΩ.
Read cycle: 10 ms.

Relay outputs

2 programmable relays, 6 contacts.
Terminals used: RL1:18, 19, 20; RL2: 23, 24, 25#.
Max. contact rating: DC 30 V / 5 A, (resistive).
AC 250 V / 2 A (resistive).

Auxiliary supply 24 V

Galvanically separated, unregulated auxiliary supply (18 to 32 V), 50 mA..
Terminal 9.

Serial interface

RS 485,(RS 232 optional with converter).
Protocols: USS, P1, and N2.
Transmission rate: Up to 38.4 kBaud (default 9.6 kBaud).

Power factor

≥0.7

VSD degree of efficiency

96 to 97%.

Switch-on current

Less than nominal input current.

Braking

DC braking, dynamic braking.

CE conformity

Corresponds to the requirements of the low-voltage guideline 73/23/EEC, supplemented by guideline 98/68/EEC and EMC.
If installed according to the recommendations issued in this manual, the SED2 satisfies all EMC guideline requirements as defined in the EMC Product Standard for Power Drive Systems EN61800-3.

Dimensions and weight (frame sizes A to C IP20 / NEMA 0)

IP20 / NEMA 0		
Frame size	**W x H x D (mm)**	**Weight (kg)**
A without filter	73 x 173 x 149	1.3
A with filter	73 x 200 x192.5	2
B without filter	149 x 202 x 172	3.4
B with filter	149 x 213 x 222.5	4.2
C without filter	185 x 245 x 195	5.5
C with filter	185 x 245 x 250	6.7
D without filter	275 x 520 x 245	16
D with filter	275 x 520 x 245	17
E without filter	275 x 650 x 245	20
E with filter	275 x 650 x 245	22
F without filter	350 x 850 x 320	56
F with filter	350 x 1150 x320	75

Dimensions and weight (frame sizes B to F IP54 / NEMA 12)

IP54 / NEMA 12			
Frame size	W x H x D (mm)	Weight (kg)	
		with filter	without filter
B	270 x 385 x 268	11.5	10.3
C	360 x 606 x 284	21	19.2
D	360 x 685 x 353	35	35
E	360 x 885 x 453	48	48
F	450 x 1150 x 428	99	81

8.2 Type-specific data

200 V to 240 V, ± 10%, 3 phases							
Output power (variable torque)		IP code	Filter class	Max. input current 3 phases	Max. output current	Frame size	Type (ASN)
kW	hp	IP		A	A		
0.37	0.5	20	B	2.4	2.3	A	SED2-0.37/22B
0.55	0.75	20	B	3.1	3	A	SED2-0.55/22B
0.75	1	20	B	4.3	3.9	A	SED2-0.75/22B
1.1	1.5	20	B	6.2	5.5	B	SED2-1.1/22B
1.5	2	20	B	8.3	7.4	B	SED2-1.5/22B
2.2	3	20	B	11.3	10.4	B	SED2-2.2/22B
3	4	20	B	15.6	13.6	C	SED2-3/22B
4	5	20	B	20.1	17.5	C	SED2-4/22B
5.5	7.5	20	B	26.3	22	C	SED2-5.5/22B
7.5	10	20	B	36.4	28	C	SED2-7.5/22B
11	15	20	B	46	42	D	SED2-11/22B
15	20	20	B	60	54	D	SED2-15/22B
18.5	25	20	B	75	68	D	SED2-18.5/22B
22	30	20	B	88	80	E	SED2-22/22B
30	40	20	B	114	104	E	SED2-30/22B
37	50	20	B	143	130	F	SED2-37/22B
45	60	20	B	170	154	F	SED2-45/22B
0.37	0.5	20	unfiltered	2.4	2.3	A	SED2-0.37/22X
0.55	0.75	20	unfiltered	3.1	3	A	SED2-0.55/22X
0.75	1	20	unfiltered	4.3	3.9	A	SED2-0.75/22X
1.1	1.5	20	unfiltered	6.2	5.5	B	SED2-1.1/22X
1.5	2	20	unfiltered	8.3	7.4	B	SED2-1.5/22X
2.2	3	20	unfiltered	11.3	10.4	B	SED2-2.2/22X
3	4	20	unfiltered	15.6	13.6	C	SED2-3/22X
4	5	20	unfiltered	20.1	17.5	C	SED2-4/22X
5.5	7.5	20	unfiltered	26.3	22	C	SED2-5.5/22X
7.5	10	20	unfiltered	36.4	28	C	SED2-7.5/22X
11	15	20	unfiltered	46	42	D	SED2-11/22X
15	20	20	unfiltered	60	54	D	SED2-15/22X
18.5	25	20	unfiltered	75	68	D	SED2-18.5/22X
22	30	20	unfiltered	88	80	E	SED2-22/22X

200 V to 240 V, ± 10%, 3 phases							
Output power (variable torque)		IP code	Filter class	Max. input current 3 phases	Max. output current	Frame size	Type (ASN)
kW	hp	IP		A	A		
30	40	20	unfiltered	114	104	E	SED2-30/22X
37	50	20	unfiltered	143	130	F	SED2-37/22X
45	60	20	unfiltered	170	154	F	SED2-45/22X

380 V to 480 V, ± 10%, 3 phases							
Output power (variable torque)		IP code	Filter class	Max. input current 3 phases	Max. output current	Frame size	Type (ASN)
kW	hp	IP		A	A		
0.37	0.5	20	B	1.6	1.2	A	SED2-0.37/32B
0.55	0.75	20	B	2.1	1.6	A	SED2-0.55/32B
0.75	1	20	B	2.8	2.1	A	SED2-0.75/32B
1.1	1.5	20	B	4.2	3	A	SED2-1.1/32B
1.5	2	20	B	5.8	4	A	SED2-1.5/32B
2.2	3	20	B	7.5	5.9	B	SED2-2.2/32B
3	4	20	B	10	7.7	B	SED2-3/32B
4	5	20	B	12.8	10.2	B	SED2-4/32B
5.5	7.5	20	B	16.6	13.2	C	SED2-5.5/32B
7.5	10	20	B	24	18.4	C	SED2-7.5/32B
11	15	20	B	33.8	26	C	SED2-11/32B
15	20	20	B	42	32	C	SED2-15/32B
18.5	25	20	B	45.7	38	D	SED2-18.5/32B
22	30	20	B	50	45	D	SED2-22/32B
30	40	20	B	68	62	D	SED2-30/32B
37	50	20	B	83	75	E	SED2-37/32B
45	60	20	B	99	90	E	SED2-45/32B
55	75	20	B	121	110	F	SED2-55/32B
75	100	20	B	160	145	F	SED2-75/32B
90	125	20	B	196	178	F	SED2-90/32B
0.37	0.5	20	unfiltered	1.6	1.2	A	SED2-0.37/32X
0.55	0.75	20	unfiltered	2.1	1.6	A	SED2-0.55/32X
0.75	1	20	unfiltered	2.8	2.1	A	SED2-0.75/32X
1.1	1.5	20	unfiltered	4.2	3	A	SED2-1.1/32X
1.5	2	20	unfiltered	5.8	4	A	SED2-1.5/32X
2.2	3	20	unfiltered	7.5	5.9	B	SED2-2.2/32X
3	4	20	unfiltered	10	7.7	B	SED2-3/32X
4	5	20	unfiltered	12.8	10.2	B	SED2-4/32X
5.5	7.5	20	unfiltered	16.6	13.2	C	SED2-5.5/32X
7.5	10	20	unfiltered	24	18.4	C	SED2-7.5/32X
11	15	20	unfiltered	33.8	26	C	SED2-11/32X
15	20	20	unfiltered	42	32	C	SED2-15/32X
18.5	25	20	unfiltered	45.7	38	D	SED2-18.5/32X
22	30	20	unfiltered	50	45	D	SED2-22/32X

380 V to 480 V, ± 10%, 3 phases							
Output power (variable torque)		IP code	Filter class	Max. input current 3 phases	Max. output current	Frame size	Type (ASN)
kW	hp	IP		A	A		
30	40	20	unfiltered	68	62	D	SED2-30/32X
37	50	20	unfiltered	83	75	E	SED2-37/32X
45	60	20	unfiltered	99	90	E	SED2-45/32X
55	75	20	unfiltered	121	110	F	SED2-55/32X
75	100	20	unfiltered	160	145	F	SED2-75/32X
90	125	20	unfiltered	196	178	F	SED2-90/32X
1.1	1.5	54	B	4.2	3	B	SED2-1.1/35B
1.5	2	54	B	5.8	4	B	SED2-1.5/35B
2.2	3	54	B	7.5	5.9	B	SED2-2.2/35B
3	4	54	B	10	7.7	B	SED2-3/35B
4	5	54	B	12.8	10.2	B	SED2-4/35B
5.5	7.5	54	B	16.6	13.2	C	SED2-5.5/35B
7.5	10	54	B	24	18.4	C	SED2-7.5/35B
11	15	54	B	33.8	26	C	SED2-11/35B
15	20	54	B	42	32	C	SED2-15/35B
18.5	25	54	B	45.7	38	D	SED2-18.5/35B
22	30	54	B	50	45	D	SED2-22/35B
30	40	54	B	68	62	D	SED2-30/35B
37	50	54	B	83	75	E	SED2-37/35B
45	60	54	B	99	90	E	SED2-45/35B
55	75	54	B	121	110	F	SED2-55/35B
75	100	54	B	160	145	F	SED2-75/35B
90	125	54	B	196	178	F	SED2-90/35B
1.1	1.5	54	unfiltered	4.2	3	B	SED2-1.1/35X
1.5	2	54	unfiltered	5.8	4	B	SED2-1.5/35X
2.2	3	54	unfiltered	7.5	5.9	B	SED2-2.2/35X
3	4	54	unfiltered	10	7.7	B	SED2-3/35X
4	5	54	unfiltered	12.8	10.2	B	SED2-4/35X
5.5	7.5	54	unfiltered	16.6	13.2	C	SED2-5.5/35X
7.5	10	54	unfiltered	24	18.4	C	SED2-7.5/35X
11	15	54	unfiltered	33.8	26	C	SED2-11/35X
15	20	54	unfiltered	42	32	C	SED2-15/35X
18.5	25	54	unfiltered	45.7	38	D	SED2-18.5/35X
22	30	54	unfiltered	50	45	D	SED2-22/35X
30	40	54	unfiltered	68	62	D	SED2-30/35X
37	50	54	unfiltered	83	75	E	SED2-37/35X
45	60	54	unfiltered	99	90	E	SED2-45/35X
55	75	54	unfiltered	121	110	F	SED2-55/35X
75	100	54	unfiltered	160	145	F	SED2-75/35X
90	125	54	unfiltered	196	178	F	SED2-90/35X

500 V to 600 V, ± 10%, 3 phases							
Output power (variable torque)		**IP code**	**Filter class**	**Max. input current 3 phases**	**Max. output current**	**Frame size**	**Type (ASN)**
kW	**hp**	**IP**		**A**	**A**		
0.75	1	20	unfiltered	2	1.4	C	SED2-0.75/42X
1.1	1.5	20	unfiltered	2.5	2.1	C	SED2-1.1/42X
1.5	2	20	unfiltered	3.2	2.7	C	SED2-1.5/42X
2.2	3	20	unfiltered	4.4	3.9	C	SED2-2.2/42X
3	4	20	unfiltered	6.3	5.4	C	SED2-3/42X
4	5	20	unfiltered	6.9	6.1	C	SED2-4/42X
5.5	7.5	20	unfiltered	9.4	9	C	SED2-5.5/42X
7.5	10	20	unfiltered	12.6	11	C	SED2-7.5/42X
11	15	20	unfiltered	18.1	17	C	SED2-11/42X
15	20	20	unfiltered	24.9	22	C	SED2-15/42X
18.5	25	20	unfiltered	30	27	D	SED2-18.5/42X
22	30	20	unfiltered	35	32	D	SED2-22/42X
30	40	20	unfiltered	45	41	D	SED2-30/42X
37	50	20	unfiltered	57	52	E	SED2-37/42X
45	60	20	unfiltered	68	62	E	SED2-45/42X
55	75	20	unfiltered	85	77	F	SED2-55/42X
75	100	20	unfiltered	109	99	F	SED2-75/42X
90	125	20	unfiltered	138	125	F	SED2-90/42X
1.1	1.5	54	unfiltered	2.5	2.1	C	SED2-1.1/45X
1.5	2	54	unfiltered	3.2	2.7	C	SED2-1.5/45X
2.2	3	54	unfiltered	4.4	3.9	C	SED2-2.2/45X
3	4	54	unfiltered	6.3	5.4	C	SED2-3/45X
4	5	54	unfiltered	6.9	6.1	C	SED2-4/45X
5.5	7.5	54	unfiltered	9.4	9	C	SED2-5.5/45X
7.5	10	54	unfiltered	12.6	11	C	SED2-7.5/45X
11	15	54	unfiltered	18.1	17	C	SED2-11/45X
15	20	54	unfiltered	24.9	22	C	SED2-15/45X
18.5	25	54	unfiltered	30	27	D	SED2-18.5/45X
22	30	54	unfiltered	35	32	D	SED2-22/45X
30	40	54	unfiltered	45	41	D	SED2-30/45X
37	50	54	unfiltered	57	52	E	SED2-37/45X
45	60	54	unfiltered	68	62	E	SED2-45/45X
55	75	54	unfiltered	85	77	F	SED2-55/45X
75	100	54	unfiltered	109	99	F	SED2-75/45X
90	125	54	unfiltered	138	125	F	SED2-90/45X

9 Appendix

9.1 Options

Depending on the application, various options are available for the SED2 variable speed drive.

Output chokes

Chokes at the VSD output may be required to compensate for leakage capacitance. Refer to the engineering manual for detailed information on this topic.

Gland plate

ASN FS A: SED2-GL-A
FS B: SED2-GL-B
FS C: SED2-GL-C

The gland plate simplifies and improves connection of shielded motor and control cables. It allows for better contact of the shields and thus optimizes the EMC behavior of the variable speed drive.
There are different gland plates depending on the frame size of the VSD.

Advanced operator panel (AOP)

ASN: SED2-AOP1

Operator panel with multilingual and multi-line clear-text display that can be used instead of the basic operator panel BOP. The AOP can be inserted on the VSD or integrated in the front plate or the control panel doors by means of a mounting set.
For further information, refer to section 5.3.2 **Description of the advanced operator** panel (AOP) or the AOP user's guide.

BOP/AOP door mounting set for 1 VSD control

ASN: SED2-DOOR-KIT1

Used to mount the BOP or AOP operator panel in the control cabinet door. The set contains an AOP/BOP cable adapter print, and an adapter for the VSD which is inserted in the VSD in place of the BOP or AOP. The serial interface RS232 and the power supply are both run to the adapters, which have screwless connection terminals. The 4-core connection cable is not part of the mounting set.

BOP/AOP door mounting set for multiple VSD control

ASN: SED2-DOOR-KIT2

The AOP communicates with several SED2 drives via RS485 (USS protocol). This mounting set allows for controlling several VSDs in a control panel by means of one AOP (mounted in the control cabinet door). Thus, up to 31 VSDs can be controlled from one AOP.
The AOP interface print also contains a separate RS232 interface. The VSD uses this interface to communicate with a PC. The cables are not included in the set.

PC – SED2 connection set

ASN: SED2-PC-KIT

This kit helps control or program the SED2 from a PC via the serial interface RS232 by using a commissioning software. The set contains an RS232 adapter card which is snapped on the VSD in place of the AOP or BOP. The RS485 interface is not used.

PC – AOP kit

ASN: SED2-PC-AOP-KIT

Allows for programming the AOP independent of the VSD from a PC, or to download or upload complete sets of parameters. The kit consists of a 3 m long modem cable and a power supply unit (to supply power to the AOP). The kit does not include the AOP.

Communication interface module

The LON module is not yet available.
Expect for end of 2002.

Software options

The commissioning software is not yet available.

9.1.1 Retrofitting EMC filters for VSD frame sizes A to C

The SED2 VSDs of frame sizes A to C without filter can be retrofitted with footprint filters as needed. Mounting instructions are included in the filter packing.
Below are the order numbers for the voltage ranges and frame sizes:

Frame size	200 V to 240 V, 3 AC	380 V to 480 V, 3 AC	500 V to 575 V, 3 AC
A	**SED2-BFLTR-A**	**SED2-BFLTR-A**	No filter available.
B	**SED2-BFLTR-B**	**SED2-BFLTR-B**	No filter available.
C	**SED2-BFLTR-C-L**	**SED2-BFLTR-C-H**	No filter available.

9.2 Applicable standards

European low-voltage guideline

The SED2 product range corresponds to the requirements of the low-voltage guideline 73/23/EEC, supplemented by guideline 98/68/EEC. The devices have been certified to the following standards:

EN 60146-1-1 Semiconductor inverters – General requirements and line commutated inverters.

EN 60204-1 Safety of machinery – Electrical equipment of machines.

European guideline for machinery

This guideline does not apply to the SED2 VSD product series. The products were tested comprehensively and evaluated for adherence to important guidelines pertaining to health and safety in a typical application. A declaration of conformity will be provided on request.

European EMC guideline

If installed according to the recommendations issued in this manual, the SED2 satisfies all EMC guideline requirements as defined in the EMC Product Standard for Power Drive Systems EN61800-3.

Underwriters Laboratories

Frequency inverter devices 5B33 approved by UL and CUL for use in pollution class 2 environments.

ISO 9001

Siemens SBT applies a quality management system according to the requirements of ISO 9001.

9.3 List of abbreviations

AC	Alternating current.
A/D	Analog / digital converter (also called ADC).
AIN	Analog input.
AOP	Advanced operator panel (AOP).
AOUT	Analog output.
BACS	Building automation and control system; do not confuse with building management system BMS.
BI	Binector input, i.e., the parameter selects the source of the binary signal.
BO	Binector output, i.e., the parameter connects as a binary signal.
BOP	Basic operator panel (BOP).
CB	Communication board.
CDS	Command data set.
CI	Plug input, i.e., the parameter selects the source of the analog signal.
CO	Plug output, i.e., the parameter connects as an analog signal.
CO/BO	Plug/binector output, i.e., the parameter connects as an analog and/or binary signal.
D/A	Digital / analog converter (also called DAC).
DC	Direct current.
Destaging	For pumps (or fans): The process of stopping an additional motor with constant speed to reduce power.
DIN	Digital input.
DOUT	Digital output.
ELCB	Earth leakage circuit breaker.
EMC	Electromagnetic compatibility.
EMI	Electromagnetic interference.
FCC	Flux current control.
FS	Frame size of the SED2 variable speed drives.
IEC	International electrotechnical commission.
IGBT	Insulated gate bipolar transistor.
IPxx	IP number (ingress protection) for the type of protection afforded to the device. IP20 Device protected against intrusion of items greater >12 mm. No protection against water. (Corresponds to the US standard NEMA 1). IP54 Device protected against dust and spray from all directions. (Corresponds to the US standard NEMA 12).
LCD	Liquid crystal display.
PID	Proportional, integral, differential (controller).
PTC	Positive temperature coefficient.
RCCB	Residual current circuit breaker.

Staging	For pumps (or fans): The process of starting an additional motor with constant speed to increase power.
USS	Universal serial interface protocol.
VSD	Variable speed drive.
Y-condensator	Star condensator.

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