POWER ELECTRONICS

SD150

GETTING STARTED MANUAL

LOW VOLTAGE VARIABLE SPEED DRIVE

SD150

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Getting Started Manual

Variable Speed Drive

Edition: March 2022

SD15IM01AI Rev. A

ABOUT THIS MANUAL

PURPOSE

This manual contains important instructions for the installation, configuration and use of Power Electronics SD150 variable speed drives. From now on, this manual refers to SD150 with the term “drive” or “equipment”.

Power Electronics reserves the right to modify product features.

TARGET AUDIENCE

EN

This manual is intended for qualified customers who will install, configure and operate Power Electronics SD150 variable speed drives.

Only qualified technical personnel validated by Power Electronics may install and start up the drives.

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REVISIONS CONTROL

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ACRONYMS

The terms commonly used in the documentation of Power Electronics' products are listed in the table below.

Please notice this is a general series of terms and it encompasses all our product divisions (industrial, solar, storage, and electric mobility), thus, some of the following expressions may not apply to this particular manual.

ACRONYM	MEANING
AASS	Auxiliary Services
AC	Alternating Current
AI	Analogue Input
AO	Analogue Output
BESS	Battery Energy Storage System
BMS	Battery Manager Solution
CCID	Charge circuit interrupting device
CCL	Charge Current Limit.
CCS	Combined charging system – charging and communications protocol following the standard IEC 61851-23 Annex CC
CHAdeMO	Charging and communications protocol following the standard IEC 61851-23 Annex AA
CPU	Central Processing Unit
DC	Direct Current
DCL	Discharge Current Limit
DI	Digital Input
DSP	Digital Signal Processor
DO	Digital Output
EMS	Energy Management System
EV	Electric Vehicle
FPGA	Programmable device (Field-Programmable Gate Array)
FRU	Field Replaceable Unit
GFDI	Ground Fault Detector Interrupter
GPRS	General Packet Radio Services, a data transmission system
HVAC	Heating, Ventilation, and Air Conditioning
IGBT	Insulated Gate Bipolar Transistor
IMI	Insulation monitoring device
IT	Grid system where the power supply is kept isolated and the electrical equipment system is grounded.
LOTO	Lock Out – Tag Out
MCB	Miniature Circuit Breaker
MPCS	Multi Power Conversion System
MID	Measuring Instrument Directive
MV	Medium Voltage. This term is used to refer to high voltage in general
PE	Ground connection
PI	Proportional and Integral
POI	Point Of Interconnection
PPE	Personal Protection Equipment
PV	Photovoltaic energy
RCD	Residual Current Device

ACRONYM	MEANING
RCM	Residual Current Monitor
RFID	Radio Frequency Identification
SOC	State Of Charge – referred to battery
SOH	State Of Health – referred to battery. It compares the actual state of the battery to its initial conditions. It is measured in percentage
STO	Safe Torque Off
TN	Grid system where the power supply is grounded, and the electrical equipment system is brought to the same ground through the neutral connector.
TT	Grid system where both the power supply and the electrical devices are connected to the ground via separate connections
UPS	Uninterruptible Power Supply
VSD / VFD	Variable Speed Drive, Variable Frequency Drive. Both terms are used

SAFETY SYMBOLS

Always follow safety instructions to prevent accidents and potential hazards from occurring.

In this manual, safety messages are classified as follows:

	**WARNING**	Identifies potentially hazardous situations where dangerous voltage may be present, which if not avoided, could result in minor personal injury, serious injury or death. Be extremely careful and follow the instructions to avoid the risk of electrical shocks.
	**CAUTION**	Identifies potentially hazardous situations, which if not avoided, could result in product damage, or minor or moderate personal injury. Read the message and follow the instructions carefully.
	**NOTICE**	Identifies important measures to take in order to prevent damage equipment and warranty lost, as well as encouraging good use and environmental practices.

Other symbols used in this manual for safety messages are the following:

	Hot surface. Be careful and follow the instructions to avoid burns and personal injuries.
	Risk of fire. Be careful and follow the instructions to prevent causing an unintentional fire.
	Caution, risk of electric shock. Energy storage timed discharge. Wait for the indicated time to avoid electrical hazards.
	Caution, risk of hearing damage. Wear hearing protection.

SAFETY INSTRUCTIONS

IMPORTANT!

Read carefully all documentation before manipulating the equipment and pay special attention to safety recommendations to maximize the performance of this product and to ensure its safe use and installation.

It is the installer's responsibility to follow the instructions provided on this manual, to follow good electrical practices and to identify all mentioned warnings and recommendations before starting up and operating the SD150.

WARNING

Do not remove the cover while the drive is powered or running.
Otherwise, you may get an electric shock.

Do not run the drive with the front cover removed.
Otherwise, you may get an electric shock.

The drive does not remove the voltage from the input terminals of the drive. Before working on the drive, isolate the whole drive from the supply.
If you do not remove the power supply, you may get an electric shock.

Do not remove the cover except for periodic inspections or wiring, even if the input power is not applied.
Otherwise, you get an electric shock.

Operate the drive with dry hands.
Otherwise, you may get an electric shock.

Do not use cables with damaged insulation.
Otherwise, you may get an electric shock.

Do not subject the cables to abrasions, excessive stress, heavy loads, or pinching.
Otherwise, you may get an electric shock.

Do not make any insulation or voltage withstand tests on the motor while the drive is connected.

WARNING

10 min

Both wiring and periodic inspections must be carried out at least 10 minutes after disconnecting the input power. To remove the front cover, make sure that the red "DC Link" LED is off. Then remove the metal cover from the terminals and check the following with a multimeter:

- **Voltage between the output busbars U, V, W, and the cabinet is around 0V.**
- **Voltage between the terminals + HVDC, -HVDC and the cabinet is below 30VDC.**

If you omit this recommendation, you may get an electric shock.

Even though multimeters have their own revisions Schedule, it is convenient to verify it works properly, specially to check voltage absence. It could be damaged and show incorrect values. Use a 1.5V battery to verify proper functioning.

CAUTION

Install the drive on a non-flammable surface. Do not place flammable material nearby.
Otherwise, a fire could occur.

Disconnect the input power if the drive is damaged.
Otherwise, it could result in a secondary accident or fire.

Do not allow lint, paper, wood chips, dust, metallic chips, or other foreign matter into the drive.
Otherwise, a fire or accident could occur.

After stopping the drive, some of its parts will stay warm for a while. Wait for the drive to cool down for handling.
Touching hot parts may result in skin burns.

Do not apply power to a damaged drive or to a drive with parts missing, even if the installation is complete.
Otherwise, you may get an electric shock.

It is not allowed to weld the cabinet or structure; this could damage the sensitive electronic components inside the cabinet or structure.

NOTICE

RECEPTION

SD150 drives are delivered tested and perfectly packed.
In the event of damage during transport, please ensure to notify the transport agency and POWER ELECTRONICS: 902 40 20 70 (International +34 96 136 65 57) or your nearest agent, within 24h from receiving the goods.

UNPACKING

Make sure model and serial number of the variable speed drive are the same on the box, delivery note and unit.
Each variable speed drive is delivered with Hardware and Software technical manuals.

RECYCLING

Packaging equipment must be recycled. Separate all different materials (plastic, paper, cardboard, wood…) and place them in the corresponding containers. Ensure waste collection is properly managed with a Non-Hazardous Waste Agent.

To guarantee health and natural environmental sources protection, the European Union has adopted the WEEE directive concerning discarded electric and electronic equipment (SEEA).

Waste of electrical and electronic equipment (WEEE) must be collected selectively for proper environmental management.

Our products contain electronic cards, capacitors and other electronic devices that should be separated when they are no longer functional. These WEEEs should be managed accordingly with a Hazardous Waste Agent.

Power Electronics promotes good environmental practices and recommends that all its products sold outside of the European Union, once they reach the end of their life, are separated and the WEEE managed according to the particular country applicable legislation (especially: electronic cards, capacitors, and other electronic devices).

If you have any questions about the electric and electronic equipment waste, please contact Power Electronics.

ELECTROMAGNETIC COMPATIBILITY (EMC)

The drive is intended to be used in industrial environment (Second Environment). It achieves compliance with category C3 defined in IEC/EN 61800-3 standard when the installation recommendations within this manual are followed. The driver can optionally operate in domestic environments (First Environment), complying with category C2 defined in IEC / EN 61800-3 standard. For category C1 consult Power Electronics. Optional IT filter.

Select communication and control system according to the drive EMC environment. Otherwise, systems could suffer from interferences due to a low EMS level.

CAPACITORS DEPLETION

If the drive has not been operated for a long time, capacitors lose their charging characteristics and are depleted. To prevent depletion, once a year run the device under no-load conditions during 30-60 minutes.

SAFETY

- Before operating the drive, read this manual thoroughly to gain an understanding of the unit. If any doubt exists, please contact POWER ELECTRONICS, (902 40 20 70 / +34 96 136 65 57) or your nearest agent.
- Wear safety glasses when operating the drive with power applied or for when the front cover is removed.
- Handle and transport the drive following the recommendations within this manual.
- Install the drive according to the instructions within this manual and the local regulations.
- Do not place heavy objects on the drive.
- Ensure that the drive is mounted vertically and keeping the minimum clearance distances.
- Do not drop the drive or subject it to impact.
- The SD150 drives contain static sensitive printed circuits boards. Use anti-static safety procedures when handling these boards.
- Avoid installing the drive in conditions that differ from those described in the Environmental Ratings section.

CONNECTION PRECAUTIONS

- To ensure a correct operation of the drive, it is recommended to use a SCREENED CABLE for the control wiring.
- The motor cable should comply with the requirements within this manual. Due to increased leakage capacitance between conductors, the external ground fault protection threshold value should be adjusted ad hoc.
- Do not disconnect motor cables if the input power supply remains connected.
- The internal circuits of the SD150 Series will be damaged if the incoming power is connected and applied to output terminals (U, V, W).
- Do not use power factor correction capacitors banks, surge suppressors, or RFI filters on the output side of the drive. Doing so may damage these components.
- Always check whether the “DC Link” red LED is OFF before wiring terminals. The capacitors may hold high-voltage even after the input power is disconnected.
- Do not connect the drive in grids whose THDv is higher than 8%.

COMMISSIONING

- Verify all parameters before operating the drive. Alteration of parameters may be required depending on application and load.
- Always apply voltage and current signals to each terminal that are within the levels indicated in this manual. Otherwise, damage to the drive may occur.
- For correct starting, refer to the start-up section.

HANDLING PRECAUTIONS

- When the "Automatic Restart" function is selected, observe the appropriate safety measures to avoid any damage in case of sudden restart of the motor after an emergency and subsequent reset.
- The "STOP / RESET" key on the driver's own keypad will be operative as long as this option has been selected. By pressing this button, the drive will not perform an emergency stop. The driver has a STO function which, installed with an external EMERGENCY pushbutton, will disconnect the motor power supply and prevent the ability to generate torque in the motor.
- If an alarm is reset without having lost the reference signal (setpoint), an automatic start may occur. Check that the system has not been configured as such. Failure to do so could result in personal injury.
- Do not modify anything inside the driver without the supervision of Power Electronics.
- Before starting the parameter setting, reset all parameters.

EARTH CONNECTION

- Ground the drive and adjoining cabinets to ensure a safe operation and to reduce electromagnetic emission.
- Connect the input PE terminal only to the dedicated PE terminal of the drive. Do not use the case, nor chassis screw for grounding.
- Ground the drive chassis through the labelled terminals. Use appropriate conductors to comply with local regulations. The ground conductor should be connected first and removed last.
- Motor ground cable must be connected to the PE output terminal of the drive and not to the installation's ground. We recommend that the section of the ground conductor (PE) is equal or greater than the active conductor (U, V, W).
- If the user decides to use screened motor cable, ensure a good 360° connection of the cable screen in both the drive cabinet and the motor terminal box.

CYBER SECURITY DISCLAIMER

This product is designed to be connected to and to communicate information and data via a network interface. The customer is the sole responsible for providing and continuously ensuring a secure connection between the product and customer network or any other network (as the case may be). Customer shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of antivirus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Power Electronics and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

TORQUE AND SCREW SIZING

The following table shows, broadly speaking, the recommended tightening torque for both mechanical and electrical connections, applicable to all cabinets [1, 2]:

<table>
<tr><th colspan="2">SCREW SIZE</th><th colspan="4">RECOMMENDED TORQUE</th></tr>
<tr><th rowspan="2">METRIC (mm)</th><th rowspan="2">ENGLISH (inches)</th><th colspan="2">DIN (Nm)</th><th colspan="2">ASTM (ft*lb)</th></tr>
<tr><th>6,9 QUALITY[a]</th><th>8,8 QUALITY[a]</th><th>A449 TYPE 1[a]</th><th>A325 TYPE 1[a]</th></tr>
<tr><td>M3</td><td>1/8</td><td>1</td><td>1,3</td><td rowspan="3">-</td><td rowspan="6">-</td></tr>
<tr><td>M4</td><td>5/32</td><td>2,5</td><td>3</td></tr>
<tr><td>M5</td><td>3/16</td><td>4</td><td>6</td></tr>
<tr><td>M6</td><td>1/4</td><td>5</td><td>10</td><td>4</td></tr>
<tr><td>M8</td><td>5/16</td><td>20</td><td>25</td><td>9</td></tr>
<tr><td>M10</td><td>7/16</td><td>40</td><td>50</td><td>25</td></tr>
<tr><td>M12</td><td>1/2</td><td>60</td><td>70</td><td>38</td><td>50 – 58</td></tr>
<tr><td>M14</td><td>9/16</td><td>100</td><td>120</td><td>54</td><td>-</td></tr>
<tr><td>M16</td><td>5/8</td><td>150</td><td>210</td><td>75</td><td>99 – 120</td></tr>
</table>

[a] For other qualities, follow the screw's manufacturer guidelines.

CAUTION

For all screwing that hold a **particular component** such as a bus, contactor, etc. it will be necessary to **apply the tightening torque indicated by the manufacturer** of the same component.

Screwing should be tightened correctly only when necessary, i.e. when the factory marks are not in place. For small screws that do not have marks, the good electrical praxis will determine if it is loose.

[1] Power Electronics recommends the use of **Zinc Steel quality 8.8 bolts for internal connections** in general, DC and earth connections included.

[2] Power Electronics recommends the use of **A2-70 stainless bolts for external connections** in general, AC connections included.

1. INTRODUCTION

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The SD150 is a high-performance general purpose AC driver. It excels in demanding heavy-duty applications that require high starting torque and precise control. The dual duty rating of the IP20 models ensures compatibility with all normal duty loads. The versatile SD150 is ideal for applications in water treatment and irrigation, food and beverage, ventilation systems, materials handling, packaging systems, textiles, plastic, wood processing, in fact, any general-purpose application where apparatus and machinery needs to be automated.

Some of its outstanding features are:

- Easy-to-use, compact and robust product, offering users savings in time and space.
- Space saving design with side by side mounting.
- The overall motor control features and the motor/drive protection functions limit unexpected machine downtime.
- A built-in display with keypad offers programming and operation capabilities.
- Integrated communication port and Modbus protocol allows the SD150 to exchange data for machine/process monitoring, control and preventive maintenance.

2. CONFIGURATION TABLE & STANDARD RATINGS

2

Configuration table

The following table shows the configuration table for SD150 drives manufactured by Power Electronics:

SERIE	DRIVE CURRENT (NORMAL DUTY)		EMC FILTER	
SD150	003	2A	F	Extended
	…	…	–	Standard
	12	12A	–	–

The equipment is coded according to the order in the table above. Some examples are shown below:

- **SD1503F:** SD150, 3A, EMC extended.
- **SD1508F:** SD150, 8A, EMC extended.

The following figure shows an example of designation label:

Standard ratings – 230Vac single-phase

The following table shows the standard ratings frames 1 and 2 for a voltage of 230Vac single-phase.

IP20			
POWER HD (kW)	CURRENT HD (A)	MODEL	FRAME
0,4	3	SD1503F	1
0,75	5	SD1505F	
1,5	8	SD1508F	2
2	12	SD1512F	

Notes:

- The rated output current is limited depending on the setup of carrier frequency (Cn 4).
- The maximum output voltage cannot exceed the power voltage. The output voltage can be set below the power voltage.
- The output voltage is 20–40% less than normal when a motor is not connected to protect the driver

3. TECHNICAL CHARACTERISTICS

3

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INPUT	Power ranges		0,4 kW ~ 2,2 kW – 230 V single phase
	Voltage range		230V: 200 – 240V single phase
	EMC Filter		C2 (First environment)
OUTPUT	Control method		V/F control, slip compensation, simple sensorless
	Frequency settings power resolution		Digital command: 0,01 Hz Analog command: 0,06 Hz (60 Hz standard)
	Frequency accuracy		1% of maximum output frequency
	V/F pattern		Linear, square reduction, user V/F
	Overload capacity		Rated current: 150%, 1 min
	Torque boost		Manual torque boost or automatic
OPERATION	Operation type		Keypad / Terminal strip / Communication operation
	Frequency settings		Analog type: V1terminal 0 –10 V, I2 terminal 0 – 20 mA and 0 – 10 V / Digital type: keypad input
	Operation function		Anti-forward and reverse direction rotation. Frequency jump. Frequency limit. Jog operation. Up-down operation. 3-wire operation. Dwell operation. Slip compensation. PID control. Energy saving operation. Speed search. Automatic restart.
	Input	Multi-function terminal	PNP (Source) or NPN (Sink) mode. The function can be set depending on the parameter settings at In 65–69. Forward direction operation. Reset. Emergency stop. Multi-step speed frequency-high/med/low. Frequency increase. 3-wire. Select acc/dec/stop. Reverse direction operation. External trip. Jog operation. Multi-step acc/dec-high/med/low. Second motor selection. Frequency reduction. Fix analog command frequency. Transition from PID to general operation.
	Output	Multi-function relay terminal	Fault output and driver operation status output. Less than (N.O., N.C.) AC250V 1A, less than DC 30 V, 1 A.
		Analog output	0–10 Vdc: Selects frequency, output current, output voltage, DC terminal voltage and others.
PROTECTION FUNCTION	Trip		Motor overheat trip. Motor overload trip. Output open-phase trip. External signal trip. Inverter overload trip. Command loss trip. Over current trip. Inverters overheat. Over voltage trip. Ground trip. COM trip. Fan trip. Low voltage trip. Command loss trip.
	Alarm		Overload alarm
	Instantaneous blackout		Less than15 ms: continue operation (must be within the rated input voltage and rated output range). More than 15 ms: auto restart operation.
STRUCTURE/ WORKING ENVIRONMENT	Cooling type		Forced fan cooling structure (0,4 – 2,2 kW).
	Protection structure		IP 20, UL Open Type.
	Ambient temperature		-10 – 50°C (14 – 122°F) (No ice or frost should be present).
	Ambient humidity		Relative humidity less than 95% RH (to avoid condensation forming).
	Storage temperature		-20°C – 65°C (- 4 –149°F).
	Surrounding environment		Prevent contact with corrosive gases, inflammable gases, oil stains, dust, and other pollutants (pollution degree 2).
	Operation altitude/oscillation		No higher than 3280ft (1,000 m). Less than 9.8 m/sec^2 (1G).
	Pressure		70 – 106 kPa

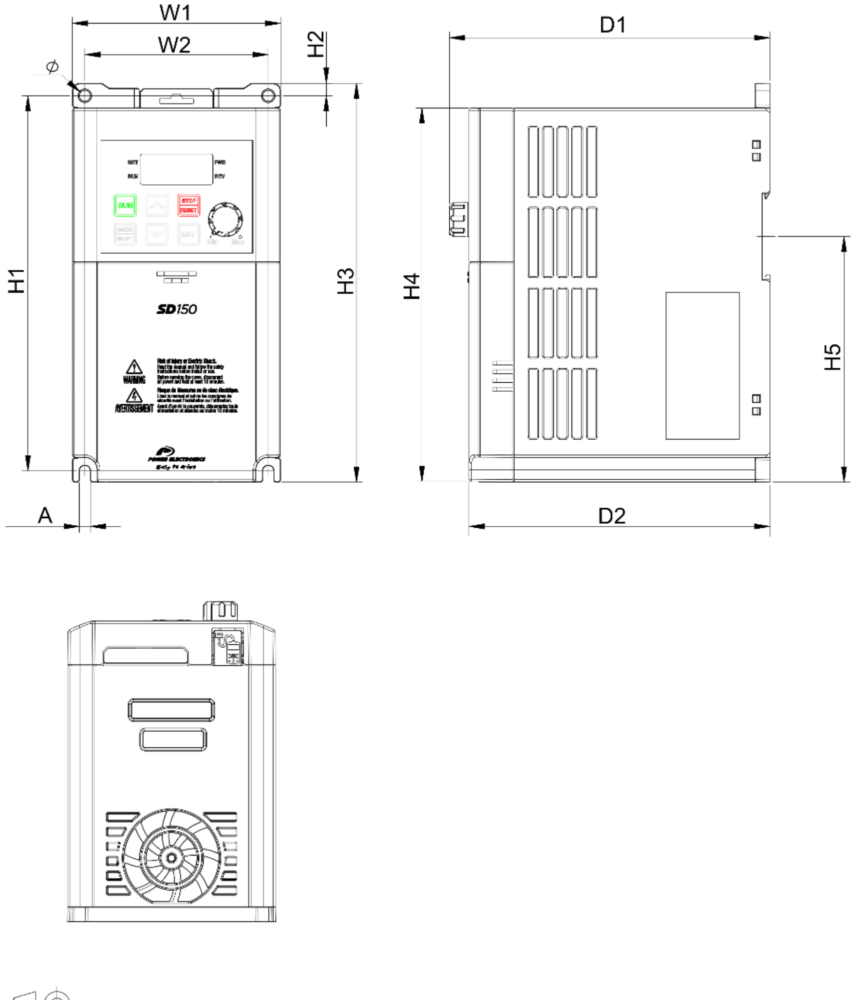
4. DIMENSIONS

4

The dimensions and weight of the SD150 equipment are detailed in this section.

Dimensions of frame 1

The top, front, and left views of SD150 drives frame 1 are shown below:



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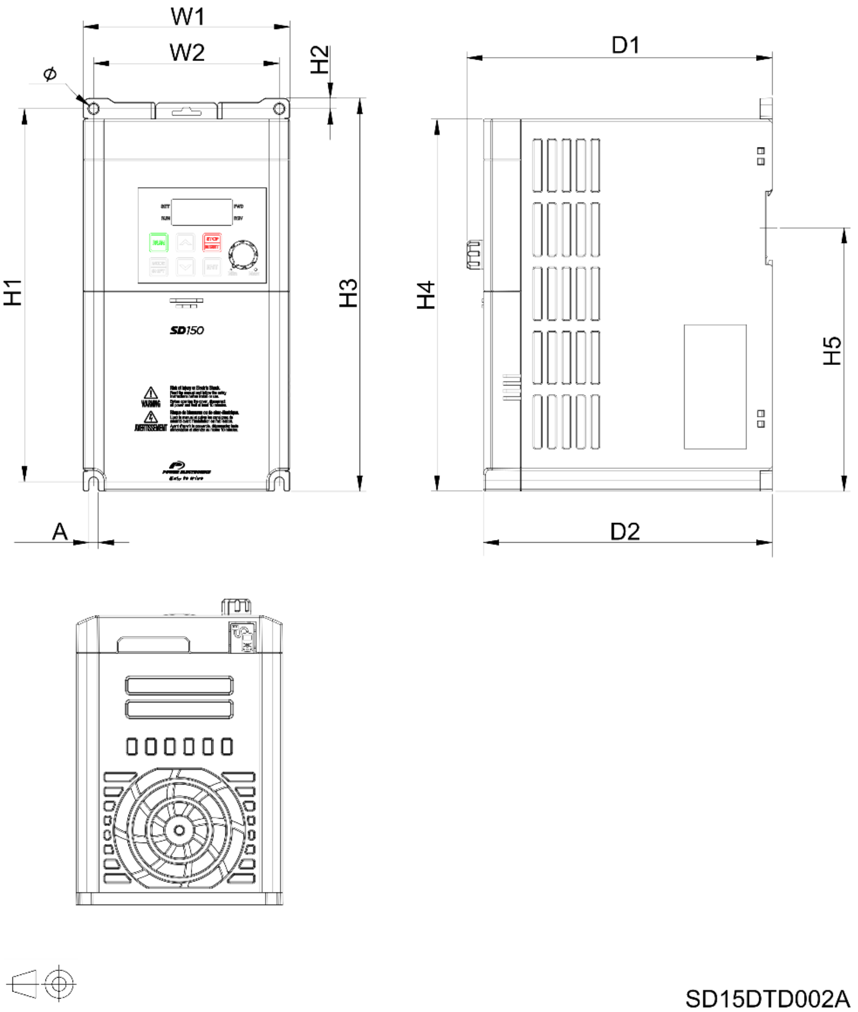
DIMENSIONS mm (inch)											WEIGHT kg (lb)
W1	W2	D1	D2	H1	H2	H3	H4	H5	A	∅	
100 (3.94")	200 (7.87")	148 (5.83")	140 (5.51")	180.5 (7.11")	5 (0.20")	190 (7.48")	180 (7.09")	127.5 (5.02")	4.5 (0.18")	4.5 (0.18")	1.45 (3.20lb)

The following table shows the input voltage for frame 1 equipment:

INPUT VOLTAGE	PHASES	EQUIPMENT
230V	1	SD1503F, SD1505F

Dimensions of frame 2

The top, front, and left views of SD150 drives frame 2 are shown below:



DIMENSIONS mm (inch)											WEIGHT kg (lb)
W1	W2	D1	D2	H1	H2	H3	H4	H5	A	∅	
100 (3.94”)	90 (3.54”)	148 (5.83”)	140 (5.51”)	180.5 (7.11”)	5 (0.20”)	190 (7.48”)	180 (7.09”)	127.5 (5.02”)	4.5 (0.18”)	4.5 (0.18”)	3.3 (7.27lb)

The following table shows the input voltage for frame 2 equipment:

INPUT VOLTAGE	PHASES	EQUIPMENT
230V	1	SD1508F, SD1512F

5. RECEPTION, HANDLING AND TRANSPORTATION

5

CAUTION

Read carefully the following installation instructions for a correct mechanical installation. Otherwise, the equipment can be damaged and lead to personal injury.

Reception

Power Electronics' equipment are carefully tested and packed for shipment. In the event of damage to the unit during transportation notify the transport agency and Power Electronics: 902 40 20 70 (International +34 96 136 65 57) or your nearest agent, within 24h from receipt of the goods.

Make sure model and serial number of the drive match the information on the delivery packing list.

The drive should be stored in a location that is protected from direct sun and moisture excess. The storage temperature rating for the drive is -10°C and +50°C, < 95 RH without condensation. It is recommended not to stack more than two units.

Standard storage

In case the equipment is stored for a short period (up to 6 months) before its connection, the following rules will keep the unit safe until it is ready for installation:

- The equipment should be stored in a location that is protected from moisture (inside and outside the equipment).
- Avoid floodable grounds. No part of the equipment should ever be submerged under water.
- Temperature in the storage location must be kept between -20ºC and +º65C (-4ºF and +149ºF).
- Store unit on a flat, even surface.
- Store unit away from high traffic areas where the drive could get damaged.
- Make sure animals cannot get inside the unit.
- Keep doors closed and covers in place during storage.
- Store unit away from corrosive chemical products or gases.
- Keep the equipment packed until the moment of installation.

Extended storage

If the equipment is stored for an extended period (more than 6 months) before installation for an undefined date, new considerations should be taken, in addition to the recommendations in section Standard storage.

- The drive must be stored in its original packaging.
- Draining bags shall be included inside the packaging to prevent moisture from damaging the equipment or its electronic components. These shall be replaced when storage conditions require it.
- Periodic inspections of the internal equipment status should be performed when possible. Proper internal cleanness must also be checked.
- To prevent deterioration of the capacitors, connect the equipment without load for 30-60 minutes once a year.
- Before commissioning, it is recommended to follow the instructions to connect power supply safely to the equipment. Please refer to document VFIC001.

Handling and Transportation

SD150 is delivered horizontally in a cardboard box. Unpack the drive carefully. Do not use sharp tools as they could damage the product. After opening the package, please check the contained goods. Verify the item numbers contained within the package with the packing inventory list. Please remove and set aside any spare parts shipped with the product. There should be no evident damage caused by vibration, dropping or moisture.
To unpack, carefully extract the drive from the box. The drive is packed with its frontal side facing up. Remove and place in its vertical standing position.

CAUTION

If the weight of the load to be handled is greater than the maximum permissible weight of the crane, it could damage the equipment and personnel.

6. MECHANICAL INSTALLATION

6

CAUTION

The installation must be done by qualified personal.
Otherwise, the equipment can be damaged and lead to personal injury.

Before installation, make sure the location chosen is appropriate. There should be sufficient space to adapt the unit to the recommended distances and to ensure that there are no obstacles preventing the airflow from the fans.

Environmental ratings

Power Electronics recommends following the instructions in this manual carefully to ensure a correct operation of the drive. The installer is responsible for performing a proper installation in order to comply with the ambient conditions of the drive. In addition, the installer is solely responsible for complying with the local regulations. The environmental conditions are:

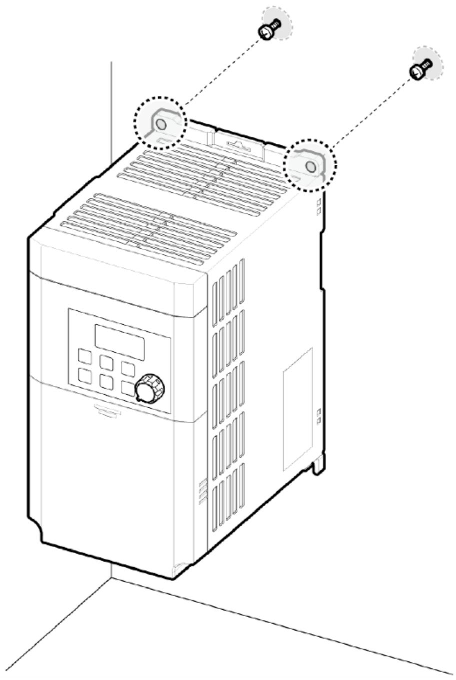
• Environmental category:	Indoor / Outdoor
• Pollution degree:	PD2
• Ingress protection rating:	IP20 UL open type
• Cooling type:	Natural cooling structure: 0,1 – 0,2 kW. Forced fan cooling structure: 0,4 – 2,2 kW.
• Operation Ambient temperature:	-10~50˚C (14~122˚F) No cold, no frost.
• Storage Ambient temperature:	-20~65˚C (-4~149˚F)
• Humidity:	Relative humidity below 95% RH (no dew formation)
• Altitude / Vibration:	Below 1,000m, below 9.8 m/s² (1G)
• Pressure:	70~106 kPa

Drive mounting

The SD150 variable speed drives are designed to be mounted on a wall or inside a panel. The location must be free from vibration as this may adversely affect the operation of the driver. Furthermore, sufficient space must be ensured to meet the ventilation specifications of the equipment.

The drive can become very hot during operation. Install the drive on a surface that is fire-resistant or flame-retardant and with sufficient clearance around the driver to allow air to circulate. Make sure to follow the clearance recommendations in Clearances section.

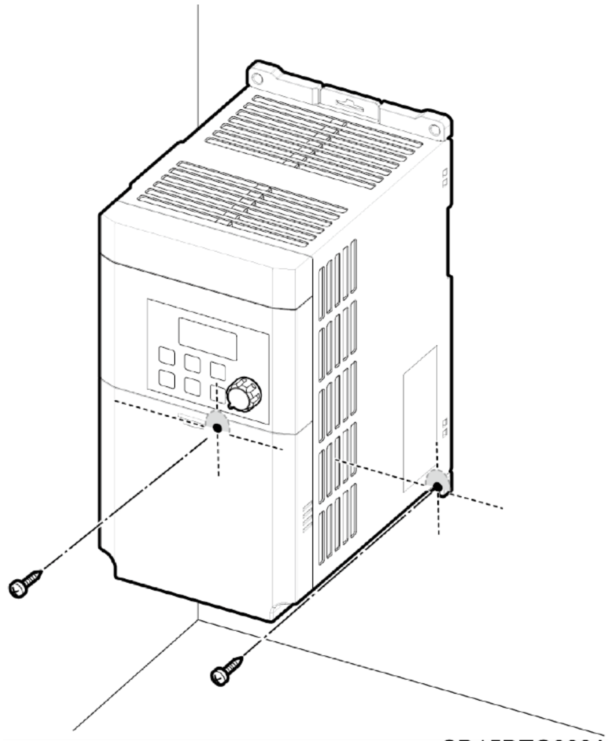
Use a level to draw a horizontal line on the mounting surface and mark the fixing points. Then, drill the two upper mounting bolt holes, and then install the mounting bolts. Do not fully tighten the bolts yet. Use the following image as a guide.



SD15DTG002A

Mount the drive on the wall or inside the panel using the top two bolts and then fully tighten the mounting bolts. Ensure that the drive is placed flat on the mounting surface and that the surface can securely support the weight of the drive. Use the following image as a guide.

EN



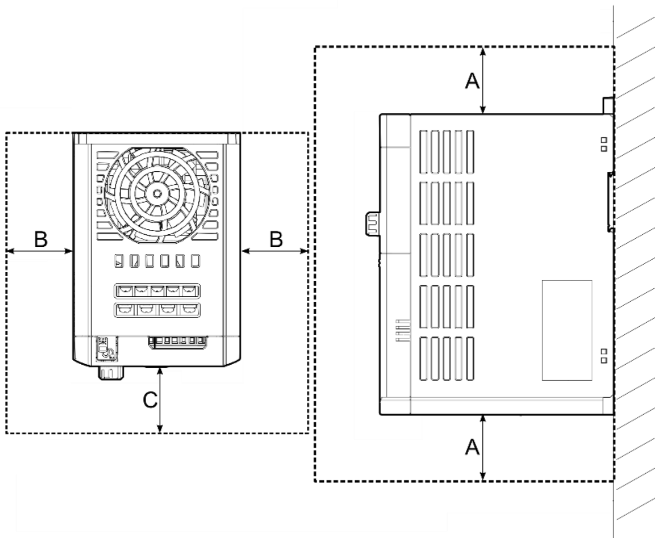
SD15DTG003A

Note: The quantity and dimensions of the mounting brackets vary based on frame size. Please refer to section Dimensions to find the information that corresponds to your model.

Clearances

The SD150 variable speed drive must be installed vertically, on a wall or inside a panel, with its back side flat on the mounting surface.

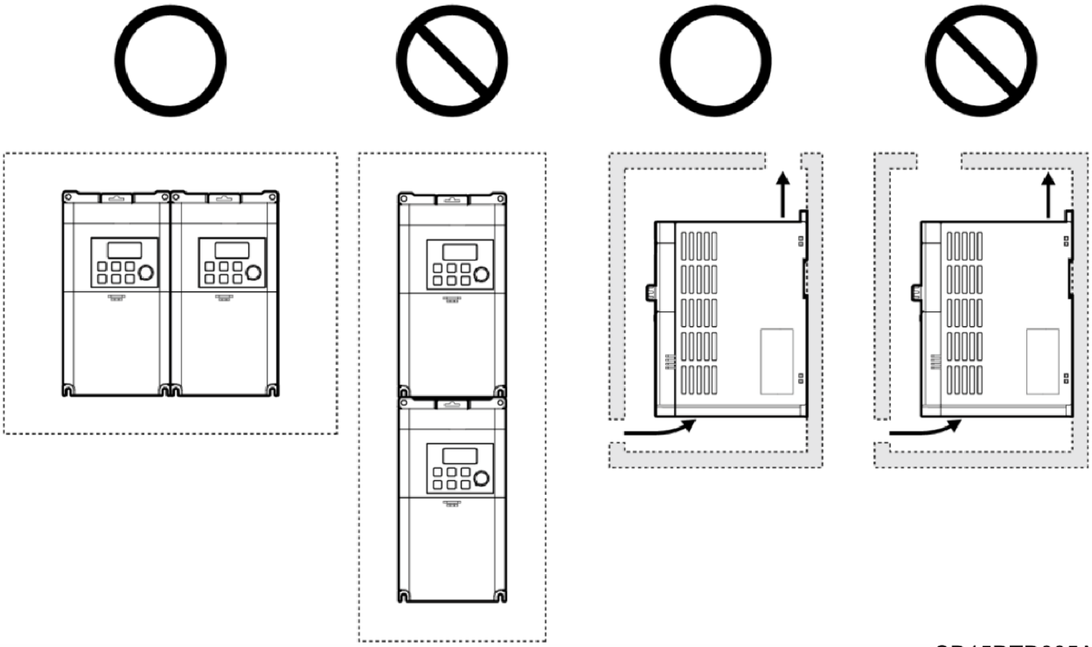
The following image and table show the minimum clearance distances for all SD150 variable speed drives.



SD15DTD003A

FRAME	MINIMUM CLEARANCE mm (inches)		
	A	B	C
1	100 (4”)	50 (2”)	50 (2”)
2	100 (4”)	50 (2”)	50 (2”)

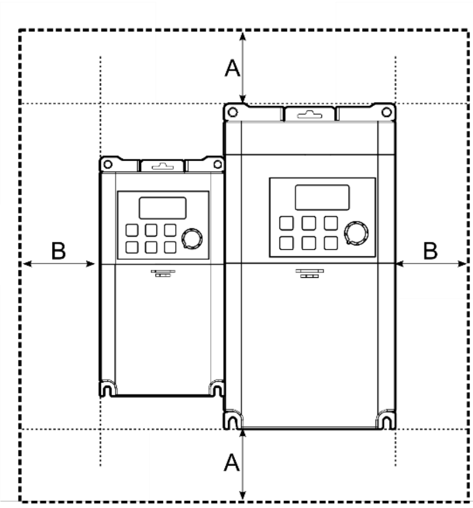
It is necessary to ensure that there is sufficient air circulation space around the drive when it is installed. If the drive is installed inside a panel or cabinet, consider the position of the drive fan and the ventilation grille. The cooling fan should be positioned so that it effectively transfers the heat generated during drive operation.



SD15DTD005A

If multiple equiment of different sizes are installed, it is necessary to leave sufficient clearance to meet the clearance specifications of the largest drive.

The following figure and table show the minimum clearances for the installation of different frames.



SD15DTD004A

FRAME	MINIMUM CLEARANCE mm (inches)		
	A	B	C
1	100 (4")	50 (2")	50 (2")
2	100 (4")	50 (2")	50 (2")

NOTICE

In case several drives are installed in one location, it is necessary to arrange them horizontally and remove their top covers. Use a flat screwdriver to remove the covers.
Otherwise, the equipment may be damaged, and the warranty will be voided.

EN

Cooling

The heat sources inside the equipment correspond to the inverter bridge (IGBT), rectifier bridge and the input filter.

The drive has at least one cooling fan (this varies depending on the drive frame) at the bottom, the hot air is then dissipated through the gratings on the top side.

It is possible to replace the cooling fans without dismounting the whole equipment. To do this, unscrew the screws in the fan corners and disconnect the connector.

NOTICE

Ensure that the technical room or cabinet has good air flow, considering that hot air cannot be recirculated by the drive.

Fan air flow

The following table shows the far air flow and the rated speed for frames 1 and 2.

INPUT VOLTAGE	CAPACITY	AVERAGE AIR VOLUME (m^3/min)		RATED SPEED		FRAME
		MINIMUM (m^3/min)	NOMINAL (m^3/min)	MINIMUM (m^{-1})	NOMINAL (m^{-1})	
230 V – single phase	0,4 kW	0,21	0,24	7300	8000	1
	0,75 kW					
	1,5 kW	0,53	0,63	4050	4400	2
	2,2 kW					

7.POWER CONNECTION

CAUTION

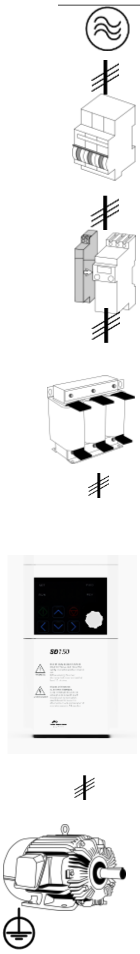
Please read the following instructions for proper electrical installation.
Otherwise, it could result in damage to equipment and personnel.

NOTICE

Consult the recommended tightening torque for both mechanical and electrical connections in section Torque and screw sizing.

Basic configuration

Select the appropriate safety equipment and perform the wiring properly to ensure proper operation of the equipment. Incorrect application or installation can lead to malfunction of the drive and consequently reduce its life or damage its components. Read and understand this manual thoroughly before performing any operations.



AC Power Supply	Use a power supply with a voltage range compatible with the selected drive. SD150 drives are available for TN and TT grids, or IT grids (floating earth). Check the serial number to ensure the correct drive selection.
Circuit Breaker	Select circuit breakers or fuses in accordance with applicable national and local codes. We recommend using specified circuit breakers or fuses to operate with the drive.
Magnetic contactor (optional)	Install if necessary. When installed, do not use it for the purpose of starting or stopping the drive.
AC reactor (optional)	Use an AC reactor if you wish to improve the input power factor of the power supply, reduce harmonics or suppress external surges.
SD150 Installation	Install the drive following the recommendation within this manual in relation with the cooling requirements, position, clearances, wiring access and ground connection.
DC reactor (optional)	DC reactors also contribute to improving the power factor and harmonics reduction, but DC reactors are usually used in facilities with higher power supply capacity.
Motor cables	Select and install the motor cables according to the recommendation within this manual and the applicable national and local codes, otherwise you could cause EMC filtering malfunction and motor damage.
Motor	Do not connect power factor capacitors, surge arrestors or RFI filters to the output side of the drive.

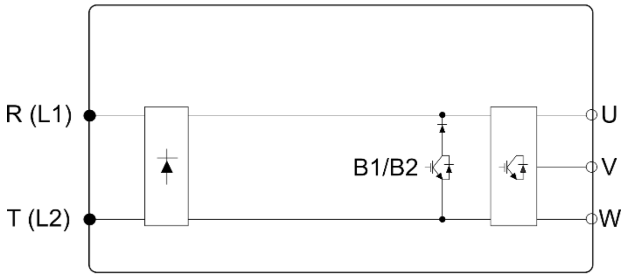
Topology

SD150 drive operates according to the principle of pulse-width modulation (PWM). By varying the power supply voltage and the grid frequency, it is possible to control the speed and torque of the connected induction three-phase motors by means of its main components: rectifier bridge, the DC bus, inverter bridge, and power and control board.

The SD150 includes a gate drive and a control board to control the rectifier thyristor diode's bridge triggering, the inverter IGBT's bridge triggering, the DC bus voltage and the motor performance. In addition, the control board integrates the interface terminals such as communication ports, the digital and analogue inputs and outputs or display among others.

Power terminals

The available power terminals are shown in the figure below. For the power connection, check section Recommended cable section.

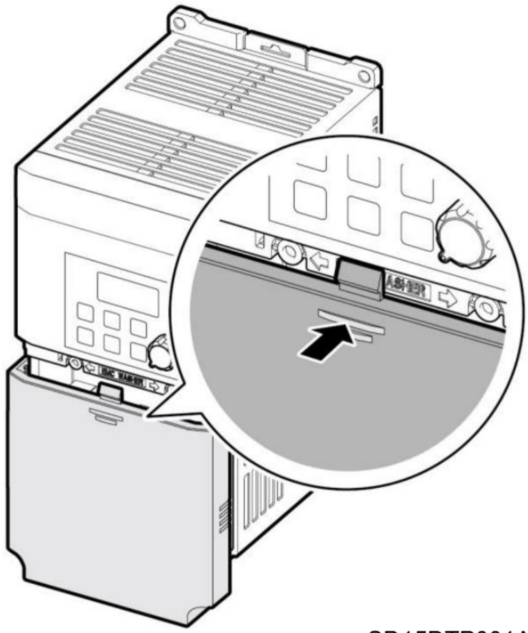


SD15DTP006A

	SIGNAL	DESCRIPTION
DYNAMIC BRAKE	B1 B2	Integrated dynamic brake unit.
POWER SUPPLY	R(L1) T(L2)	AC Line Voltage input. Single-phase 230 Vac.
MOTOR OUTPUT	U V W	Motor connection terminals (3-phase, AC 200 ~ 230 V) (3-phase, AC 380 ~ 480 V)

To access the power terminals, the user must slide the front cover down while pressing and holding the top centre of the cover. Subsequently, the cover must be removed by lifting it up from the bottom and away from the front of the drive.

The following picture shows the removal of the bottom cover of the drive.

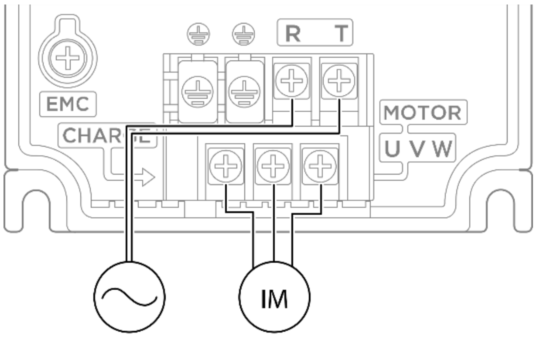


SD15DTP001A

Note: In case the remote keypad is installed, remove the plastic cover under the lower right side of the control terminal cover and connect the remote keypad signal to the RJ-45 connector.

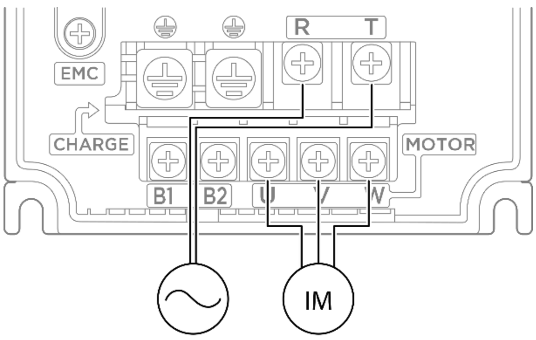
The power terminals for each frame are shown in the following images:

- Frame 1 (0,4 – 0,75 kW)



SD15DTP002A

- Frame 2 (1,5 – 2,2 kW)



SD15DTP003A

Power connection and wiring

CAUTION

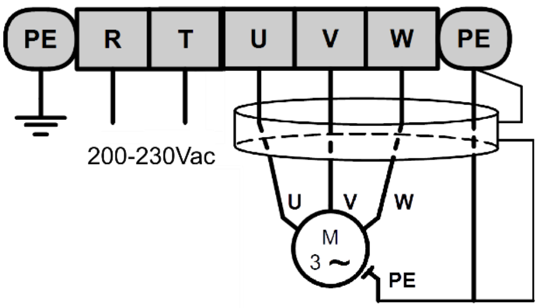
The following installation recommendations are suitable for TN and TT grids. For IT grids, consult Power Electronics. Otherwise, the equipment could be damaged and the risk of injury heightened.

Wiring and periodic inspections must be carried out at least 10 minutes after disconnecting the input power. To remove the front cover, check that the red "DC Link" LED is off. Then remove the metal terminal cover and check the following measurements with a multimeter:

- Check that the voltage between the output terminals, U, V, W and the chassis is around 0V.
- Check that the voltage between the DC +, - terminals and the chassis is below 30VDC.

Failure to observe this safety recommendation may result in electric shock.

The user input and output busbars are labelled according to the following diagram.



SD15DTP004A

As standard, the input and output terminals are made of tin plated copper. If they are oxidized prior to its installation, the terminals will be poorly connected and this is a cause of overheating. To avoid this effect, clean the terminal lugs and all contact surfaces with ethanol and follow the recommended cable section.

Use insulated ring lugs when connecting the power terminals.

CAUTION

The power supply wires must be connected to terminals R and T. Connecting the power supply wires to terminals U, V, and W will cause internal damage to the driver. Connect the motors to the U, V, and W terminals of the motors. The phase sequence arrangement is not necessary.

Do not connect two wires to a single terminal when making wire connections to the power terminals.

It is necessary that the installer guarantees the correct observance of the law and the regulations that are in force in those countries or areas where this device is going to be installed.

Do not use capacitors for power factor correction, surge suppressors, or RFI filters on the output side of the drive. In doing so, the components could get damaged.

STP (shielded twisted pair) cables must be used to connect the motor to the driver. Do not use 3-core cables. If the driver settings are set to default (switching frequency 3kHz), make sure that the total cable length does not exceed 50m.

The voltage drop is defined as:

Voltage Drop (V) = [√3 X cable resistance (mΩ/m) X cable length (m) X current(A)] / 1000

Use cables with the largest possible cross-section to ensure that voltage drop is minimised on long cable runs. Decreasing the carrier frequency and installing a micro surge filter can also help to reduce voltage drop.

DISTANCE	< 50 m (165 ft)	< 100 m (330 ft)	> 100 m (330 ft)
ALLOWED CARRIER FREQUENCY	< 15 kHz	< 5 kHz	< 2.5 kHz

The power cables must have a sufficient power rating in order to prevent overheating and voltage drops. The installer must consider the cable cross-section, cable type, routing method and the ambient conditions to select the appropriate cable. It is only permitted the use of cooper or aluminum cables.

EN

NOTICE

Do not exceed the motor cable distances. Longer cables can cause reduced motor torque in low frequency applications due to the voltage drop, increase circuit susceptibility to stray capacitance which may trigger over-current protection devices or result in a malfunction of the equipment connected to the drive.

Recommended cable section

Power cables must have a sufficient current rating to prevent overheating and significant voltage drops. **Only copper or aluminium cables are permitted.**

The following tables indicate the cable cross-section at the power for frames 1 and 2 of the SD150 variable speed driver . **The installer is responsible for deciding the cross-section, type, wiring method and environmental conditions for selecting the appropriate cable to be installed between the drive and the motor.**

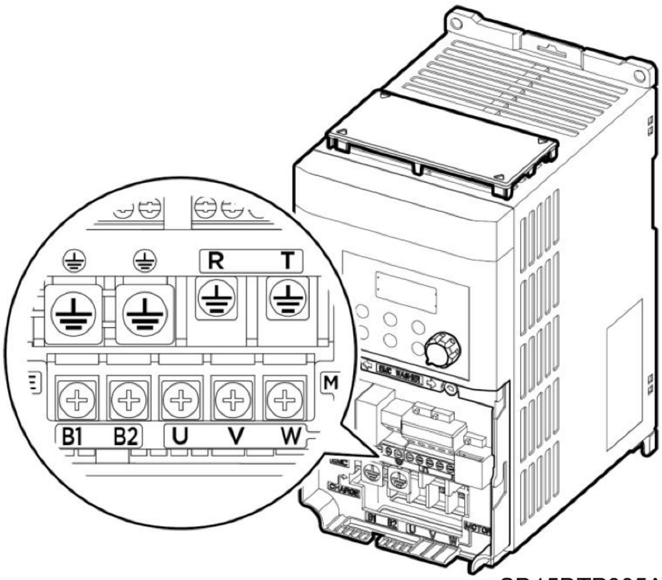
The following table shows the power wiring and ground wiring specifications.

LOAD (kW)		GROUND		CABLE[1]				SCREW			TORQUE (Nm)		
		mm^2	AWG	mm^2		AWG							
				R/T	U/V/W	R/T	U/V/W	R/T	B1/B2	U/V/W	R/T	B1/B2	U/V/W
230V - Single-phase	0,4 0,75	3,5	12	2	2	14	14	M3 (1/8")	M3 (1/8")	M3 (1/8")	5	5	5
	1,5 2,2	3,5	12	3,5	3,5	12	12	M4 (5/32")	M3.5 (9/64")	M3.5 (9/64")	8	0,5	0,5

[1] The wiring of the power terminals must permanently support 600 V and Tº > 75ºC.

Ground connection

Before connecting the power conductors, make sure that the chassis of the drive and the joining cabinets are connected to ground through the dedicated (PE) terminals. These are situated at both sides of the bottom metal walls of the drive, and they are labeled with the earth symbol. Check section Power Terminals.



SD15DTP005A

The motor chassis ground must be connected to the drive. In other words, connect the motor's ground conductor to the PE protection terminal of the drive and not to the installation's ground. It is recommended that the section of the motor ground conductor (PE) has at least the same cross section as the motor power cables sections (U, V, W). Additionally, it must be installed following the recommendations indicated in sections Power connection and wiring.

The line ground must be connected to the drive. In other words, connect the installation's transformer ground conductor to the PE terminal of the drive and not to the installation's ground. We recommend that the cross section of the transformer's ground conductor (PE) complies with the IEC 61800-5-1 standard (10 mm² for copper cables and 16 mm² for aluminium cables). Additionally, it should be installed following the recommendations indicated in sections Power connection and wiring.

When connecting the earth, ensure that all connected cable terminals are properly tight and protected from mechanical forces.

Note: Class 3 grounding is required. The earth resistance must be less than 100 Ω.

CAUTION

For safety reasons, the earth resistance of the installation must be measured. This must be established before the first start up of the plant and with the drive disconnected.

It is the responsibility of the installer to provide the appropriate number, type and section of cables for the ground conductor in accordance with the characteristics of the equipment used and the plant to minimize ground resistance, which must comply with local and national regulations.

EMC installation requirements

Introduction

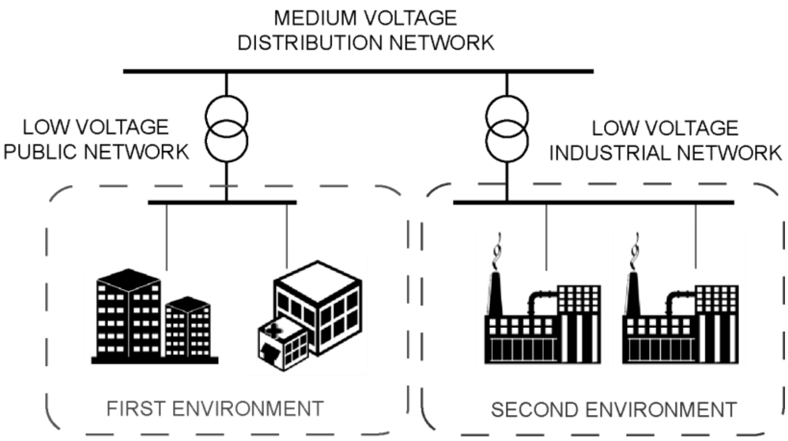
The EMC European Directive defines electromagnetic compatibility as the capability of an apparatus, an industrial plant, or a system to work satisfactorily in the electromagnetic environment without at the same time causing electromagnetic disturbances in the apparatus, industrial plant or systems present in the same environment.

The Electromagnetic Compatibility (EMC) depends on two main characteristics of the equipment: Electromagnetic Interference (EMI) and Electromagnetic Susceptibility (EMS). The EMC standards aims to ensure that all the electrical equipment that could operate simultaneously in the same environment are compatible. This means that the interference immunity of all the devices is greater than the interference emission of all the devices within the same environment.

The EMC requirements for Power Drive System (PDS) are defined in IEC/EN 61800-3 standard that is included in the Declaration of conformity CE enclosed. In the European Union, EN61800-3 standard takes priority over all generic standards. The PDS in the context of this standard comprises the drive converter, the motor cables and the motor. Therefore, the installer as the ultimate responsible must follow the installation instructions given within this manual.

EN

Depending on the location of the drive, the standards define four categories distributed in two environments.



GITG0006AI

- *First Environment:* Domestic installations. It also includes premises directly connected to a low-voltage power supply network without an intermediate transformer which supplies buildings used for domestic purposes such as shopping malls, cinemas, hospitals…
- *Second environment*: Industrial installations. Second Environment includes all plants other than those directly connected to the public low-voltage network which supplies buildings used for domestic purposes, e.g. factories and those other premises supplied by their own dedicated transformer.

The two environments are divided in four categories C1 to C4 that are summarized in the following table.

	FIRST ENVIRONMENT		SECOND ENVIRONMENT	
	C1	C2	C3	C4
Restricted installation [1]	NO	YES	YES	YES [2]

Notes

[1] “Restricted installation” means that the installation and commissioning must be carried out by specialist personnel.

[2] C4 Category applies only for complex systems or when ratings are equal or above to 1000 V or 400 A which are unable to comply with the limits of C3 Category. In these cases, C4 Category can be achieved by adjusting the equipment in situ and applying the EMC recommendations.

SD150 compliance

SD150 variable speed drives have been designed for the industrial use (Second Environment). The implementation of radio frequency interference filters (RFI filters) and dV/dt filters as standard, and the correct installation following the recommendations within this manual, permit to achieve compliance with C2 category defined in IEC/EN 61800-3.

EMC recommendations

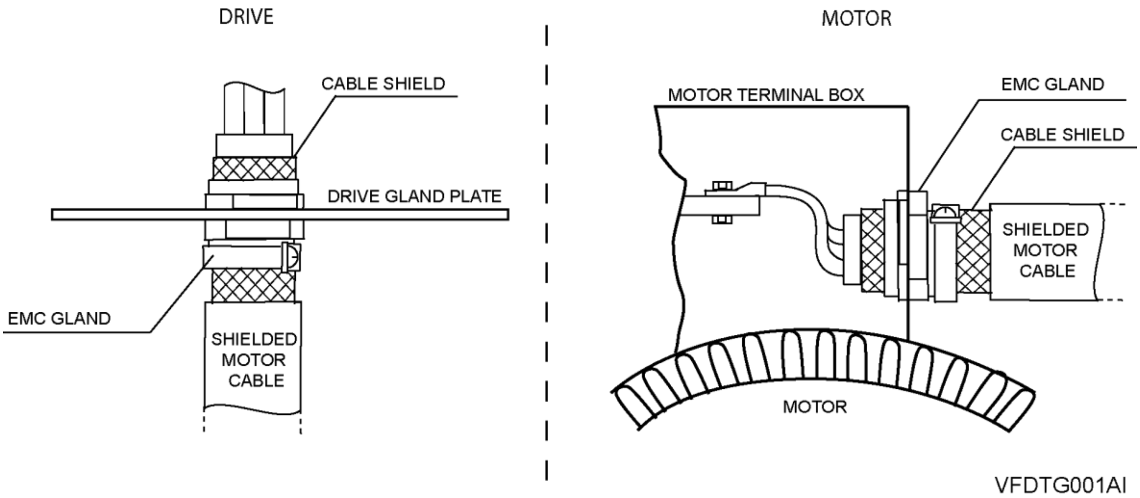
To conform the EMC directive, it is necessary that these instructions be followed as closely as possible. Follow the usual safety procedures when working with electrical equipment. All electrical connections to the filter, inverter and motor must be made by a qualified electrical technician.

1. Check the filter rating label to ensure that the current, voltage rating and part number are correct.
2. For best results, the filter should be fitted as closely as possible to the incoming mains supply of the wiring enclousure, usually directly after the enclousures circuit breaker or supply switch.
3. The back panel of the wiring cabinet of board should be prepared for the mounting dimensions of the filter. Be sure to remove any paint etc from the mounting holes and face area of the panel to ensure the best possible earthing of the filter.
4. Mount the filter securely.
5. Connect the mains supply to the filter terminals marked LINE, connect any earth cables to the earth stud provided. Connect the filter terminals marked LOAD to the mains input of the inverter using short lengths of appropriate gauge cable.
6. Connect the motor and fit the ferrite core (output chokes) as close to the inverter as possible. Armoured or screened cable should be used with the 3 phase conductors only threaded twice through the center of the ferrite core. The earth conductor should be securely earthed at both drive and motor ends. The screen should be connected to the enclousure body via and earthed cable gland.
7. Connect any control cables as instructed in Wiring recommendations section, inside Control connection section.

It is important that all lead lengths are kept as short as possible, and that incoming mains and outgoing motor cables are kept well separated.

Connection

The SD150 do not require the use of shielded motor cable to achieve compliance with C2 category when a correct installation is made. Wiring and Installation recommendations are included in sections Power connection and wiring and Ground connection. In shielded cables it is recommended to connect the shield by making 360° contact in both the drive cabinet and the motor terminal box. As an example, EMC cable glands can be installed as shown in the next figure.



VFDTG001AI

It is recommended to use shielded cable for control signals and to follow recommendations included in section Wiring recommendations.

CAUTION

Select communication and control system according to the drive EMC environment. Otherwise, systems could suffer from interferences due to a low EMS level.

EN

Protections

Ground fault protection

The drive is equipped with an internal software that protect the motor and the drive against input and output unbalanced currents. The response threshold can be set from 0% to 30% of the rated current.

This function is not intended to protect people against direct or indirect contacts or against fire, so an external protection must be provided to ensure that a substantial ground fault current is promptly interrupted. The SD150 drives are suitable to operate with RCD components Type B, if it is required. The EMC / EMC filters and motor cable lengths increase the earth leakage currents, so the protection range is set according to the installation conditions. For additional information, contact Power Electronics.

Short circuit

The following table shows the voltage, current and inductance specifications of the AC fuses and reactor.

MODEL	AC Input fuse		AC Reactor	
	Current (A)	Voltage (V)	Inductance (mH)	Current (A)
SD1503F	10	600	1,2	10
SD1505F				
SD1508F	15		0,88	14
SD1512F	20		0,56	20

CAUTION

Use only UL listed Class H or RK5 input fuses and UL listed circuit breakers. Refer to the table above for fuse and circuit breaker voltages and currents.

Motor thermal protection

The drive includes a motor thermal protection based on the motor performance parameters which mathematically calculates the remaining heating capacity in the motor. When this reservoir is reduced below the limits, this is, the motor temperature approaches the maximum, the drive automatically stops the motor.

The drive includes as standard a PTC connection that permits monitor the motor temperature. Once connected and configured, the drive could either stop the motor or generate a warning signal.

Others

The drive can implement additional motor and drive protections such as power-loss ride through, automatic fly restart, high and low input and output voltage, and/or pump overload and underload among others.

8. CONTROL CONNECTION

8

Wiring recommendations

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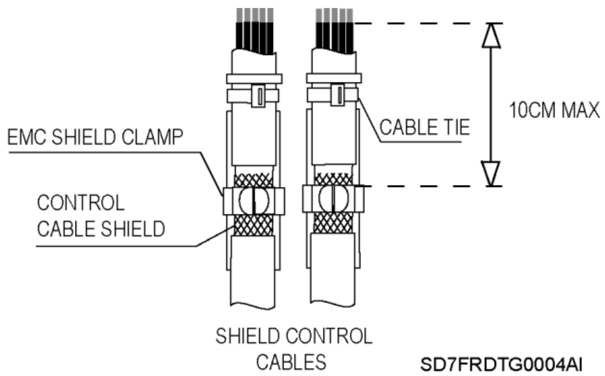
Before planning the installation, follow and understand the next recommendations. The parallel cable routing should be avoided and the distance between the control wiring and the power wiring should be maximized. It is recommended to route control cables with different voltages in separately cable racks, trays or ducts.

It is recommended to use shielded cable for all the data, signal or control cables coming from the variable speed drive. Each cable must have an EMC clip that secures an effective ground shield, making a contact of the 360º shield.



SD7FRDTG0004AI

Cable shields for digital signal must be grounded at both ends of the cable. It is recommended to use independent shielded cables for digital and analogue signals. When using multiple analogue signals, do not use common return for them. If using analogue signals, a low interference is experienced (hum loops), disconnect the shield grounding from one of the ends. Refer to Recommended cable section for cable specifications and recommended adjustment.

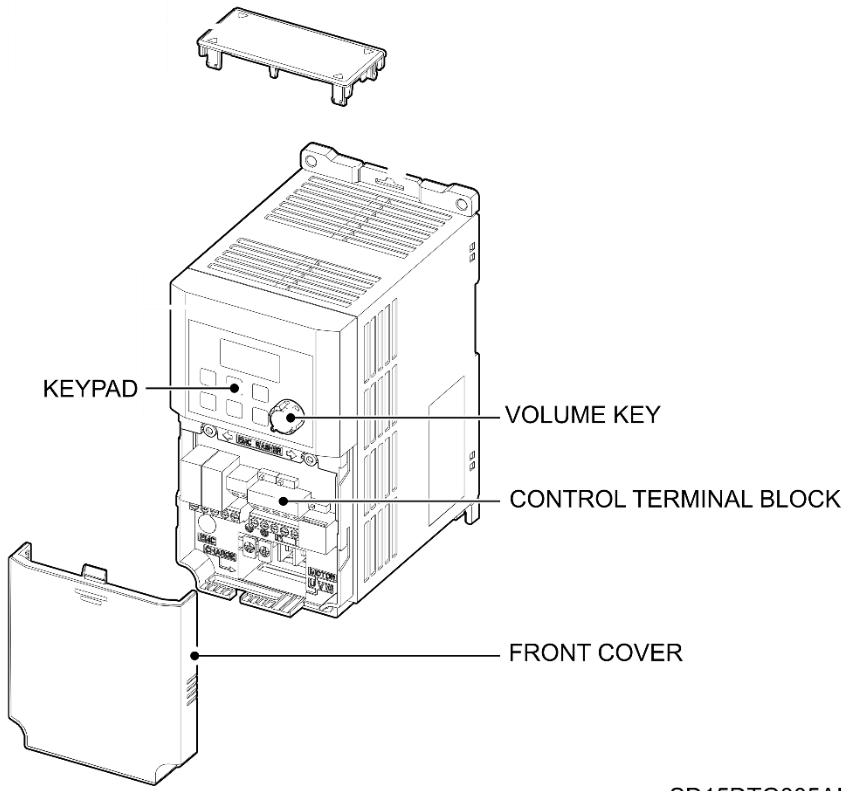
Although the control boards are insulated galvanically, for safety reasons it is recommended not to modify the wiring while the equipment is connected to the input power supply.

CAUTION

Any change to the control board wiring or bridges must be performed following the safety instructions indicated before. Otherwise, it could cause damage to the equipment and cause damage to people.

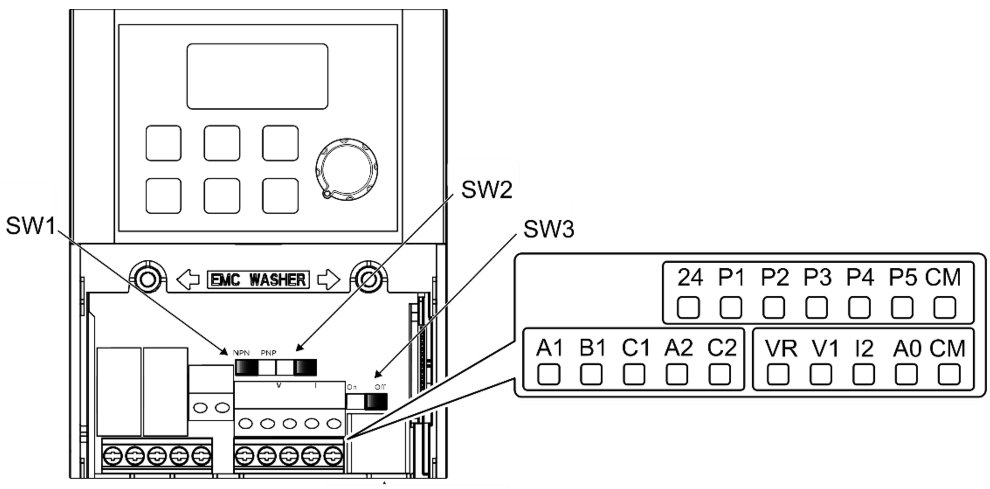
Control cables access

The control cables must be connected to the control terminals located below the seven-segment display. Remove the front cover by pressing the cover outwars to access the control terminals. The following figure shows the detail of the front cover.



SD15DTG005AI

Once the front cover is removed, the control terminals for both frames are shown. The following figure shows in detail the control terminals located on the front of the equipment.

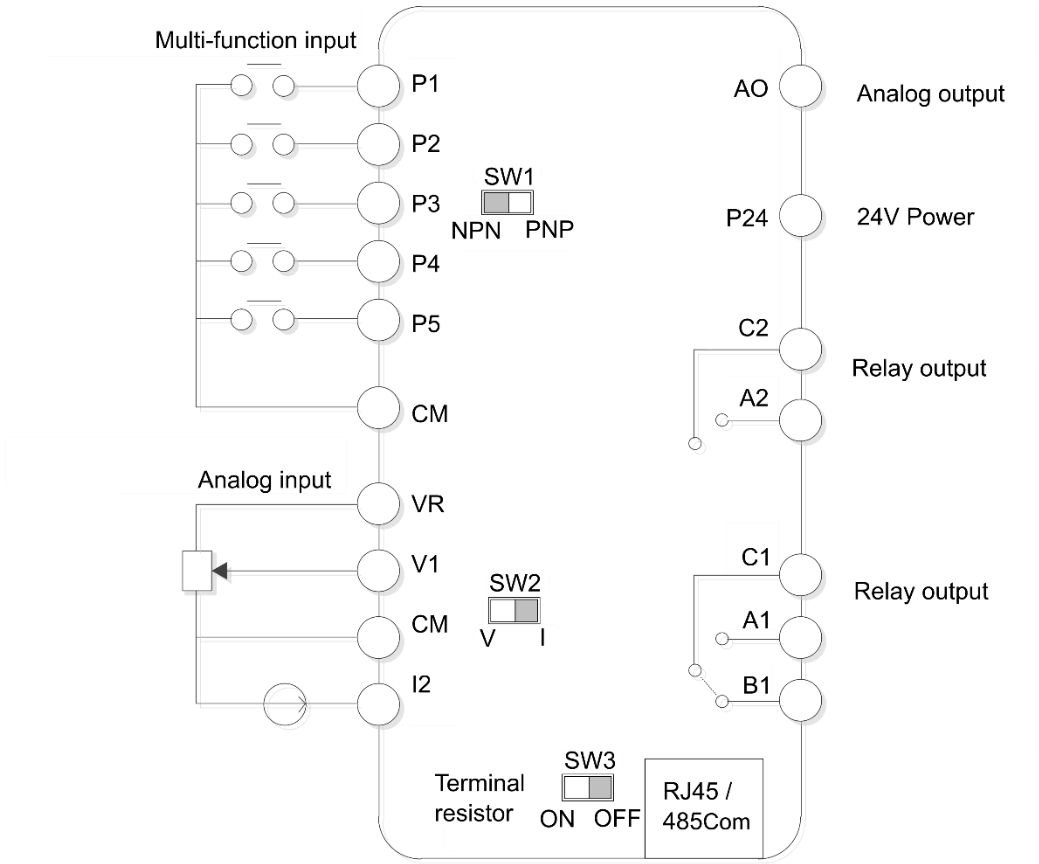


SD15DTC001A

Control board terminals description

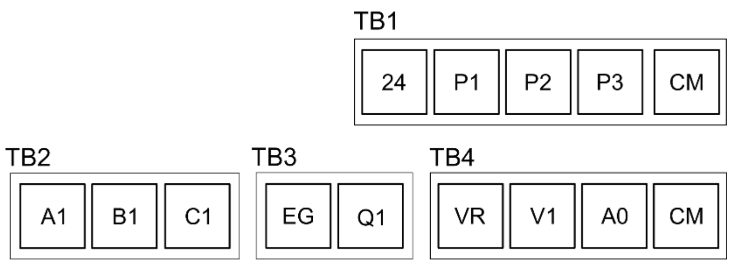
The control board of the drive integrates some switches and connection terminals. These connection terminals vary depending on the equipment's degree of protection.

The following figures show the control board terminals schema:



SD15DTC002AI

The following figure shows the control terminals for IP20 drives. This configuration applies to both frames.



SD15DTC0003A

The following table contains the control terminals description:

SIGNAL	PIN	DESCRIPTION
DIGITAL INPUTS	P1	Configurable multi-function Input. Default value: Fx.
	P2	Configurable multi-function Input. Default value: Rx.
	P3	Configurable multi-function Input. Default value: Emergency stop trip.
	P4	Configurable multi-function Input. Default value: Fault reset (RESET).
	P5	Configurable multi-function Input. Default value: Jog operation command (JOG).
	CM	Common terminal for analog terminal inputs and outputs.
ANALOGUE INPUTS	VR	Used to setup or modify a frequency reference via analog voltage or current input. • Maximum voltage output: 12 V. • Maximum current output: 100 mA. • Potentiometer: 1-5 kΩ.
	V1	Used to setup or modify a frequency reference via analog voltage input terminal. • Unipolar: 0-10 V (12 Vmax.).
	I2	Used to setup or modify a frequency reference via the voltage or current analogue input terminals. Switches between voltage (V2) and current (I2) modes via a switch on the control board (SW2). V mode: • Unipolar: 0-10 V (12 Vmax.). I mode: • Input current: 4 – 20 mA.
ANALOGUE OUTPUTS	AO	Used to send output information from the drive to the following external devices: output frequency, output current, output voltage, or a DC voltage. • Output voltage: 0 - 10 V. • Maximum output voltage/current: 10 V, 10 mA. • Default output: Output frequency.
DIGITAL OUTPUTS	Q1	Multifunction terminal DC 26V, ≤ 100 mA.
	EG	Common ground contact for an open collector (with external power source).
	24	External 24 V power source. 150 mA máximum output current.
	A1	Sends out alarm signals when the safety functions of the drive are activated (AC 250 V <1A, DC 30 V < 1A). • Fault condition: A1 and C1 contacts are connected (B1 and C1 connected). • Normal operation: B1 and C1 contacts are connected (A1 and C1 open).
	C1	
	B1	
	A2	Sends out alarm signals when the safety functions of the inverter are activated (AC 250 V <1A, DC 30 V < 1 A). • Fault condition: contacts A2 and C2 are connected. • Normal operation: contacts A2 and C2 are open connection.
	C2	
COMMUNICATION	RJ45	Remote keypad signal line. Used to send or receive the remote keypad signal (optional).
		RS-485 signal line. Used to send or receive RS-485 signals.

Recommended cable section

The recommended wire characteristics are summarized in the table below. The wire length of the safety input should not exceed 30m.

TERMINAL TYPE	RECOMMENDED WIRE SIZE[1] (mm²/AWG)				SCREW	TORQUE (Nm)
	NO CRIMP-STYLE TERMINAL		CRIPM-STYLE			
	mm²	AWG	mm²	AWG		
P1-P5, CM	0,75	18	0,5	20	M2 (1/32")	0,22 ~ 0,25
VR						
V1						
I2						
AO						
Q1						
EG						
24						
A1, B1, C1	1	17	1,5	15	M2.6 (3/32")	0,4
A2, C2						

EN

Control switches

There are three control switches, one for the PNP/NPN mode, one for analog input and one for the terminal resistor.

The switches are described in the following table.

	SWITCH	OPTIONS	DESCRIPTION
SW1	PNP/NPN	PNP/NPN	NPN/PNP mode selection switch.
SW2	ANALOG INPUT	V/I	Analog voltage/current input terminal selection switch.
SW3	TERMINAL RESISTOR	ON/OFF	Terminal resistor selection switch.

[1] The wiring of the control terminals must permanently support 300 V and Tº > 75ºC.

9. COMMISSIONING

CAUTION

Only qualified personnel are allowed to commission the drive. Read carefully and follow the safety instructions of this manual.
Failure to do so may result in damage to the equipment and you may suffer an electric shock.

Make sure that there is no voltage at the power terminals. Make sure that voltage is not connected to the computer unexpectedly.

This section does not include all the tasks to be performed during the commissioning of the equipment. Follow local and national regulations.

If the equipment is stored for an extended period (more than 6 months) before installation, the recommendations from section "Extended storage" must be taken into account.
Ensure all the instructions on such section have been followed before starting the commissioning of the equipment.

For a proper commissioning, follow the next steps:

Check the compatibility of the upstream protections (circuit breakers, fuses, etc...) that could cause an unexpected stop during the soft charge.

↓

Assure that the line voltage is compatible with the drive voltage range. Otherwise, the drive could get damaged.

↓

Connect input, PE and output wiring and check that the connections and tightening torque are correct.

↓

Check that the protective covers are mounted.

↓

Check control cables and analogue and digital signals free of voltage.

Verify operation in remote and local mode.

Connect input power supply.

Verify that the display is turned on and check the control parameters.

Check line voltages with the display.

Start the drive without the motor connected by pressing the "RUN" button on the display keypad.

Check that the fans rotate smoothly and there is no obstacle reducing the cooling capacity. Verify that there are no ibstructing elements that could affect equipment cooling.

Conect on the motor and check its direction of rotation.

Verify that the drive follows the set parameters of speed, current, etc.

10. MAINTENANCE

The SD150 series drives are industrial electronic products that contain advanced semiconductor elements. For this reason, temperature, humidity, vibrations and worn components can affect performance. To avoid any possible irregularities, it is recommended to carry out periodic inspections.

WARNING

Ensure to follow all instructions to safely carry out maintenance tasks.
Otherwise, you could cause damages to the equipment and personnel.

Warnings

Make sure to remove the input power while performing maintenance.

Make sure to perform maintenance after checking the DC Link capacitor has discharged. Check that the voltage between terminals +HVDC and -HVDC is below DC 30V. The bus capacitors in the drive main circuit can still be charged even after the power is turned off.

The correct output voltage of the drive can only be measured by using an RMS voltage meter. Other's voltage meters, including digital voltage meters, are likely to display incorrect values caused by the high frequency PWM output voltage of the drive.

Routine inspection

It is necessary to perform periodic inspections of the drive. The frequency of the tasks shown in the table below are recommended, the times indicated depend on the working conditions in each case.

Tasks with monthly recommendation must be performed, at least, every three months.

Make sure to check the following points before handling the drive:

- Installation site conditions.
- Drive cooling system conditions.
- Excessive vibrations or noise in the motor.
- Excessive overheating.
- Normal output current value on the monitor.

Inspection site	Inspection element	Inspection	Period: Monthly	Period: 3 months	Period: 2 years	Inspection method	Criterion	Instrument of Measurement
All	Ambient conditions	Are there dust particles? Are the ambient temperature and the humidity within specification?	o			Visual check	Temperature: -30 to +50 (or 40ºC) Humidity: below 95% non-condensing.	Thermometer, Hygrometer, Recorder.
All	Module	Are there any abnormal noises or oscillations?	o			Visual and audible.	There are no anomalies.	
All	Input power	Is the input power to the main circuit correct?	o			Measure the voltage between terminals L1, L2 and GND.		Digital multimeter. Tester.
All	Power connections	Are the Power terminals correctly fastened?		o		Measure the temperature and torque of the power connections	Fasten the bolts again one week after its start-up. Check that the temperature is homogeneous and below 70ºC	Infrared thermometer, Torque key
Main circuit	Conductor/ Cable	Is the conductor corroded? Is the sheathing of the cable damaged?		o o		Visual check.	No anomaly.	
Main circuit	Terminal	Is any damage visible?		o		Visual check.	No anomaly.	
Main circuit	IGBT's module Diodes module and Rectifier	Check the resistance value between each one of the terminals			o	Disconnect the cables of the inverter and measure the resistance value between: L1, L2 ⇔ VDC+, VDC- and U, V, W ⇔ VDC+, VDC- with a tester > 10kΩ		Digital multimeter. Analogue tester.
Main circuit	Correct capacitor	Have fluid leakages been observed? Is the capacitor well fastened? Is any dilation or retraction sign observed? Measure the capacitance	o o	o		Visual check. Measure the capacitance with a proper instrument.	No anomaly Capacitance higher than 85% of rated capacitance.	Instrument for measuring capacity.
Main circuit	Input Inductances	Is there any liquid leak? Is there any overheated point?		o o		Visual check. Measure the surface and connectors' temperature.	No anomaly. Check that the temperature is homogeneous and below 70ºC	Infrared thermometer.
Main circuit	Contactor	Is there any contactor chatter? Is the contact damaged?		o o		Audible check. Visual check.	No anomaly.	
Control circuit and Protections	Operating check	Is there any imbalance between output voltage phases?		o		Measure voltage between output terminals U, V and W.	Balanced voltage between phases i.e. lower than 8V difference for 400V models.	Digital multimeter / RMS voltage meter.
Cooling system	Cooling fans	Are there any abnormal noises or oscillations? Is the cooling fan disconnected?	o	o		Disconnect the power supply (OFF) and rotate the fan manually. Check the connections.	Fan should rotate effortlessly. No anomaly.	
Cooling system	Dust filters	Are the dust filters obstructed?		o		Visual check	No anomaly	

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Inspection site	Inspection element	Inspection	Period			Inspection method	Criterion	Instrument of Measurement
			Monthly	3 months	2 years			
Display	Measurement	Is the displayed value correct?	o	o		Check the reading instrument with an external measurement.	Check the specified values and the control values.	Voltage meter / Current meter etc.
Motor	All	Is there any noise or abnormal vibrations? Has any unusual smell been perceived?	o o			Audible, sensory and visual check. Check if damages have been produced by overheating.	No anomaly.	
	Insulation resistance	Megger check (between terminals of output circuit and ground terminal)			o	Disconnect the cables U, V and W and join them together. Check the resistance between this join and ground.	More than 5MΩ	Megger type 500V

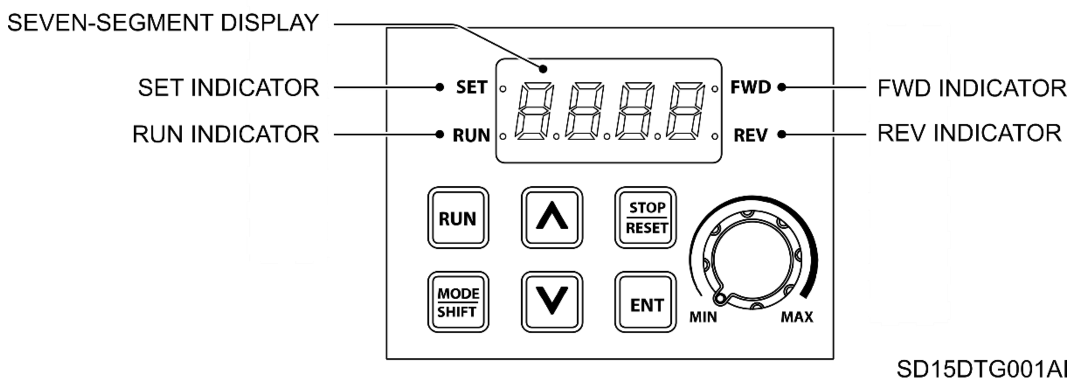
Note: Long life of the main components above indicated are based on a continuous operation for the stipulated load. These conditions can change according to the environment conditions.

11. USE OF THE DISPLAY

The SD150 variable speed drive has an integrated built-in seven segment display which provides intuitive data presentation, easy navigation through the control parameters and allow thousands of customized configurations to be stored by the user.

Integrated display

The figure below shows the integrated display in the drive. There are four indicators that provide information on the operating status of the device, as well as six control keys and a potentiometer for setting the frequency of operation.



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The LED indicators turn on or flicker, showing the current operation status of the drive. The following table lists the names and functions of the operating keys on the display:

KEY / LED	NAME	FUNCTION
RUN	RUN key	Run command.
STOP / RESET	STOP / RESET key	STOP: Stop command during operation. RESET: Reset command when a fault occurs.
∧ / ∨	UP / DOWN key	Used both to jump between codes, or to increase or decrease parameter values.
MODE / SHIFT	MODE / SHIFT key	Used to jump to other groups, or to move the cursor during parameter setup or modification.
ENT	ENTER key	Used to enter the parameter setting mode, apply the set parameter, and enter the operation information screen from the fault notice screen when a fault occurs.
MIN MAX	VOLUME key	Used to set the operation frequency.
SET	SET indicator	Flickering during parameter setting.
RUN	RUN indicator	Illuminated and remains steady during an operation and flickering during acceleration or deceleration of the drive.

KEY / LED	NAME	FUNCTION
FWD	FWD indicator	Illuminated and remains steady during forward run.
REV	REV idicator	Illuminated and remains steady during reverse run.
Seven-segment display	Current value	Indicates operating conditions and parameter data.

The following table shows the different characters of the seven-segment display:

Display	Number/ character	Display	Number/ character	Display	Number/ character	Display	Number/ character
0	0	A	A	K	K	U	U
1	1	b	B	L	L	u	V
2	2	C	C	M	M	W	W
3	3	d	D	n	N	X	X
4	4	E	E	O	O	y	Y
5	5	F	F	P	P	Z	Z
6	6	G	G	q	Q	ı	0 (bit)
7	7	H	H	r	R	!	1 (bit)
8	8	I	I	S	S	-	-
9	9	J	J	t	T	-	-

The groups, except for the operation group, are not displayed in the group list and are not accessible according to the factory defaults. To display and access all groups, it is necessary to access code 0 Gr in the Operation group and set the parameter to 1.

The following table shows the steps to follow in order to move between groups in one direction only:

STEP	INSTRUCTION	KEYPAD DISPLAY
1	0.00[1] is the initial code of the Operation group. It is displayed when the inverter is turned on. Press the [MODE] key.	0.00
2	The initial code of the Drive (dr) group displayed on the screen is dr 0. Press the [MODE] key.	dr 0
3	The initial code of the Basic (bA) group displayed on the screen is bA 0. Press the [MODE] key.	bA 0
4	The initial code of the Advanced (Ad) group displayed on the screen is Ad 0. Press the [MODE] key.	Ad 0
5	The initial code of the Control (Cn) group displayed on the screen is Cn 0. Press the [MODE] key.	Cn 0
6	The initial code of the input terminal displayed on the screen is In 0. Press the [MODE] key.	In 0
7	The initial code of the output terminal displayed on the screen is In 0. Press the [MODE] key.	OU 0
8	The initial code of the Communication (CM) group displayed on the screen is CM 0. Press the [MODE] key.	CM 0
9	The initial code of the Application (AP) group displayed on the screen is AP 0. Press the [MODE] key.	AP 0
10	The initial code of the Protection (Pr) group displayed on the screen is Pr 0. Press the [MODE] key.	Pr 0
11	The initial code of the Secondary Motor group displayed on the screen is M2. This group is available when the secondary motor function is enabled. To enable the secondary motor function, set one of the multi-function input terminal's codes to I2. Press the [MODE] key.	M2 0
12	The initial code of the Configuration (CF) group displayed on the screen is CF 0. Press the [MODE] key.	CF 0
13	Press the [MODE] key at the Configuration group. The initial code of the Operation group will be displayed: 0.00.	0.00

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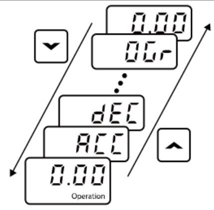
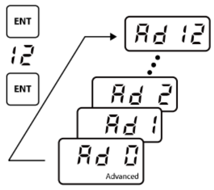
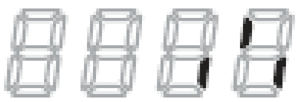
[1] It is possible to set reference frequencies in the initial code of the operation group. The initial code is set to 0.00. After setting the frequency reference, the set value will be displayed.

The following table shows two examples to learn how to switch and navigate between codes:

STEP	INSTRUCTION	KEYPAD DISPLAY
1	Move up and down within a group of parameters using the keys [▲] and [▼].	
2	Move up and down through the different codes using the keys [▲] and [▼].	
3	Press the [ENT] key to sabe the changes.	

Binary numbers are shown in the integrated display as segment lines. "1" is displayed in the top part of the display and "0" in the bottom part. For example, "010" is represented as:



12. WARNING AND FAULT MESSAGES

List of fault messages and troubleshooting

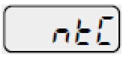
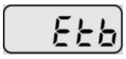
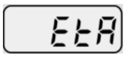
The variable speed drive stops when it detects a fault or when it sends a warning signal. The keypad displays information when a trip or warning message occurs. If more than two trips occur within a short period of time, the keypad displays the highest priority fault trip information.

The List of fault messages section shows a list of all possible faults. The probable causes and troubleshooting for each fault are listed in section Fault troubleshooting.

List of fault messages

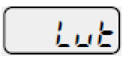
The following table shows the protection functions for output current and input voltage, as well as the protection functions for abnormal conditions of the internal circuit and external signals.

SCREEN	DESCRIPTION
OLt	**Overload.** The drive stops when the motor overload trip is activated, and the actual load level exceeds the set level. The protection operates if Pr 20 has been set to a value other than 0.
OCt	**Overcurrent.** The drive trips when the output current exceeds the 200% of the rated current value.
Out	**Overvoltage.** The fault appears when the internal DC circuit voltage exceeds the specified value.
Lut	**Low voltage**. The drive trips when the internal DC circuit voltage is less than the specified value.
GFt	**Ground Trip.** The fault appears when a ground fault trip occurs on the output side of the driver and causes the current to exceed the specified value. The specified value varies depending on driver capacity.
EtH	**E-Thermal.** The fault appears depending on the inverse time-limit thermal characteristics to prevent motor overheating. Operates when Pr 40 is set to a value other than 0.
OPO	**Out Phase Open.** The fault appears when a 3-phase output has one or more phases in an open circuit condition. Operates when bit 1 of Pr 5 is set to 1.
IOL	**Inverter Overload.** The fault appears when the inverter has been protected from overload and resultant overheating, based on inverse timelimit thermal characteristics. Allowable overload rate for the drive is 150% for 1 min.
rOt	**ROT**. The falut appears when the input power is unstable, or an initial charging circuit trip occurs while supplying power to the inverter. This trip occurs only in the 0,4–2,2 kW models. There is a possibility of ROT trip when power is turned on within 1 second after LVT trip due to power OFF.
ULt	**Underload.** The motor is working with insufficient load. The drive trips when its current is within the values set in parameter Pr 29 and Pr 30 exceeding the time limit set in parameter Pr 28. The protection will be enabled if the parameter Pr 27 has been set with a value different to 0 ‘NONE’.
OHt	**Overheat.** The fault appears when the temperature of the inverter heat sink exceeds the specified value.

SCREEN	DESCRIPTION
	**NTC.** The fault appears when an error is detected in the temperature sensor of the Insulated Gate Bipolar Transistor (IGBT).
	**Fan trip.** An anomaly detecting within the cooling fan. The cooling fan trip can be occurred when it is overloaded, its connectors are disconnected, or its components break. When the problems are solved, fan trip is cleared, and the fan operates normally.
 	**External trip A, B.** When the multi-function input terminal of the I/O is set to EtA or EtB, the input terminal is used as the signal: • EtA. This fault is displayed when the CM and short signal are generated when the multi-function input is NPN or P24 and the short signal is generated when multifunction input is PNP. • EtB. This fault is displayed when the CM and open signal are generated when multi-function input is NPN or P24 and open signal is generated when multi-function input is PNP.
	**Communication trip.** This fault appears when communication between the Main DSP and the IO CPU is disconnected for more than 500 ms.
	**Nbr.** This fault appears when the inverter's output current is below the value set at Ad 41 during the external brake signal operation based on the multi-function terminal function setting.

Fault troubleshooting

The following table shows the possible causes and actions for a trip or warning due to a protective function.

SCREEN	DESCRIPTION OR POSSIBLE CAUSE	ACTIONS
	Elevated motor consumption caused by an excessive load.	Ensure that the motor and the drive have the correct rated capacities.
	Load defined in parameter Pr 21 is too low.	Increase the defined value in parameter Pr 21.
	The acceleration or deceleration time is too short compared to the inertia of the load (bA 16).	Increase acceleration or deceleration time.
	The drive load is greater than the rated capacity	Replace the drive with a higher capacity model.
	The drive provides an output while the motor was idling.	Operate the drive after the motor has stopped or use the speed search function Cn 71.
	The mechanical brake of the motor is operating too fast.	Check the mechanical brake.
	The deceleration time is too short compared to the inertia of the load (bA 16).	Increase the acceleration time.
	A generative load occurs at the drive output.	Use the braking unit.
	The input voltage is too high.	Check if the input voltage is above the specified value.
	The input voltage is too low.	Determine if the input voltage is below the specified value. Set the value of the input voltage of the drive bA 19.
	A load in excess of the power capacity is connected to the system.	Increase the power capacity.
	The magnetic contactor connected to the power supply has a faulty connection.	Replace the magnetic contactor.
	Ground leakage produced in the drive output.	Check the drive output wiring.
	The motor insulation is damaged due to heat.	Change the motor.

SCREEN	DESCRIPTION OR POSSIBLE CAUSE	ACTIONS
EtH	Motor overheated.	Reduce the load or frequency of operation.
	Load exceeds the drive capacity.	Replace the drive with a higher capacity model.
	The drive operates at low speed for an extended period of time.	Replace the motor with a model that supplies additional power to the cooling fan.
OPO	The magnetic contactor on the output side has a connection fault.	Check the magnetic contactor on the output side.
	The output wiring is faulty.	Check the output wiring.
IOL	The load within the drive is greater than the rated value of the drive.	Increase the motor and drive capacity.
	The start torque setting is too high.	Reduce the start torque value.
OHt	There is a problem with the cooling system.	Check whether a foreign object is obstructing the air inlet, outlet or ventilation.
	The cooling fan of the drive operates for an extended period of time.	Replace the cooling fan.
	The ambient temperature is too high.	Keep the ambient temperature below 50ºC.
ntC	The ambient temperature is too low.	Keep the ambient temperature above -10ºC.
	There is a fault with the internal temperature sensor.	Contact with Power Electronics.
FAn	Foreign object obstruction in ventilation.	Remove the foreign object from the air inlet or outlet.
	The cooling fan needs to be replaced.	Replace the cooling fan.
rOt	The input power is unstable, or a disconnection of the initial load circuit occurs while power is being supplied from the driver.	Disconnect and reconnect the power supply. If the problem persists, contact with Power Electronics.

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13. DESCRIPTION OF PROGRAMMING PARAMETERS

13

The different parameters of the SD150 are organized in groups and are described within this section.

Use the up and down keys to navigate between the parameters of the selected group.

Please refer to section Integrated display, for instructions on how to modify parameter values.

Group 0: Operation

This group is only available in the integrated display. It allows performing a basic set up of the drive with its main parameters.

<table>
<tr><th>SCREEN</th><th>DESCRIPTION</th><th>DEFAULT VALUE</th><th>RANGE</th><th>FUNCTION</th></tr>
<tr><td>0.00</td><td>Command frequency</td><td>0.00 Hz</td><td>0.00 to 400.00 Hz</td><td>Sets and modifies a frequency reference for an operation. See parameter (Frq).</td></tr>
<tr><td>ACC</td><td>Acceleration time</td><td>5.0 s</td><td rowspan="2">0.0 to 6000 s</td><td rowspan="2">The setting range varies depending on the set value of code bA 8.
See group Basic functions (bA). Parameters bA 8 and bA 9.</td></tr>
<tr><td>dEC</td><td>Deceleration time</td><td>10.0 s</td></tr>
<tr><td>drv</td><td>Start/stop control</td><td>1</td><td>0 to 3</td><td>Selects the command source according to the following table:<table><tr><th>OPT.</th><th>DESCRIPTION</th></tr><tr><td>0</td><td>Keypad</td></tr><tr><td>1</td><td>Fx/Rx-1</td></tr><tr><td>2</td><td>Fx/Rx-1</td></tr><tr><td>3</td><td>RS-485 communication.</td></tr></table></td></tr>
<tr><td>Frq</td><td>Frequency setting mode</td><td>0</td><td>0 to 10</td><td>Selects the frequency setting method according to the following table:<table><tr><th>OPT.</th><th>DESCRIPTION</th></tr><tr><td>0</td><td>Keypad 1</td></tr><tr><td>1</td><td>Keypad 2</td></tr><tr><td>2</td><td>V0: 0 – 5V</td></tr><tr><td>3</td><td>V1: 0 – 10V</td></tr><tr><td>4</td><td>I2(I): 0 – 20V</td></tr><tr><td>5</td><td>I2(I): 0 – 10V</td></tr><tr><td>6</td><td>V0 + I2 (I)</td></tr><tr><td>7</td><td>V0 + I2 (V)</td></tr><tr><td>8</td><td>V0 + V1</td></tr><tr><td>9</td><td>RS-485 communication</td></tr><tr><td>10</td><td>Up – Down operation</td></tr></table></td></tr>
<tr><td>MkW</td><td>Motor rated power</td><td>-</td><td>0.4 to 2.2 kW</td><td>Selects the motor according to the following table:<table><tr><th>OPT.</th><th>DESCRIPTION</th></tr><tr><td>0.4</td><td>0.4kW</td></tr><tr><td>0.75</td><td>0.75kW</td></tr><tr><td>1.1</td><td>1.1kW</td></tr><tr><td>1.5</td><td>1.5kW</td></tr><tr><td>2.2</td><td>2.2kW</td></tr></table></td></tr>
<tr><td>MrC</td><td>Rated motor current</td><td>-</td><td>0.1 to 150.0 A</td><td>The initial value varies depending on the setting of the motor capacity (MkW). See group Basic functions (bA), parameters bA 14, bA 15 and bA 16.</td></tr>
<tr><td>MbF</td><td>Motor base frequency</td><td>60.00 Hz</td><td>30.00 to 400.00 Hz</td><td>The base frequency refers to the output frequency of the driver when operating at its rated voltage. Refer to the motor nameplate to set the value of this parameter.</td></tr>
<tr><td>FrM</td><td>Maximum frequency</td><td>60.00 Hz</td><td>40.00 to 400.00 Hz</td><td>Sets the upper limit value for parameters that are expressed as a unit of frequency, except for MbF (base</td></tr>
</table>

SCREEN	DESCRIPTION	DEFAULT VALUE	RANGE	FUNCTION
				frequency). It is not possible to set the frequency value above the maximum frequency within this function.
IOv	Output voltage setting	0 V	0.170 ~ 264 V	This function is used when a motor is operated with a voltage lower than the input voltage.
Ftb	Forward boost	4.0%	0.0 to 20.0%	Adjusts motor torque for forward operation.
rtb	Reverse boost			Sets the torque for reverse operation.
CUr	Output current	-	-	These values depend on the characteristics of the drive.
rPM	Motor RPM	-	-	
dCL	Inverter DC voltage	-	-	
vOL, POr, tOr, v1M, I2M	User select signal	vOL	-	Allows selection of input or output signals: **OPT.** – **DESCRIPTION** **VOL** – Output voltaje. **Por** – Output power. **tOr** – Output torque. **V1M** – Analog V1 terminal Input. **I2M** – Analog I2 terminal input
nOn	Currently out of order	-	-	-
OGr	Open hidden groups	-	0 to 1	Allows to hide or enable groups: **OPT.** – **FUNCTION** **0** – Hide groups except for operation group. **1** – Enable all groups.

Group 1: Drive → dr

<table>
<tr><th>SCREEN</th><th>DESCRIPTION</th><th>DEFAULT VALUE</th><th>RANGE</th><th>FUNCTION</th><th>SET ON RUN</th></tr>
<tr><td>dr 0</td><td>Jump Code</td><td>9</td><td>0 to 81</td><td>Allows to navigate between the different parameters.</td><td>YES</td></tr>
<tr><td>dr 9</td><td>Control mode</td><td>1</td><td>0 to 1</td><td>Configures the control mode for controlling the drive.<table><tr><th>OPT.</th><th>DESCRIPTION</th></tr><tr><td>0</td><td>V/F schedule control.</td></tr><tr><td>1</td><td>Slip compensation control</td></tr></table></td><td>YES</td></tr>
<tr><td>dr 11</td><td>Jog frequency</td><td>10.00 Hz</td><td>0.00 Hz to FrM</td><td>This operation is the second highest priority operation. If a Jog operation is requested while operating in multi-step, up-down or 3 wire modes of operation, the Jog operation overrides all other modes of operation.</td><td>YES</td></tr>
<tr><td>dr 15</td><td>Torque boost</td><td>0</td><td>0 to 1</td><td>Allows the output voltage to be adjusted from the motor torque.<table><tr><th>OPT.</th><th>DESCRIPTION</th></tr><tr><td>0</td><td>Manual torque boost.</td></tr><tr><td>1</td><td>Automatic torque boost.</td></tr></table></td><td>YES</td></tr>
<tr><td>dr 19</td><td>Start frequency</td><td>0.50 Hz</td><td>0.10 to 10.00 Hz</td><td>Sets the start of the frequency. Corresponds to the frequency at which the driver starts the voltage output.</td><td>NO</td></tr>
<tr><td>dr 20</td><td>Select rotation direction</td><td>F</td><td>-</td><td>Applies only when drv (source control mode) is set to 0. It is possible to display and set the dr 20 setting when drv (source control mode) is set to a value other than 0.<table><tr><th>OPT.</th><th>DESCRIPTION</th></tr><tr><td>F</td><td>Forward run</td></tr><tr><td>R</td><td>Reverse run</td></tr></table></td><td>YES</td></tr>
<tr><td>dr 26</td><td>Automatic torque boost filter gain</td><td>2</td><td>1 to 1000</td><td rowspan="3">They can be adjusted by increasing the voltage to the output voltage by the torque current when the voltage is too low to start operation of the V/F pattern.
When the starting torque is too low or too high, parameters dr 27 and dr 28 (automatic torque boost voltage gains) can be used to adjust the compensation according to the load. They are enabled only when dr 15 (torque boost) is set to 1.</td><td rowspan="3">NO</td></tr>
<tr><td>dr 27</td><td>Automatic torque boost motoring gain</td><td>120.0%</td><td>0.0 to 300.0%</td></tr>
<tr><td>dr 28</td><td>Automatic torque boost regeneration gain</td><td>120.0%</td><td>0.0 to 300.0%</td></tr>
<tr><td>dr 81</td><td>Select monitor code</td><td>0</td><td>0 to 4</td><td>Sets the monitor code.<table><tr><th>OPT.</th><th>DESCRIPTION</th></tr><tr><td>0</td><td>Output voltage vOL [V]</td></tr><tr><td>1</td><td>Output power (POr) [kW]</td></tr><tr><td>2</td><td>Torque (tOr) [kgf*m]</td></tr><tr><td>3</td><td>Analog V1 terminal input [v1M].</td></tr><tr><td>4</td><td>Analog I2 terminal input (I2M) [mA/V]</td></tr></table></td><td>YES</td></tr>
<tr><td>dr 85</td><td>Read parameters</td><td>No</td><td>-</td><td>Indicates the reading status of the parameters.<table><tr><th>OPT.</th><th>DESCRIPTION</th></tr><tr><td>No</td><td>No parameters reading.</td></tr><tr><td>Yes</td><td>Parameters reading.</td></tr></table></td><td>YES</td></tr>
<tr><td>dr 86</td><td>Write parameters</td><td>No</td><td>-</td><td>Indicates the writing status of the parameters.<table><tr><th>OPC.</th><th>DESCRIPTION</th></tr><tr><td>No</td><td>No parameters writing.</td></tr><tr><td>Yes</td><td>Parameters writing.</td></tr></table></td><td>YES</td></tr>
<tr><td>dr 91</td><td>Smart copier</td><td>0</td><td>0 to 3</td><td>Indicates the status the smart copier.<table><tr><th>OPT.</th><th>DESCRIPTION</th></tr><tr><td>0</td><td>None</td></tr><tr><td>1</td><td>Reserved</td></tr><tr><td>2</td><td>Reserved</td></tr><tr><td>3</td><td>SmartUpLoad</td></tr></table></td><td>NO</td></tr>
</table>

Group 2: Basic Functions → bA

<table>
<tr><th>SCREEN</th><th>DESCRIPTION</th><th>DEFAULT VALUE</th><th>RANGE</th><th>FUNCTION</th><th>SET ON RUN</th></tr>
<tr><td>bA 0</td><td>Jump Code</td><td>19</td><td>0 to 83</td><td>Allows to navigate between the different parameters.</td><td>YES</td></tr>
<tr><td>bA 4[1]</td><td>Command source 2</td><td>1</td><td>0 to 3</td><td>Allows the parameter setting of the second command source to be changed via the multifunction terminals.
<table>
<tr><th>OPT.</th><th>DESCRIPTION</th></tr>
<tr><td>0</td><td>Keypad 1</td></tr>
<tr><td>1</td><td>Fx/Rx-1</td></tr>
<tr><td>2</td><td>Fx/Rx-2</td></tr>
<tr><td>3</td><td>RS-485 communication</td></tr>
</table></td><td>NO</td></tr>
<tr><td>bA 5</td><td>Frequency source 2</td><td>0</td><td>0 to 10</td><td>Allows the parameter setting of the second frequency source to be changed via the multifunction terminals.
<table>
<tr><th>OPT.</th><th>DESCRIPTION</th></tr>
<tr><td>0</td><td>Keypad 1</td></tr>
<tr><td>1</td><td>Keypad 2</td></tr>
<tr><td>2</td><td>V0: 0–5 V</td></tr>
<tr><td>3</td><td>V1: 0–10 V</td></tr>
<tr><td>4</td><td>I2 (I): 0–20 mA</td></tr>
<tr><td>5</td><td>I2(V): 0–10 V</td></tr>
<tr><td>6</td><td>Volume +I2 (I)</td></tr>
<tr><td>7</td><td>Volume+ I2 (V)</td></tr>
<tr><td>8</td><td>Volume + V1</td></tr>
<tr><td>9</td><td>RS-485 communication</td></tr>
<tr><td>10</td><td>Up-down operation</td></tr>
</table></td><td>YES</td></tr>
<tr><td>bA 7</td><td>V/F pattern</td><td>0</td><td>0 to 2</td><td>Configures the drive to increase or decrease the output voltage at a fixed rate for different operating frequencies depending on the V/F characteristics.
<table>
<tr><th>OPT.</th><th>DESCRIPTION</th></tr>
<tr><td>0</td><td>Linear</td></tr>
<tr><td>1</td><td>Square reduction</td></tr>
<tr><td>2</td><td>User defined V/F pattern.</td></tr>
</table>
Note: When a normal induction motor is used, make sure that the output pattern is not set far from a linear V/F pattern. Non-linear V/F patterns may cause insufficient motor torque or motor overheating due to overexcitation.</td><td>NO</td></tr>
<tr><td>bA 8</td><td>Unit of acc/dec time setting</td><td>1</td><td>0 to 2</td><td>Sets the time scale. The time values can be set according to the maximum frequency, not the drive operation, starting from bA 9.
<table>
<tr><th>OPT.</th><th>DESCRIPTION</th></tr>
<tr><td>0</td><td>0.01 – 20.0 s</td></tr>
<tr><td>1</td><td>0.1 – 6000.0 s</td></tr>
<tr><td>2</td><td>1 – 60000 s</td></tr>
</table></td><td>NO</td></tr>
<tr><td>bA 9</td><td>Acc/dec frequency reference</td><td>0</td><td>0 to 1</td><td>Sets the acceleration and deceleration frequency reference.
<table>
<tr><th>OPT.</th><th>DESCRIPTION</th></tr>
<tr><td>0</td><td>Maximum frequency (FrM)</td></tr>
<tr><td>1</td><td>Delta frequency</td></tr>
</table></td><td>NO</td></tr>
<tr><td>bA 11</td><td>Number of motor poles</td><td>4</td><td>2 to 12</td><td>Adjusts the number of poles on the motor according to its nameplate.</td><td>NO</td></tr>
<tr><td>bA 12</td><td>Motor no load current</td><td>-</td><td>0.00 to 10.00 Hz</td><td rowspan="2">These parameters ensure that the engine rotates at a constant speed, compensating for engine slip as the load increases.</td><td>NO</td></tr>
<tr><td>bA 14[2]</td><td>Motor efficiency</td><td>-</td><td>0.1 to 100.0 A</td><td>NO</td></tr>
<tr><td>bA 15[1]</td><td>Motor efficiency</td><td>-</td><td>50 to 100%</td><td>Adjusts the efficiency of the motor according to its nameplate.</td><td>NO</td></tr>
<tr><td>bA 16</td><td>Load inertia rate</td><td>0</td><td>0 to 2</td><td>Selects the load inertia based on the motor inertia.
<table>
<tr><th>OPT.</th><th>FUNCTION</th></tr>
<tr><td>0</td><td>Less than ten times motor inertia.</td></tr>
<tr><td>1</td><td>Ten times motor inertia.</td></tr>
<tr><td>2</td><td>More than ten times motor inertia.</td></tr>
</table></td><td>NO</td></tr>
</table>

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[1] Displayed only when one of the In 65 – 69 (Multi-function input terminal function setting) is set to 22.
[2] The initial value varies depending on the motor capacity setting (MkW).

SCREEN	DESCRIPTION	DEFAULT VALUE	RANGE	FUNCTION	SET ON RUN
bA19	Input voltage adjustment	220 V	170 to 240 V	Adjusts the input voltage. The undervoltage trip level is modified according to the input voltage.	YES
bA 25	Slip gain	100.0%	0.0 to 150.0%	Indicates the slip gain of the engine.	NO
bA 41	User V/F frequency 1	15.00 Hz	0.00 Hz to 400.00 Hz	When code bA 7 is set to 2 (User V/F), user-defined V/F patterns can be configured to suit special engine load characteristics. **Note:** When a user V/F pattern is used, forward torque boost (Ftb) and reverse torque boost (rtb) do not function.	YES
bA 42	User V/F voltage 1	25%	0 to100%		YES
bA 43	User V/F frequency 2	30.00 Hz	0.00 Hz to 400.00 Hz		YES
bA 44	User V/F voltage 2	50%	0 to100%		YES
bA 45	User V/F frequency 3	45.00 Hz	0.00 Hz to 400.00 Hz		YES
bA 46	User V/F voltage 3	75%	0 to100%		YES
bA 47	User V/F frequency 4	60.00 Hz	0.00 Hz to 400.00 Hz		YES
bA 48	User V/F voltage 4	100%	0 to 100%		YES
bA 50	Multi-step frequency 1	10.00 Hz	0.00Hz to 400.00 Hz	Adjusts the multipass frequency from 1 to 7 in parameters bA 50 – bA 56.	NO
bA 51	Multi-step frequency 2	20.00 Hz			NO
bA 52	Multi-step frequency 3	30.00 Hz			NO
bA 53	Multi-step frequency 4	30.00 Hz			NO
bA 54	Multi-step frequency 5	25.00 Hz			NO
bA 55	Multi-step frequency 6	20.00 Hz			NO
bA 56	Multi-step frequency 7	15.00 Hz			NO
bA 70	Multi-step acceleration time 1	2.0 s	0.00 to 6000.0 s	The acceleration / deceleration times (Acc / Dec) can be set based on the time required to reach the next step frequency from the existing operating frequency. To set the Acc/Dec time values based on the existing operating frequency, it is necessary to set bA 9 (Acc/Dec reference) in group bA to 1 (delta frequency). If, for example, the Acc/Dec reference is set to 1 (delta frequency) and the acceleration time is set to 5 seconds, the operating frequency changes as shown in the graph below, while the target frequency is set to 10 Hz at the beginning and then changes to 30 Hz during the A section. **Note:** The setting range varies depending on the set value of parameter bA 8.	YES
bA 71	Multi-step deceleration time 1	2.0 s			YES
bA 72	Multi-step acceleration time 2	3.0 s			YES
bA 73	Multi-step deceleration time 2	3.0 s			YES
bA 74	Multi-step acceleration time 3	4.0 s			YES
bA 75	Multi-step deceleration time 3	4.0 s			YES
bA 76	Multi-step acceleration time 4	5.0 s			YES
bA 77	Multi-step deceleration time 4	5.0 s			YES
bA 78	Multi-step acceleration time 5	4.0 s			YES
bA 79	Multi-step deceleration time 5	4.0 s			YES
bA 80	Multi-step acceleration time 6	3.0 s			YES
bA 81	Multi-step deceleration time 6	3.0 s			YES
bA 82	Multi-step acceleration time 7	2.0 s			YES
bA 83	Multi-step deceleration time 7	2.0 s			YES

Group 3: Expanded Functions → Ad

<table>
<tr><th>SCREEN</th><th>DESCRIPTION</th><th>DEFAULT VALUE</th><th>RANGE</th><th>DESCRIPTION</th><th>SET ON RUN</th></tr>
<tr><td>Ad 0</td><td>Jump Code</td><td>24</td><td>0 to 79</td><td>Allows to navigate between the different parameters.</td><td>YES</td></tr>
<tr><td>Ad 1</td><td>Acceleration pattern</td><td>0</td><td>0 to 1</td><td>Allows adjustment of the acceleration pattern.<table><tr><th>OPT.</th><th>DESCRIPTION</th></tr><tr><td>0</td><td>Linear pattern</td></tr><tr><td>1</td><td>S pattern</td></tr></table></td><td>NO</td></tr>
<tr><td>Ad 2</td><td>Deceleration pattern</td><td>0</td><td>0 to 1</td><td>Allows adjustment of the deceleration pattern.<table><tr><th>OPT.</th><th>DESCRIPTION</th></tr><tr><td>0</td><td>Linear</td></tr><tr><td>1</td><td>S-curve</td></tr></table></td><td>NO</td></tr>
<tr><td>Ad 3</td><td>S-curve start point gradient</td><td>40%</td><td>1 to 100%</td><td>Defines the slope level of the S-curve as a percentage, up to half of the total acceleration and deceleration values. It can set parameter Ad 3 to a higher value to increase the slope level for smoother acceleration and deceleration.</td><td>NO</td></tr>
<tr><td>Ad 4</td><td>S-curve end point gradient</td><td>40%</td><td>1 to 100%</td><td>Defines the slope level of the S-curve as a percentage, up to half of the remaining total acceleration and deceleration values. It can set the parameter Ad 4 to a higher value to increase the slope level to reach constant speed and stop more smoothly.</td><td>NO</td></tr>
<tr><td>Ad 8</td><td>Stop mode</td><td>0</td><td>0 to 2</td><td>Allows selection of the stop mode.<table><tr><th>OPT.</th><th>FUNCTION</th></tr><tr><td>0</td><td>Deceleration stops.</td></tr><tr><td>1</td><td>DC braking stops.</td></tr><tr><td>2</td><td>Free run stops.</td></tr></table></td><td>YES</td></tr>
<tr><td>Ad 9</td><td>Forward and reverse run prevention</td><td>0</td><td>0 to 2</td><td>Configures the direction of rotation of the motors to prevent the motors from running in only one direction.<table><tr><th>OPT.</th><th>FUNCTION</th></tr><tr><td>0</td><td>Allows forward and reverse run.</td></tr><tr><td>1</td><td>Prevents forward run.</td></tr><tr><td>2</td><td>Prevents reverse run.</td></tr></table></td><td>YES</td></tr>
<tr><td>Ad 10</td><td>Start after low voltage</td><td>0</td><td>0 to 1</td><td>It can start an operation on the drive after the power is turned ON. This parameter is not disabled when the [RUN] key on the keypad or RS-485 communication is selected as the command input device.<table><tr><th>OPT.</th><th>DESCR.</th><th>FUNCTION</th></tr><tr><td>0</td><td>No</td><td>Drive does not tart after power loss.</td></tr><tr><td>1</td><td>Yes</td><td>Drive starts after power loss.</td></tr></table>Caution: The motor will start to rotate when the drive is started.</td><td>YES</td></tr>
<tr><td>Ad 12</td><td>DC braking time at startup</td><td>0.0 s</td><td>0.0 to 60.0 s</td><td>Adjusts the running time of the DC brake. The motor accelerates after the DC voltage is supplied for the set time.</td><td>NO</td></tr>
<tr><td>Ad 13</td><td>DC braking rate at startup</td><td>50%</td><td>0 to 200%</td><td>Sets the level of current to be applied to the motor, as a percentage of the rated motor current during DC brake operation. The parameter setting depends on the rated motor current (MrC).</td><td>NO</td></tr>
<tr><td>Ad 14</td><td>Output blocking time before DC braking</td><td>0.00 s</td><td>0.00 to 60.00 s</td><td>Adjusts the blocking time of the drive output before DC braking. This parameter is available when code Ad 8 is set to 1.</td><td>YES</td></tr>
</table>

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<table>
<tr><th>SCREEN</th><th>DESCRIPTION</th><th>DEFAULT VALUE</th><th>RANGE</th><th>DESCRIPTION</th><th>SET ON RUN</th></tr>
<tr><td>Ad 15</td><td>DC braking time</td><td>1.0 s</td><td>0.0 to 60.0 s</td><td>Adjusts the duration time of the DC power supply to the motor. This parameter is available when code Ad 8 is set to 1.
Caution: the motor may overheat or be damaged if an excessive amount of DC braking is applied to the motor, or if the DC braking time is set too high.</td><td>YES</td></tr>
<tr><td>Ad 16</td><td>DC braking rate</td><td>50%</td><td>0 to 200%</td><td>Sets the amount of DC braking to be applied. The parameter setting is based on the rated motor current (MrC). This parameter is available when code Ad 8 is set to 1.
Caution: the motor may overheat or be damaged if an excessive amount of DC braking is applied to the motor, or if the DC braking time is set too high.</td><td>YES</td></tr>
<tr><td>Ad 17</td><td>DC braking frequency</td><td>5.00 Hz</td><td>dr 19 to 60.00 Hz</td><td>Adjusts the frequency to initiate DC braking. This parameter is available when code Ad 8 is set to 1.</td><td>YES</td></tr>
<tr><td>Ad 20</td><td>Frequency</td><td>5.00 Hz</td><td>0.00 Hz to 400.00 Hz</td><td rowspan="2">During the acceleration process, the drive will stop at this frequency, keeping it constant for the type set in parameter Ad 21.
Similarly, during the acceleration process, parameter Ad 21 allows to define how long the drive will run at the constant frequency set in Ad 20.
Caution: For a lift type load, the motor may be damaged, or its life cycle may be reduced due to motor overload current.</td><td>NO</td></tr>
<tr><td>Ad 21</td><td>Dwell time</td><td>0.0 s</td><td>0.0 to 10.0 s</td><td>NO</td></tr>
<tr><td>Ad 24</td><td>Use frequency limits</td><td>0</td><td>0 to 1</td><td>Enables or disables frequency limits.<table><tr><th>OPT.</th><th>DESCR.</th><th>FUNCTION</th></tr><tr><td>0</td><td>No</td><td>Frequency limit off.</td></tr><tr><td>1</td><td>Yes</td><td>Frequency limit on.</td></tr></table></td><td>NO</td></tr>
<tr><td>Ad 25</td><td>Frequency lower limit</td><td>0.50 Hz</td><td>0.00 Hz to Ad 26</td><td>Adjusts the lower frequency limit if parameter Ad 24 is set to 1.</td><td>YES</td></tr>
<tr><td>Ad 26</td><td>Frequency higher limit</td><td>60.00 Hz</td><td>0.00 Hz to 400.00 Hz</td><td>Adjusts the upper frequency limit when parameter Ad 24 is set to 1.</td><td>NO</td></tr>
<tr><td>Ad 27</td><td>Frequency jump</td><td>0</td><td>0 to 1</td><td>The user can enable or disable a jump frequency band to avoid resonant frequencies or other types of reference frequencies that the motor will avoid as references. The unit will pass these frequencies during speed changes (acceleration and/or deceleration) but will not operate within these values.<table><tr><th>OPT.</th><th>VALUE</th><th>FUNCTION</th></tr><tr><td>0</td><td>No</td><td>Frequency jumping deactivated.</td></tr><tr><td>1</td><td>Yes</td><td>Frequency jumping activated.</td></tr></table></td><td>NO</td></tr>
<tr><td>Ad 28[1]</td><td>Frequency jump lower limit 1</td><td>10.00 Hz</td><td>0.00 to Ad 29</td><td>Sets the lower frequency jump limit 1.</td><td>YES</td></tr>
<tr><td>Ad 29[1]</td><td>Frequency jump upper limit 1</td><td>15.00 Hz</td><td>Ad 28 to 400.00 Hz</td><td>Sets the upper frequency jump limit 1.</td><td>YES</td></tr>
<tr><td>Ad 30[1]</td><td>Frequency jump lower limit 2</td><td>20.00 Hz</td><td>0.00 Hz to Ad 31</td><td>Sets the lower frequency jump limit 2.</td><td>YES</td></tr>
<tr><td>Ad 31[1]</td><td>Frequency jump upper limit 2</td><td>25.00 Hz</td><td>Ad 30 to 400.00 Hz</td><td>Sets the upper frequency jump limit 2.</td><td>YES</td></tr>
<tr><td>Ad 32[1]</td><td>Frequency jump lower limit 3</td><td>30.00 Hz</td><td>0.00 Hz to Ad 33</td><td>Sets the lower frequency jump limit 3.</td><td>YES</td></tr>
</table>

[1] Displayed only when Ad27 (Frequency jump) is set to 1.

<table>
<tr><th>SCREEN</th><th>DESCRIPTION</th><th>DEFAULT VALUE</th><th>RANGE</th><th>DESCRIPTION</th><th>SET ON RUN</th></tr>
<tr><td>Ad 33[1]</td><td>Frequency jump upper limit 3</td><td>25.00 Hz</td><td>Ad 32 to 400.00 Hz</td><td>Sets the upper frequency jump limit 3.</td><td>YES</td></tr>
<tr><td>Ad 41[1]</td><td>Brake open current</td><td>50.0%</td><td>0.0 to 180.0%</td><td>Sets the brake opening current.</td><td>NO</td></tr>
<tr><td>Ad 42[1]</td><td>Brake open delay time</td><td>1.00 s</td><td>0.00 to 10.00s</td><td>Once the motor current is higher than the current set in Ad 41 and the frequency reached in the motor is the same as the frequency set in Ad 44, the drive will open the output relay or the multifunction output terminal and maintain this speed for the time set in this parameter.</td><td>NO</td></tr>
<tr><td>Ad 44[1]</td><td>Brake open forward frequency</td><td>1.00 Hz</td><td>0.00 Hz to 400.00 Hz</td><td>Adjusts the brake opening frequency of the configured relay while the motor is accelerating in positive direction.</td><td>NO</td></tr>
<tr><td>Ad 45[1]</td><td>Brake open reverse frequency</td><td>1.00 Hz</td><td>0.00 Hz to 400.00 Hz</td><td>Adjusts the brake opening frequency of the configured relay while the motor is accelerating in the negative direction.</td><td>NO</td></tr>
<tr><td>Ad 46[1]</td><td>Brake close delay time</td><td>1.00 s</td><td>0.00 to 10.00 s</td><td>Once the motor has reached the frequency set in Ad 47, the drive shall close the braking relay and maintain this speed for the time set in this parameter.</td><td>NO</td></tr>
<tr><td>Ad 47[1]</td><td>Brake close frequency</td><td>2.00 Hz</td><td>0.00 Hz to 400.00 Hz</td><td>Sets the frequency value at which the brake relay shall stop operating, allowing the brake closed function.</td><td>NO</td></tr>
<tr><td>Ad 51</td><td>Energy saving operation</td><td>0%</td><td>0 to 30%</td><td>Sets the amount of reduction of the output voltage of Ad 51 as a function of the maximum output voltage IOv. This operation is used to save energy by reducing the voltage supplied to motors under low load and no-load conditions when a fan or pump is running.</td><td>YES</td></tr>
<tr><td>Ad 63</td><td>Motor RPM display gain</td><td>100%</td><td>1 to 1000%</td><td>Introduces the motorRPM display gain with the gearing rate involved when monitoring motor system RPM instead of motor shaft RPM.</td><td>NO</td></tr>
<tr><td>Ad 64[1]</td><td>Up-down operation frequency save</td><td>0.00 Hz</td><td>0.00 Hz to 400.00 Hz</td><td>If parameter Ad 65 is set to 1, the Up-Down save function allows the drive to save the frequency in parameter Ad 64 before stopping or accelerating.</td><td>YES</td></tr>
<tr><td>Ad 65</td><td>Up-down operation frequency save selection</td><td>No
Yes</td><td>No
Yes</td><td>Indicates Up-Down frequency save selection.<table><tr><th>OPT.</th><th>FUNCTION</th></tr><tr><td>No</td><td>Save the frequency.</td></tr><tr><td>Yes</td><td>Configures frequency saving.</td></tr></table></td><td>YES</td></tr>
<tr><td>Ad 66</td><td>Up-down operation mode selection</td><td>0</td><td>0 to 2</td><td>When parameter Ad 66 is set to 1, the motor accelerates at the step frequency set by parameter Ad 67 that has been set as the Up signal. The motor decelerates by the step frequency set by parameter Ad 67 that has been set as the Down signal.<table><tr><th>OPT.</th><th>FUNCTION</th></tr><tr><td>0</td><td>Maximum/minimum frequency reference.</td></tr><tr><td>1</td><td>Increase or decrease based on the step frequency (Ad67)</td></tr><tr><td>2</td><td>Mixed DESCRIPTION of 0 and 1.</td></tr></table></td><td>YES</td></tr>
<tr><td>Ad 67</td><td>Up-down operation step frequency</td><td>0.00 Hz</td><td>0.00 Hz to 400.00 Hz</td><td>Indicates the assigned jump frequency.</td><td>NO</td></tr>
<tr><td>Ad 79</td><td>DB operation voltage (Dynamic Braking)</td><td>390 V</td><td>300 to 400 V</td><td>Indicates the operating voltage of the dynamic brake.</td><td>NO</td></tr>
</table>

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[1] Displayed only when OU31 (Multi-function relay setting) or OU32 (Multi-function output 2 function setting) is set to 19 (brake signal setting).
[2] Displayed only when Ad65 is set to 1.

Group 4: Control Functions → Cn

<table>
<tr><th>SCREEN</th><th>DESCRIPTION</th><th>DEFAULT VALUE</th><th>RANGE</th><th>FUNCTION</th><th>SET ON RUN</th></tr>
<tr><td>Cn 0</td><td>Jump Code</td><td>4</td><td>0 to 79</td><td>Allows to navigate between the different parameters.</td><td>YES</td></tr>
<tr><td>Cn 4</td><td>Modulation frequency</td><td>3.0 Hz</td><td>1.0 to 15.0 Hz</td><td>Varies the switching frequency at the output stage of the motor to adjust the noise inside the motor. If the frequency is high, it reduces the operational noise of the motor. If it is low, the operational noise inside the motor increases.</td><td>NO</td></tr>
<tr><td>Cn 71</td><td>Speed search selection</td><td>0000</td><td>0000 to 1111</td><td>Sets the speed search mode by setting each bit according to the following table:
<table>
<tr><th>OPT.</th><th>FUNCTION</th></tr>
<tr><td>0001</td><td>Speed search on general acceleration.</td></tr>
<tr><td>0010</td><td>Speed search on operation after fault trip.</td></tr>
<tr><td>0100</td><td>Speed search on restart after instantaneous power interruption.</td></tr>
<tr><td>1000</td><td>Speed search when power is on (Ad10).</td></tr>
</table></td><td>NO</td></tr>
<tr><td>Cn 72</td><td>Speed search current level</td><td>100%</td><td>80 to 200%</td><td>Controls the amount of current flow during speed search operation as a function of the rated motor current (MrC).</td><td>YES</td></tr>
<tr><td>Cn 73</td><td>Speed search P gain</td><td>500</td><td>0 to 9999</td><td>Sets the proportional gain for speed search. The gain is adjusted according to the characteristics of the load.</td><td>YES</td></tr>
<tr><td>Cn 74</td><td>Speed search I gain</td><td>1000</td><td>0 to 9999</td><td>Sets the integral gain for speed search. The gain is adjusted according to the characteristics of the load.</td><td>YES</td></tr>
</table>

Group 5: Inputs → In

SCREEN	DESCRIPTION	DEFAULT VALUE	RANGE	FUNCTION	SET ON RUN
In 0	Jump Code	65	0 to 90	Allows to navigate between the different parameters.	YES
In 7	Time constant of V1 input filter	10	0 to 9999	Indicates the time constant of the V1 terminal filter.	NO
In 8[1]	V1 Minimum input voltage	0.00 V	0.00 to 10.00 V	Sets the minimum terminal voltage V1.	YES
In 9	Frequency corresponding to V1 minimum input voltage	0.00 Hz	0.0 Hz to 400.00 Hz	Sets the frequency corresponding to the minimum input voltage of terminal V1.	YES
In 10[1]	V1 Maximum input voltage	10.00 V	0.00 to 10.00 V	Sets the maximum terminal voltage V1.	YES
In 11	Frequency corresponding to V1 maximum input voltage	60.00 Hz	0.00 Hz to 400.00 Hz	Sets the frequency corresponding to the maximum input voltage of the V1 terminal.	YES
In 37	Time constant of V0 input filter	10	0 to 9999 s	Indicates the time constant of the V0 potentiometer filter.	NO
In 38	V0 Minimum input voltage	0.00 V	0.00 to 5.00 V	Sets the minimum input voltage of the potentiometer V0.	YES
In 39	Frequency corresponding to V0 minimum input voltage	0.00 Hz	0.00 Hz to 400.00 Hz	Sets the frequency corresponding to the minimum input voltage of the potentiometer V0.	YES
In 40	V0 Maximum input voltage	5.00 V	0.00 to 5.00 V	Sets the maximum input voltage of potentiometer V0.	YES
In 41	Frequency corresponding to V0 maximum input voltage	60.00 Hz	0.00 Hz to 400.00 Hz	Sets the frequency corresponding to the maximum input voltage of the potentiometer V0.	YES
In 52	I2 input filter time constant	10	0 to 9999 s	Indicates the time constant of the I2 terminal filter.	NO
In 53[2]	I2 minimum current	4.00 mA	4.00 to 20.00 mA	Sets the minimum current of terminal I2.	YES
In 54	I2 minimum frequency reference	0.00 Hz	0.00 Hz to 400.00 Hz	Sets the frequency corresponding to the minimum current of terminal I2.	YES
In 55[2]	I2 maximum current	20.00 mA	4.00 to 20.00 mA	Sets the maximum current of terminal I2.	YES
In 56	I2 maximum frequency reference	60.00 Hz	0.00 Hz to 400.00 Hz	Sets the frequency corresponding to the maximum current of the I2 terminal.	YES
In 57	V input filter time constant	10	0 to 9999 s	Indicates the time constant of the input filter of terminal V1.	NO
In 58[3]	V mínimum input voltage	0.00 V	0.00 to 10.00 V	Sets the minimum input voltage of the V terminal.	YES
In 59	Frequency corresponding to V minimum input voltage	0.00 Hz	0.00 Hz to 400.00 Hz	Sets the frequency corresponding to the minimum input voltage of the V terminal.	YES
In 60[3]	V maximum input voltage	10.00 V	0.00 to 10.00 V	Sets the maximum input voltage of the V terminal.	YES
In 61	Frequency corresponding to V maximum input voltage	60.00 Hz	0.00 Hz to 400.00 Hz	Sets the frequency corresponding to the maximum input voltage of the terminal V.	YES

EN

[1] Frequency reference can be changed by configuring the voltage inputs when using the V1 terminal or the VR terminal is connected to the V1 terminal.
[2] Displayed when I is selected on the analogue input circuit switch SW2.
[3] Displayed when switch SW2 is changed to V.

<table>
<tr><th>SCREEN</th><th>DESCRIPTION</th><th>DEFAULT VALUE</th><th>RANGE</th><th>FUNCTION</th><th>SET ON RUN</th></tr>
<tr><td>In 65</td><td>Multifunction input terminal P1 function setting</td><td>0</td><td rowspan="5">0 to 27</td><td rowspan="5">Configures the digital inputs according to the following table:
<table>
<tr><th>OPT.</th><th>DESCRIPTION</th></tr>
<tr><td>0</td><td>Forward run command (FX).</td></tr>
<tr><td>1</td><td>Reward run command (RX).</td></tr>
<tr><td>2</td><td>Emergency stop (Emergency Stop Trip).</td></tr>
<tr><td>3</td><td>Reset when fault trip occurs (RESET).</td></tr>
<tr><td>4</td><td>Jog operation command (JOG).</td></tr>
<tr><td>5</td><td>Multi-step speed – low.</td></tr>
<tr><td>6</td><td>Multi-step speed – middle.</td></tr>
<tr><td>7</td><td>Multi-step speed – high.</td></tr>
<tr><td>8</td><td>Multi-step acc/dec – low.</td></tr>
<tr><td>9</td><td>Multi-step acc/dec – middle.</td></tr>
<tr><td>10</td><td>Multi-step acc/dec – high.</td></tr>
<tr><td>11</td><td>DC braking during stop command.</td></tr>
<tr><td>12</td><td>Second motor selection.</td></tr>
<tr><td>13</td><td>Reserved.</td></tr>
<tr><td>14</td><td>Reserved.</td></tr>
<tr><td>15</td><td>Up – Down operation function. Frequency increase command (UP).</td></tr>
<tr><td>16</td><td>Up – Down operation function. Frequency reduction command (DOWN).</td></tr>
<tr><td>17</td><td>3-wire operation.</td></tr>
<tr><td>18</td><td>External trip signal input: A terminal (EtA).</td></tr>
<tr><td>19</td><td>External trip signal input: B terminal (EtB).</td></tr>
<tr><td>20</td><td>Reserved.</td></tr>
<tr><td>21</td><td>Transition from PID to general operation.</td></tr>
<tr><td>22</td><td>Second source.</td></tr>
<tr><td>23</td><td>Fix analog command frequency.</td></tr>
<tr><td>24</td><td>Acceleration/deceleration stop command.</td></tr>
<tr><td>25</td><td>Initialize saved up-down frequency.</td></tr>
<tr><td>26</td><td>Jog forward operation command (JOG-FX).</td></tr>
<tr><td>27</td><td>Jog reverse operation command (JOG-RX).</td></tr>
</table></td><td>NO</td></tr>
<tr><td>In 66</td><td>Multifunction input terminal P2 function setting</td><td>1</td><td>NO</td></tr>
<tr><td>In 67</td><td>Multifunction input terminal P3 function setting</td><td>2</td><td>NO</td></tr>
<tr><td>In 68</td><td>Multifunction input terminal P4 function setting</td><td>3</td><td>NO</td></tr>
<tr><td>In 69</td><td>Multifunction input terminal P5 function setting</td><td>4</td><td>NO</td></tr>
<tr><td>In 70</td><td>PNP/NPN selection switch</td><td>-</td><td>0 to 1</td><td>Allows selection of the type of PNP/NPN selector switch on the control board (SW1).
<table>
<tr><th>OPT.</th><th>DESCRIPTION</th></tr>
<tr><td>0</td><td>PNP</td></tr>
<tr><td>1</td><td>NPN</td></tr>
</table></td><td>YES</td></tr>
<tr><td>In 85</td><td>Multifunction input terminal filter time constant</td><td>4</td><td>1 to 15</td><td>Indicates the time constant of the digital input filter.</td><td>NO</td></tr>
<tr><td>In 87</td><td>Multifunction input contact selection</td><td>0000</td><td>0000 to 1111</td><td>Set each bit to 0 or 1 according to the following table: (P5 - P1):
<table>
<tr><th>OPT.</th><th>DESCRIPTION</th></tr>
<tr><td>0</td><td>A contact (NO).</td></tr>
<tr><td>1</td><td>B contact (NC).</td></tr>
</table>
The order of assignment is P1, P2, ..., P5 starting from the bit furthest to the right.</td><td>NO</td></tr>
<tr><td>In 90</td><td>Input terminal block status display</td><td>-</td><td>-</td><td>Displays the reserved bits for each input terminal.
<table>
<tr><th>BIT4</th><th>BIT3</th><th>BIT2</th><th>BIT1</th><th>BIT0</th></tr>
<tr><td>P5</td><td>P4</td><td>P3</td><td>P2</td><td>P1</td></tr>
</table></td><td>NO</td></tr>
</table>

Group 6: Outputs → OU

<table>
<tr><th>SCREEN</th><th>DESCRIPTION</th><th>DEFAULT VALUE</th><th>RANGE</th><th>FUNCTION</th><th>SET ON RUN</th></tr>
<tr><td>OU 0</td><td>Jump Code</td><td>30</td><td>0 to 58</td><td>Allows to navigate between the different parameters.</td><td>YES</td></tr>
<tr><td>OU 1</td><td>Multifunction input terminal P1 function setting</td><td>0</td><td>0 to 3</td><td>The analogue outputs are programmable according to the following table:
<table>
<tr><th>OPT.</th><th>FUNCTION</th><th>DESCRIPTION</th></tr>
<tr><td>0</td><td>Output frequency</td><td>Maximum frequency (FrM).</td></tr>
<tr><td>1</td><td>Current</td><td>150% or inverter's rated current.</td></tr>
<tr><td>2</td><td>Output Voltage</td><td>AC 282V</td></tr>
<tr><td>3</td><td>DC voltage</td><td>DC 410V</td></tr>
</table></td><td>YES</td></tr>
<tr><td>OU 2</td><td>Analog output level adjustment</td><td>100%</td><td>10 to 200%</td><td>Adjusts the value of the analogue output according to various counters when an analogue output is used as input to the counter.</td><td>NO</td></tr>
<tr><td>OU 30</td><td>Fault output setting</td><td>010</td><td>000 to 111</td><td>Configures the relay output in the event of a fault. The multifunction output terminal and the relay with configuration OU 30 operate when code OU 31 or OU 32 is set to 17.
<table>
<tr><th>OPT.</th><th>FUNCTION</th></tr>
<tr><td>001</td><td>Operation when low voltage trip occurs.</td></tr>
<tr><td>010</td><td>Operation when fault trip other than low voltage trip occurs.</td></tr>
<tr><td>100</td><td>Operation when number of automatic restarts after fault trip (Pr 9) is set.</td></tr>
</table></td><td>YES</td></tr>
<tr><td>OU 31</td><td>Multi function relay setting</td><td>17</td><td>0 to 19</td><td>Configure the relay according to the following table:
<table>
<tr><th>OPT.</th><th>DESCR.</th><th>FUNCTION</th></tr>
<tr><td>0</td><td>FDT-1</td><td>Detects the output frequency of the drive reaching the frequency set by the user. Outputs a signal when the absolute value (set frequency - output frequency) is less than or equal to the detected frequency width/2.</td></tr>
<tr><td>1</td><td>FDT-2</td><td>Emits a signal when the frequency set by the user and the detected frequency (OU 57) are equal and meets the FDT-1 condition at the same time.</td></tr>
<tr><td>2</td><td>FDT-3</td><td>Emits a signal when the absolute value (output frequency-operating frequency) is less than or equal to the width of the detected frequency/2.</td></tr>
<tr><td>3</td><td>FDT-4</td><td>Emits a signal under the following conditions:
-In acceleration:
Operating frequency≧ Detected frequency.
-In deceleration:
Operating frequency> (Detected frequency-Detected frequency width-detected frequency/2).</td></tr>
</table></td><td>YES</td></tr>
</table>

SCREEN	DESCRIPTION	DEFAULT VALUE	RANGE	FUNCTION	SET ON RUN

OPT.	DESCR.	FUNCTION
4	FDT-5	Outputs a signal to contact B, in the reverse direction to FDT-4, under the following conditions: - In acceleration: Operating frequency ≥ Detected frequency. - In deceleration: Operating frequency> (Detected frequency-Detected frequency range detected frequency/2)
5	Overload (OL)	The motor will be active when the motor is overloaded.
6	Inverter Overload (IOL)	The output is blocked when the current level exceeds the set value during the overload trip time.
7	Motor stall (STALL)	When accelerating, the motor decelerates when the current exceeds the value set in parameter Pr 52. When operating at constant speed, the motor decelerates when the current exceeds the value set in parameter Pr 52. The motor stops decelerating when the internal DC circuit voltage increases to a certain level.
8	Over voltage (Ovt)	Emits a signal when the DC voltage of the main circuit of the drive exceeds the rated voltage (410 Vdc).
9	Low voltage (Lvt)	Emits a signal when the DC voltage of the drive circuit falls below the nominal voltage (initial value: 170 Vdc, determined by setting bA 19) and an undervoltage disconnection occurs.
10	Inverter cooling fan overheat (OHt)	Emits a signal when the cooling pin of the drive is overheated.
11	Lost command	Outputs a signal when there is a loss of analogue input (V0, V1, I21) input terminal and RS-485 communication command.
12	Run	IEmits a signal when the operating command is entered and the drive outputs voltage.
13	Stop	Emits a signal when the drive is not working.
14	At constant speed	Emits a signal in continuous operation.

<table>
<tr><th>SCREEN</th><th>DESCRIPTION</th><th>DEFAULT VALUE</th><th>RANGE</th><th>FUNCTION</th><th>SET ON RUN</th></tr>
<tr><td></td><td></td><td></td><td></td><td>
<table>
<tr><th>OPT.</th><th>DESCR.</th><th>FUNCTION</th></tr>
<tr><td>15</td><td>Speed search</td><td>Can select a speed search operation via parameter Cn 71.</td></tr>
<tr><td>16</td><td>Ready</td><td>Emits a signal when the drive is in standby operation and is ready to receive an external operating command.</td></tr>
<tr><td>17</td><td>Fault output setting</td><td>Emits a signal according to the settings of parameter OU 30. If parameter OU 31 is set to 17, and parameter OU 30 is set to 2, the multifunction relay operates when a trip occurs (except for an undervoltage trip).</td></tr>
<tr><td>18</td><td>Abnormal cooling fan alarm</td><td>Emits a signal when parameter Pr 79 is set to 0 (continuous operation when the cooling fan fails).</td></tr>
<tr><td>19</td><td>Brake signal setting</td><td>Emits a signal when the external brake signal is activated.</td></tr>
</table>
</td><td></td></tr>
<tr><td>OU 32</td><td>Multifunction output 2 feature selection</td><td>17</td><td>O to 17</td><td>Same as OU 31.</td><td></td></tr>
<tr><td>OU 41</td><td>Output terminal block status display</td><td>00</td><td>00 to 11</td><td>Allows the status of the output terminal block to be displayed.
<table>
<tr><th>OPT.</th><th>DESCRIPTION</th></tr>
<tr><td>BIT0</td><td>Relay1.</td></tr>
<tr><td>BIT1</td><td>Relay2 / Open collector output.</td></tr>
</table>
</td><td>YES</td></tr>
<tr><td>OU 52</td><td>Multifunction output/relay contact selection</td><td>00</td><td>0 to 1</td><td>Defines the type of contact according to the following table:
<table>
<tr><th>OPT.</th><th>DESCRIPTION</th></tr>
<tr><td>0</td><td>A contact (NO)</td></tr>
<tr><td>1</td><td>B Contact (NC)</td></tr>
</table>
</td><td>NO</td></tr>
<tr><td>OU 57</td><td>Detection frequency</td><td>30.00Hz</td><td>0.00 Hz to 400.00 Hz</td><td>Output frequency value for FDT options of digital outputs.</td><td>YES</td></tr>
<tr><td>OU 58</td><td>Detection frequency band</td><td>10.00Hz</td><td>0.00Hz to 400.00 Hz</td><td>Frequency detection band for FDT options of digital outputs.</td><td>YES</td></tr>
</table>

EN

Group 7: Communication Bus → CM

<table>
<tr><th>SCREEN</th><th>DESCRIPTION</th><th>DEFAULT VALUE</th><th>RANGE</th><th>FUNCTION</th><th>SET ON RUN</th></tr>
<tr><td>CM 0</td><td>Jump Code</td><td>31</td><td>0 to 58</td><td>Allows to navigate between the different parameters.</td><td>YES</td></tr>
<tr><td>CM 1</td><td>Inverter station ID</td><td>1</td><td>1 to 250</td><td>Unit identifier for communicating within the network.</td><td>YES</td></tr>
<tr><td>CM 2</td><td>Communication protocol setting</td><td>0</td><td>0 to 1</td><td>Allows selection of the protocol used in communications.<table><tr><th>OPT.</th><th>DESCR.</th><th>FUNCTION</th></tr><tr><td>0</td><td>Modbus RTU</td><td>Modbus-RTU compatible protocol.</td></tr><tr><td>1</td><td>PE BUS</td><td>Communication protocol used to communicate drives.</td></tr></table></td><td>YES</td></tr>
<tr><td>CM 3</td><td>Communication speed</td><td>3</td><td>0 to 5</td><td>Sets the data transfer rate in Modbus communication.<table><tr><th>OPT.</th><th>DESCRIPTION</th></tr><tr><td>0</td><td>1,200 bps</td></tr><tr><td>1</td><td>2,400 bps</td></tr><tr><td>2</td><td>4,800 bps</td></tr><tr><td>3</td><td>9,600 bps</td></tr><tr><td>4</td><td>19,200 bps</td></tr><tr><td>5</td><td>38,400 bps</td></tr></table></td><td>YES</td></tr>
<tr><td>CM 4</td><td>Parity/stop bit setting</td><td>0</td><td>0 to 3</td><td>Sets a communication configuration, the data length, the parity confirmation method and the number of stop bits.<table><tr><th>OPT.</th><th>DESCR.</th><th>FUNCTION</th></tr><tr><td>0</td><td>D8/PN/S1</td><td>8-bit data/no parity/1 stop bit</td></tr><tr><td>1</td><td>D8/PN/S2</td><td>8-bit data/no parity/2 stop bit</td></tr><tr><td>2</td><td>D8/PE/S1</td><td>8-bit data/even parity/1 stop bit</td></tr><tr><td>3</td><td>D8/PO/S1</td><td>8-bit data/odd parity/1 stop bit</td></tr></table></td><td>YES</td></tr>
<tr><td>CM 5</td><td>Communication time setting</td><td>5ms</td><td>2 to 100 ms</td><td>Sets the Modbus communications transfer rate, which must match with the bus communication master within the drive.</td><td>YES</td></tr>
<tr><td>CM31</td><td>Read address registration 1</td><td>000A</td><td rowspan="8">0000 to AA4FF</td><td rowspan="8">Defines the output parameter group for data transmission, so that addresses configured in CM 31-38 ca be used to send several parameters at once in the same communications frame.</td><td>YES</td></tr>
<tr><td>CM32</td><td>Read address registration 2</td><td>000E</td><td>YES</td></tr>
<tr><td>CM33</td><td>Read address registration 3</td><td>000F</td><td>YES</td></tr>
<tr><td>CM34</td><td>Read address registration 4</td><td>000A</td><td>YES</td></tr>
<tr><td>CM35</td><td>Read address registration 5</td><td>0000</td><td>YES</td></tr>
<tr><td>CM36</td><td>Read address registration 6</td><td>0000</td><td>YES</td></tr>
<tr><td>CM37</td><td>Read address registration 7</td><td>0000</td><td>YES</td></tr>
<tr><td>CM38</td><td>Read address registration 8</td><td>0000</td><td>YES</td></tr>
<tr><td>CM51</td><td>Write address registration 1</td><td>0000</td><td rowspan="8">0000 to AA4FF</td><td rowspan="8">Defines the input parameter group for data transmission, so that addresses configured in CM 51-58 ca be used to send several parameters at once in the same communications frame.</td><td>YES</td></tr>
<tr><td>CM52</td><td>Write address registration 2</td><td>0000</td><td>YES</td></tr>
<tr><td>CM53</td><td>Write address registration 3</td><td>0000</td><td>YES</td></tr>
<tr><td>CM54</td><td>Write address registration 4</td><td>0000</td><td>YES</td></tr>
<tr><td>CM55</td><td>Write address registration 5</td><td>0000</td><td>YES</td></tr>
<tr><td>CM56</td><td>Write address registration 6</td><td>0000</td><td>YES</td></tr>
<tr><td>CM57</td><td>Write address registration 7</td><td>0000</td><td>YES</td></tr>
<tr><td>CM58</td><td>Write address registration 8</td><td>0000</td><td>YES</td></tr>
</table>

Group 8: PID → AP

<table>
<tr><th>SCREEN</th><th>DESCRIPTION</th><th>DEFAULT VALUE</th><th>RANGE</th><th>FUNCTION</th><th>SET ON RUN</th></tr>
<tr><td>AP 0</td><td>Jump Code</td><td>20</td><td>0 to 71</td><td>Allows to navigate between the different parameters.</td><td>YES</td></tr>
<tr><td>AP 1</td><td>PID control setting</td><td>0</td><td>0 to 1</td><td>Allows you to section the PID control settings according to the following table:
<table>
<tr><th>OPT.</th><th>STATUS</th></tr>
<tr><td>0</td><td>No</td></tr>
<tr><td>1</td><td>Yes</td></tr>
</table></td><td>YES</td></tr>
<tr><td>AP 2[1]</td><td>PID units selection</td><td>0</td><td>0 to 1</td><td>Allows selection of the PID scale according to the following table:
<table>
<tr><th>OPT.</th><th>DESCRIPTION</th></tr>
<tr><td>0</td><td>Frequency (Hz)</td></tr>
<tr><td>1</td><td>Percentage (%)</td></tr>
</table></td><td>YES</td></tr>
<tr><td>AP 18[1]</td><td>Amount of PID feedback</td><td>0.00 Hz / 0.0%</td><td>0.00 to 400.00 Hz / 0.0 to 100.0 %</td><td>Corresponds to the feedback input value to the PID controller.
<table>
<tr><th>OPT.</th><th>DESCRIPTION</th></tr>
<tr><td>0</td><td>When AP 2 is 0: frequency display range 0.00 - 400.00 Hz</td></tr>
<tr><td>1</td><td>When AP 2 is 1: frequency display range 0.00 - 100.00%</td></tr>
</table></td><td>YES</td></tr>
<tr><td>AP 19[1]</td><td>PID reference</td><td>0.00Hz / 0.0%</td><td>0.00 to 400.00 Hz / 0.0 to 100.0 %</td><td>Corresponds to the PID controller reference value.
<table>
<tr><th>OPT.</th><th>DESCRIPTION</th></tr>
<tr><td>0</td><td>When AP 2 is 0: 0.00 – 400.00 Hz</td></tr>
<tr><td>1</td><td>When AP 2 is 1: 0.00 - 100.0%</td></tr>
</table></td><td>YES</td></tr>
<tr><td>AP 20[1]</td><td>PID reference setting</td><td>0</td><td>0 to 5</td><td>Select the PID controller ordering number according to the following table:
<table>
<tr><th>OPT.</th><th>DESCRIPTION</th></tr>
<tr><td>0</td><td>Keypad 1</td></tr>
<tr><td>1</td><td>Keypad 2</td></tr>
<tr><td>2</td><td>V1: 0 – 10 V</td></tr>
<tr><td>3</td><td>I2(I): 0 – 20 mA</td></tr>
<tr><td>4</td><td>I2(I): 0 – 10 mA</td></tr>
<tr><td>5</td><td>RS - 485 communication</td></tr>
</table></td><td>NO</td></tr>
<tr><td>AP 21[1]</td><td>PID feedback setting</td><td>2</td><td>0 to 3</td><td>Selects the reference through which the feedback signal will be introduced to close the control loop.
<table>
<tr><th>OPT.</th><th>FUNCTION</th></tr>
<tr><td>0</td><td>I2(I): 0 – 20 mA</td></tr>
<tr><td>1</td><td>I2(I): 0 – 10 mA</td></tr>
<tr><td>2</td><td>V1: 0 – 10 V</td></tr>
<tr><td>3</td><td>RS - 485 communication</td></tr>
</table></td><td>NO</td></tr>
<tr><td>AP 22[1]</td><td>PID controller P gain</td><td>300.0%</td><td>0.0 to 999.9%</td><td>Adjusts the value of the gain controller proportional to the PID controller. This value should be increased whenever a higher control response is required.</td><td>YES</td></tr>
<tr><td>AP 23[1]</td><td>PID controller integral time (I gain)</td><td>1.00 s</td><td>0.10 to 32.00 s</td><td>Adjusts the integration time of the controller. If higher precision is required, this value must be increased.</td><td>YES</td></tr>
<tr><td>AP 24[1]</td><td>PID controller differentiation time (D gain)</td><td>0.00 s</td><td>0.00 to 30.00 s</td><td>Adjust the differential time of the controller. Whenever a higher response is required, this value can be increased.</td><td>YES</td></tr>
</table>

EN

[1] Este parámetro está disponible cuando el código AP01 está ajustado a 1.

SCREEN	DESCRIPTION	DEFAULT VALUE	RANGE	FUNCTION	SET ON RUN
AP 28[1]	PID mode	0	0 to 1	Sets the control mode of the PID controller according to the following table: OPT. / DESCRIPTION 0 / Normal PID control 1 / Process PID control	NO
AP 29[1]	PID output upper limit frequency	60.00 Hz	AP 30 to 400.00 Hz	Adjusts the PID output upper limit.	YES
AP 30[1]	PID output lower limit frequency	60.00 Hz	0.00 to AP 29	Adjusts the PID output lower limit.	YES
AP 37[2]	Sleep mode activation delay	60.0s	0.0 to 2000.0 s	Set the delay time before enabling the sleep mode. If the drive operates at a speed value under the value of AP.38, it will stop running and enter in sleep mode.	YES
AP 38[1]	Sleep mode activation speed	0.00 Hz	0.00 Hz to 400.00 Hz	Set the speed under which if a time period greater than the one defined in parameter AP 37, the drive will stop operating and enter in sleep mode.	YES
AP 39[1]	Wake-up level	35.0%	0.0 to 100.0%	Set the resuming PID control level after a suspension period (sleep mode).	YES
AP 70	Draw operation mode selection	0	0 to 4	Draw operation is a tension control. This feature allows a constant tension to be applied to the material being pulled by a motorised device by adjusting the motor speed finely using operating frequencies that are proportional to a ratio of the main frequency reference. The ratio applied to the output frequency differs according to the setting of parameter AP 70 (extraction operation). OPT. / DESCRIPTION 0 / Do not use draw operation 1 / V1 (0 – 10 V): input draw operation. 2 / V0 (0 – 5 V): input draw operation. 3 / I2 (0 – 20 V): input draw operation. 4 / I2 (0 – 10 V): input draw operation.	NO
AP 22[1]	Draw percentage	0.0%	0.0 to 100.0%	Indicates the draw percentage.	NO

[1] This parameter is available when code AP01 is set to 1.

Group 9: Protections → Pr

<table>
<tr><th>SCREEN</th><th>DESCRIPTION</th><th>DEFAULT VALUE</th><th>RANGE</th><th>FUNCTION</th><th>SET ON RUN</th></tr>
<tr><td>Pr 0</td><td>Jump Code</td><td>40</td><td>0 to 96</td><td>Sets and modifies a frequency reference for an operation.</td><td>YES</td></tr>
<tr><td>Pr 5</td><td>Output openphase protection setting</td><td>0</td><td>0 to 1</td><td>Configures the type of open phase protection on the output.
<table>
<tr><th>OPT.</th><th>DESCR.</th><th>FUNCTION</th></tr>
<tr><td>0</td><td>No</td><td>Does not use open phase protection selection of the output.</td></tr>
<tr><td>1</td><td>Yes</td><td>Configures to use open phase protection of the output.</td></tr>
</table>
Caution: sets the motor rated current (MrC) correctly. The output open phase protection function may not work if the MrC code value does not match the actual rated current of the motor.</td><td>NO</td></tr>
<tr><td>Pr 8</td><td>Operation on reset after fault trip</td><td>0</td><td>0 to 1</td><td>Allows to start after the fault trip.
<table>
<tr><th>OPT.</th><th>DESCRIPTION</th></tr>
<tr><td>0</td><td>No</td></tr>
<tr><td>1</td><td>Yes</td></tr>
</table></td><td>YES</td></tr>
<tr><td>Pr 9</td><td>Number of automatic restarts after fault trip</td><td>0</td><td>0 to 10</td><td rowspan="2">When a trip occurs and the run command is entered after the trip, the drive protection function is activated and the drive restarts automatically after the time programmed in code Pr 10. At each restart, the drive counts the number of retries and subtracts it from the number programmed in code Pr 9 until the retry number count reaches 0. The retry count returns to the original setting when manually reset using the terminal block of the inverter or the [STOP/RESET] key and when no trip occurs within 30 seconds of an automatic reset.</td><td rowspan="2">YES</td></tr>
<tr><td>Pr 10</td><td>Automatic restart delay time after fault trip</td><td>1.0 s</td><td>0.0 to 60.0 s</td></tr>
<tr><td>Pr 12</td><td>Motion at speed command loss</td><td>0</td><td>0 to 2</td><td>Selects the operation that is executed when a communication error occurs that exceeds the time set in Pr13.
<table>
<tr><th>OPT.</th><th>FUNCTION</th></tr>
<tr><td>0</td><td>Continue to run at frequency before the command loss.</td></tr>
<tr><td>1</td><td>Free run stop (output block).</td></tr>
<tr><td>2</td><td>Deceleration stop.</td></tr>
</table></td><td>YES</td></tr>
<tr><td>Pr 13</td><td>Time to decide speed command loss</td><td>1.0 s</td><td>0.1 to 120.0 s</td><td>Adjusts the delay time after which the loss of speed reference protection will be activated.</td><td>YES</td></tr>
<tr><td>P r15</td><td>Time to determine analog speed command loss</td><td>0</td><td>0 to 2</td><td>Adjusts the time for determining the loss of the analogue speed command.
<table>
<tr><th>OPT.</th><th>FUNCTION</th></tr>
<tr><td>0</td><td>Not operating.</td></tr>
<tr><td>1</td><td>When the input value is less than half of the value set in the codes In 8, In 38 and In 53.</td></tr>
<tr><td>2</td><td>When the value of the input is less than the value set in the codes In 8, In 38 and In 53.</td></tr>
</table></td><td>YES</td></tr>
<tr><td>Pr 18</td><td>Overload alarm level</td><td>150%</td><td>30 to 150%</td><td rowspan="2">The overload warning is a combination of parameters Pr 18-20. The drive will enable some of the digital outputs configured as 'OverLoad' whenever the current flowing into the motor is greater than the value defined in parameter Pr 18 for the time set in parameter Pr 19.</td><td>YES</td></tr>
<tr><td>Pr 19</td><td>Overload warning time</td><td>10.0 s</td><td>0.0 to 30.0 s</td><td>YES</td></tr>
</table>

<table>
<tr><th>SCREEN</th><th>DESCRIPTION</th><th>DEFAULT VALUE</th><th>RANGE</th><th>FUNCTION</th><th>SET ON RUN</th></tr>
<tr><td>Pr 20</td><td>Overload warning selection</td><td>0</td><td>0 to 1</td><td>The drive takes the following actions in case of an overload failure.
<table>
<tr><th>OPT.</th><th>FUNCTION</th></tr>
<tr><td>0</td><td>Protection is disabled.</td></tr>
<tr><td>1</td><td>Blocks the output of the drive when it is overloaded.</td></tr>
</table>
Caution: Ensure that disabling this protection does not compromise the operation of the installation and/or equipment.</td><td>YES</td></tr>
<tr><td>Pr 21</td><td>Overload fault level</td><td>180%</td><td>30 to 200%</td><td rowspan="2">The overload fault protection is a combination of parameters Pr 20-22. The drive will perform the action selected in parameter Pr 20 whenever the current flow inside the motor is higher than the value of parameter Pr 21 for the time defined in parameter Pr 22.
Displayed only when Pr 20 is set to 1.</td><td>YES</td></tr>
<tr><td>Pr 22</td><td>Overload fault time</td><td>60.0 s</td><td>0.0 to 60.0 s</td><td>YES</td></tr>
<tr><td>Pr 40</td><td>ETH selection</td><td>0</td><td>0 to 1</td><td>Protects the motor from overheating based on inverse time limit thermal characteristics. The drive output is blocked based on the ETH (Electronic Thermal Motor Overheating Prevention) trip time when the current exceeds the value set in code Pr 42.
<table>
<tr><th>OPT.</th><th>FUNCTION</th></tr>
<tr><td>0</td><td>The ETH function is not active.</td></tr>
<tr><td>1</td><td>The ETH function is active.</td></tr>
</table></td><td>YES</td></tr>
<tr><td>Pr 41[1]</td><td>Motor cooling type</td><td>0</td><td>0 to 1</td><td>Selects the type of motor cooling according to the following table:
<table>
<tr><th>OPT.</th><th>FUNCTION</th></tr>
<tr><td>0</td><td>General motor that cooler is attached to its axis.</td></tr>
<tr><td>1</td><td>Motor that supplies separate power to the cooler.</td></tr>
</table></td><td>YES</td></tr>
<tr><td>Pr42[1]</td><td>Electronic thermal 1minute level</td><td>150%</td><td>Pr 43 to 200%</td><td>Introduces the maximum current per minute of the motor based on the rated current of the motor. The value cannot be set lower than the value set in Pr 43.</td><td>YES</td></tr>
<tr><td>Pr 43[1]</td><td>Electronic thermal continuous operation level</td><td>100%</td><td>50% to Pr 42</td><td>Introduces the current at which the motor must run continuously. Generally, the value is the rated current specified on the motor nameplate. The value cannot be set to the value set in Pr 42, 150%, or higher.</td><td>YES</td></tr>
<tr><td>Pr 50</td><td>Stall prevention selection</td><td>000</td><td>000 to 100</td><td>This protection limits the output current to the motor and can be configured for acceleration, deceleration or constant speed motor operation.
<table>
<tr><th>OPT.</th><th>FUNCTION</th></tr>
<tr><td>001</td><td>Prevent stall when accelerating.</td></tr>
<tr><td>010</td><td>Prevent stall when running at a constant speed.</td></tr>
<tr><td>100</td><td>Prevent stall when decelerating.</td></tr>
</table></td><td>NO</td></tr>
<tr><td>Pr 52</td><td>Stall prevention level</td><td>150%</td><td>30 to 200%</td><td>Motor accelerates or decelerates when it exceeds the value set in parameter Pr52.</td><td>NO</td></tr>
<tr><td>Pr 53</td><td>Voltage limit when using stall prevention during deceleration</td><td>0</td><td>0 to 1</td><td>Enables or disables the voltage limit during deceleration. Displayed when Pr50 is set to 2 or 1.
<table>
<tr><th>OPT.</th><th>DESCRIPTION</th></tr>
<tr><td>0</td><td>Not activated</td></tr>
<tr><td>1</td><td>Activated</td></tr>
</table></td><td>NO</td></tr>
<tr><td>Pr 65</td><td>DB (Dynamic Braking) resistor warning level limit setting</td><td>1</td><td>0 to 1</td><td>Adjusts the warning level limit of dynamic brake resistance.
<table>
<tr><th>OPT.</th><th>FUNCTION</th></tr>
<tr><td>0</td><td>Use DB resistor without level limit.</td></tr>
<tr><td>1</td><td>Use DB resistor during the time set at Pr 66.</td></tr>
</table></td><td>NO</td></tr>
<tr><td>Pr 66</td><td>DB resistor warning level</td><td>10%</td><td>0 to 30%</td><td>Defines the rate at which the braking resistor operates for one operating cycle. Displayed when Pr 50 is set to 2 or 1.</td><td>YES</td></tr>
</table>

[1] Available when Pr 40 (ETH selection) is set to 1.

<table>
<tr><th>SCREEN</th><th>DESCRIPTION</th><th>DEFAULT VALUE</th><th>RANGE</th><th>FUNCTION</th><th>SET ON RUN</th></tr>
<tr><td>Pr 79</td><td>Operation at fan fault</td><td>1</td><td>0 to 1</td><td>Selects the action to be taken in case a fan failure is detected.
<table>
<tr><th>OPT.</th><th>DESCRIPTION</th></tr>
<tr><td>0</td><td>Run continuously.</td></tr>
<tr><td>1</td><td>Stop operation.</td></tr>
</table></td><td>YES</td></tr>
<tr><td>Pr 80</td><td>Initial charging circuit trip protection (ROT)</td><td>1</td><td>0 to 1</td><td>The initial load circuit limits the input current when supplying power to the drive and consists of a resistor and a relay.
<table>
<tr><th>OPT.</th><th>DESCRIPTION</th></tr>
<tr><td>0</td><td>Not used FUNCTION ROT.</td></tr>
<tr><td>1</td><td>Used FUNCTION ROT1.</td></tr>
</table>
Caution: This function can only be used when the input power is 0,4 - 2,2 kw and does not protect tripping due to relay fusing.
this function activates and protects the drive when the input power is unstable, or a disconnection of the initial load circuit occurs while power is being supplied to the drive. if rot continues to occur after turning the power off and on again, stop using the drive. the drive may be damaged if you use the drive in an initial load circuit disconnection status.</td><td>YES</td></tr>
<tr><td>Pr 91</td><td>Fault history 1</td><td>nOn</td><td>-</td><td rowspan="5">Stores information on the types of faults, the frequency, the current and the acceleration/deceleration condition at the time of fault.</td><td>-</td></tr>
<tr><td>Pr 92</td><td>Fault history 2</td><td>nOn</td><td>-</td><td>-</td></tr>
<tr><td>Pr 93</td><td>Fault history 3</td><td>nOn</td><td>-</td><td>-</td></tr>
<tr><td>Pr 94</td><td>Fault history 4</td><td>nOn</td><td>-</td><td>-</td></tr>
<tr><td>Pr 95</td><td>Fault history 5</td><td>nOn</td><td>-</td><td>-</td></tr>
<tr><td>Pr 96</td><td>Deletion of fault history</td><td>0</td><td>0 to 1</td><td>Allows clearing the fault history stored from Pr91 to Pr95.
<table>
<tr><th>OPT.</th><th>FUNCTION</th></tr>
<tr><td>0</td><td>Maintain history.</td></tr>
<tr><td>1</td><td>Delete history.</td></tr>
</table></td><td>YES</td></tr>
</table>

Group 10: Second Motor→ M2

This groups appears if of the multi-function input terminals In 65-69 has been set to 12 (secondary motor).

<table>
<tr><th>SCREEN</th><th>DESCRIPTION</th><th>DEFAULT VALUE</th><th>RANGE</th><th>FUNCTION</th><th>SET ON RUN</th></tr>
<tr><td>M2 0</td><td>Jump Code</td><td>12</td><td>0 to 30</td><td>Sets and modifies a frequency reference for an operation.</td><td>YES</td></tr>
<tr><td>M2 4</td><td>Second motor acceleration time</td><td rowspan="2">5.0 s</td><td rowspan="2">0.0 to 6000.0 s</td><td rowspan="2">Sets the acceleration time for second motor adjustment. The setting range varies depending on the set value of the bA 8 code</td><td>YES</td></tr>
<tr><td>M2 5</td><td>Second motor deceleration time</td><td>YES</td></tr>
<tr><td>M2 7</td><td>Second motor base frequency</td><td>60.00 Hz</td><td>0.1 Hz to 400.00 Hz</td><td>Sets the second motor frequency to rated value according to its nameplate.</td><td>NO</td></tr>
<tr><td>M212</td><td>Second motor rated current</td><td>-</td><td>0.1 to 100.0 A</td><td>Sets the motor rated current in accordance with the nameplate.</td><td>NO</td></tr>
<tr><td>M2 25</td><td>Second motor V/F pattern</td><td>0</td><td>0 to 2</td><td>Sets V/F pattern according to the following table:<table><tr><th>OPT.</th><th>DESCRIPTION</th></tr><tr><td>0</td><td>Linear.</td></tr><tr><td>1</td><td>Square reduction.</td></tr><tr><td>2</td><td>User V/F.</td></tr></table></td><td>NO</td></tr>
<tr><td>M2 26</td><td>Second motor forward torque boost</td><td rowspan="2">4.0%</td><td rowspan="2">0.0 to 15.0%</td><td>Sets the torque boost in forward direction.</td><td>NO</td></tr>
<tr><td>M2 27</td><td>Second motor reverse torque boost</td><td>Sets the torque boost in reverse direction.</td><td>NO</td></tr>
<tr><td>M2 28</td><td>Second motor stall prevention level</td><td>150%</td><td>30 to 150%</td><td>Sets the stall prevention level.</td><td>NO</td></tr>
<tr><td>M2 29</td><td>Second motor electronic thermal 1 minute level</td><td>150%</td><td>100 to 200%</td><td>Sets the current level which flows continuously during one minute in percentage referenced to the motor nominal current. The motor nominal current is set in parameter M2 12. Whenever this limit is over passed, the thermo-electronic protection will be enabled, and the action defined in parameter Pr 40 will be executed.</td><td>NO</td></tr>
<tr><td>M2 30</td><td>Second motor electronic thermal continuous operation level</td><td>100%</td><td>50 to 150%</td><td>Sets the overcurrent level under which the drive is able to work without enabling the thermo-electronic protection.</td><td>NO</td></tr>
</table>

Group 11: Configuration Mode → CF

<table>
<tr><th>SCREEN</th><th>DESCRIPTION</th><th>DEFAULT VALUE</th><th>RANGE</th><th>FUNCTION</th><th>SET ON RUN</th></tr>
<tr><td>CF 0</td><td>Jump Code</td><td>1</td><td>0 to 95</td><td>Sets and modifies a frequency reference for an operation</td><td>YES</td></tr>
<tr><td>CF 1</td><td>Display after power on</td><td>0</td><td>0 to 17</td><td>Items that are displayed after power is on:
<table>
<tr><th>OPT.</th><th>DESCRIPTION</th></tr>
<tr><td>0</td><td>Command Frequency</td></tr>
<tr><td>1</td><td>Acceleration time</td></tr>
<tr><td>2</td><td>Deceleration time</td></tr>
<tr><td>3</td><td>Command source</td></tr>
<tr><td>4</td><td>Frequency setting method</td></tr>
<tr><td>5</td><td>Motor selection</td></tr>
<tr><td>6</td><td>Rated motor current</td></tr>
<tr><td>7</td><td>Base frequency</td></tr>
<tr><td>8</td><td>Maximum frequency</td></tr>
<tr><td>9</td><td>Output voltage adjustment</td></tr>
<tr><td>10</td><td>Forward boost</td></tr>
<tr><td>11</td><td>Reverse boost</td></tr>
<tr><td>12</td><td>Output current</td></tr>
<tr><td>13</td><td>Motor RPM</td></tr>
<tr><td>14</td><td>Inverter DC voltage</td></tr>
<tr><td>15</td><td>User select signal (code, dr 81 setting)</td></tr>
<tr><td>16</td><td>Currently out of order</td></tr>
<tr><td>17</td><td>Open hidden groups</td></tr>
</table></td><td>NO</td></tr>
<tr><td>CF 2</td><td>I/O Type</td><td>-</td><td>0 to 1</td><td>Indicates the type of inputs and outputs. In this case is advanced I/O.</td><td>NO</td></tr>
<tr><td>CF 79</td><td>Software version</td><td>-</td><td>-</td><td>Indicates software versión.</td><td>NO</td></tr>
<tr><td>CF93</td><td>Parameter initialization</td><td>0</td><td>0 to 13</td><td>Indicates the initialization of the parameters:
<table>
<tr><th>OPT.</th><th>FUNCTION</th></tr>
<tr><td>0</td><td>Do not initialize.</td></tr>
<tr><td>1</td><td>Initialize all.</td></tr>
<tr><td>2</td><td>Initialize operation group.</td></tr>
<tr><td>3</td><td>Initialize drive (dr) group.</td></tr>
<tr><td>4</td><td>Initialize basic function (bA) group.</td></tr>
<tr><td>5</td><td>Initialize expanded function (Ad) group.</td></tr>
<tr><td>6</td><td>Initialize control function (Cn) group.</td></tr>
<tr><td>7</td><td>Initialize input terminal block (In) group.</td></tr>
<tr><td>8</td><td>Initialize output terminal block (OU) group.</td></tr>
<tr><td>9</td><td>Initialize communication function (CM) group.</td></tr>
<tr><td>10</td><td>Initialize application function (AP) group.</td></tr>
<tr><td>11</td><td>Initialize protection function (Pr) group.</td></tr>
<tr><td>12</td><td>Initialize second motor function group (M2).</td></tr>
<tr><td>13</td><td>Initialize config mode group (CF).</td></tr>
</table></td><td>YES</td></tr>
<tr><td>CF94</td><td>Password registration</td><td>0000</td><td>0000 to FFFF</td><td>Registers a password to prevent unauthorized modification of parameter settings.</td><td>YES</td></tr>
<tr><td>CF95</td><td>Parameter lock</td><td>0</td><td>-</td><td>Unlocks or locks the parameters according to the password.
<table>
<tr><th>OPC.</th><th>DESCRIPTION</th></tr>
<tr><td>UL (Unlock)</td><td>Unlock parameter.</td></tr>
<tr><td>L (Lock)</td><td>Lock parameter.</td></tr>
</table></td><td>YES</td></tr>
</table>

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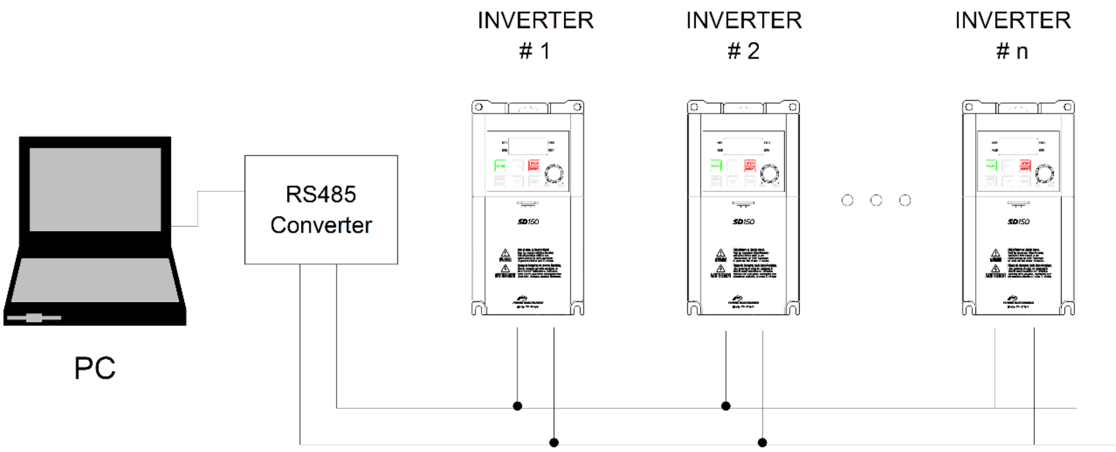
14. MODBUS COMMUNICATION

Introduction

To control the variable speed drive with a PLC or a computer. the industrial standard communications protocol of Modicon, Modbus, is used. Connect the communication cables and set the communication parameters on the drive according to the guidelines within this section. Various drives, or other slave devices, can be connected in a RS485 network to be controlled by a PLC or computer. This way, parameter setting, and monitoring can be done from a computer, via a user program.

To communicate, any kind of RS485 converter can be used. Specifications depend on the manufacturer.



SD15DTR001AI

To communicate, any kind of RS485 converter can be used. Specifications depend on the manufacturer.

The purpose of the Serial Communication Network of the SD150 is to integrate the drive into a network compatible with the Modbus communications protocol. This is possible using the RS485 physical communications port or USB port.

Modbus communication system allows SD150 drives to be controlled and/or monitored as a slave by a Modbus master from a remote location.

RS485 network allows connecting up to 16 equipment in the same network.

SD150 drives operate as a peripheral slave when connected to Modbus system. This means that the drive does not start the communication task, the master does.

Practically all of the operating modes, parameters and drive characteristics are accessible through serial communications. For example, master can give start and stop order to the drive, control SD150 status, read the current used by the motor etc., in short, the master can access all of the features of the drive.

Communication standards

The RS-485 communication standards support the Multi-drop Link System and offer an interface that is strongly resistant to noise. The following table details the communication standards.

ITEM	STANDARD
Communication method/ Transmission type	RS-485/Bus type, Multi-drop Link System
Drive type name	SD150
Number of connected inverters/ Transmission distance	Maximum of 16 inverters / Maximum 1,200 m (recommended distance: within 700 m)
Recommended cable size	Two Pair Shielded Twisted Pair Cable (keep it a safe distance from the power cable.)
Installation type	RJ45 connector (pin 1: S+, pin 8: S-, pin 7: SG) on the I/O board
Power supply	Supplied by the inverter– an insulated power source from the driver's power circuit
Communication speed	1,200/ 2,400/ 4,800/ 9,600/ 19,200/ 38,400 bps
Control procedure	Asynchronous communications system
Communication system	Half duplex system
Character system	Modbus-RTU: Binary / LS INV 485: ASCII
Stop bit length	1-bit/2-bit
Frame error check	2 bytes
Parity check	None/Even/Odd
Output signal level	'1' logical = +5V differential '0' logical = -5V differential
Input signal level	'1' logical = +5V differential '0' logical = -5V differential
Programmable inputs via Modbus	7 digital inputs in IP20 drives 2 programmable analogue inputs (0~10- V / 4~20 mA)
Programmable outputs via Modbus	2 relay output; 1 1 programmable analogue outputs (0~10 V / 0~32 mA)

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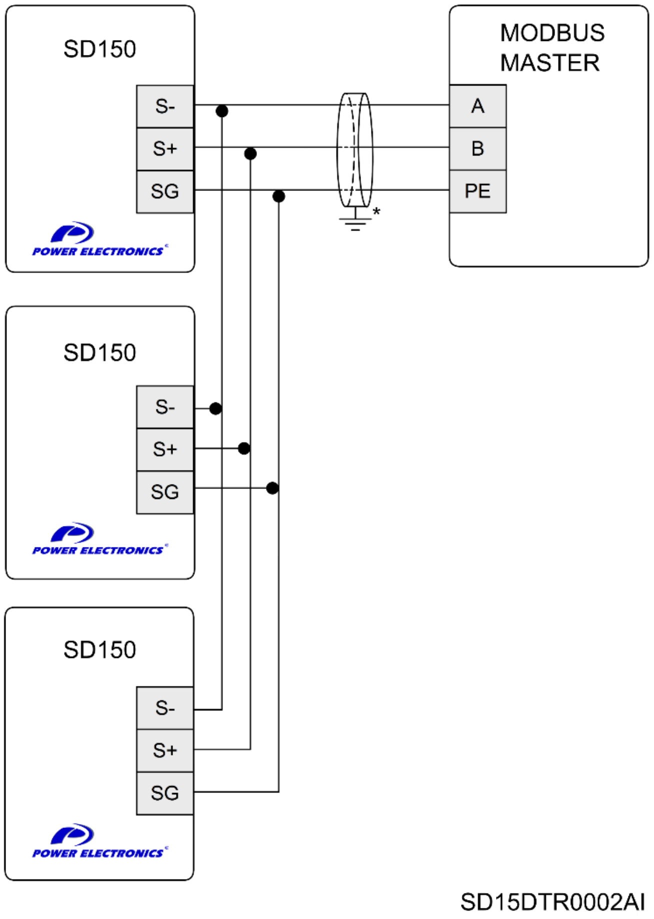
RS485 Connections

The following diagram shows a common wiring for a RS485 connection:



Supported Modbus function codes

Serial communications protocol provided by SD150 drive adheres to Modbus. The drive uses four reading and writing functions from all of the functions that exist in Modbus protocol. These are:

FUNCTION	DESCRIPTION
3	Registers Reading
4	Read Input Register
6	Write Single Register
16	Registers Writing

The implementation of these function codes allows reading up to 120 registers from a Parameter Group using a single frame. If you want to access to a consecutive memory register, but belonging to different groups, you should access in as many frames as groups are involved.

Modbus function code Nº 3: Registers Reading

This function code allows the Modbus controller (master) to read the content of the data registers indicated in the drive (slave). This function code only admits unicast addressing. Broadcast or groupcast addressing are not possible with this function code. The implementation of this function code in the drive allows reading up to 120 registers with consecutive addresses of the drive in a single frame.

Next, a frame is shown where the master tries to read the content of 3 registers of a drive where the current used by each phase is. The information that should be attached in the ask frame is the following:

- Data address of the drive.
- Modbus function code (3 Registers reading).
- Starting Data address.
- Registers number for reading.
- CRC-16 code[1].

The answer of the drive (slave) should contain the following fields:

- Data address of the slave.
- Modbus function code (3 Registers reading).
- Bytes number for reading.
- Bytes number / 2 registers.
- CRC-16 code[1].

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Each register consists of 2 bytes (2x8bits=16 bits). This is the default length of all registers in the SD150.

Example:

Suppose that we want to read the motor current (nameplate data) via communications. This data corresponds to the parameter G2.13 'MTR CUR=0.0A'. The frame that should be transmitted is:

MODBUS ADDRESS	MODBUS FUNCTION CODE	STARTING DATA ADDRESS (44622)	REGISTERS NUMBER	CRC-16[1]
0x0A	0x03	0x0120D	0x0001	0x2493

Suppose that instantaneous current of the equipment is 8.2 A. (Modbus value 82 decimals = 0x52 Hexadecimal). The answer of the slave will be:

MODBUS ADDRESS	MODBUS FUNCTION CODE	BYTES NUMBER	DATA (ADDRESS 20) (=110)	CRC-16[1]
0x0A	0x03	0x02	0x0052	0x9C78

[1] CRC is only required for serial communication (R232, RS485). It does not apply for TCP communication.

Modbus function code Nº 16: Registers writing

This function code allows the Modbus controller (master) to write the content of the data registers indicated in the drive (slave). whenever those registers are not of Read only. Registers writing by the master does not impede the later modification of those registers by the slave.

The implementation of this function code in the drive allows writing up to 5 registers of the drive in a single frame.

Next is shown a frame where the master tries to write the content of 1 register that stores the acceleration time. The information that should be sent in the request frame is the following:

- Data address of the slave.
- Modbus function code (16 Registers writing).
- Starting Data Address.
- Registers number for writing.
- Bytes number for writing.
- Content of registers for writing.
- CRC-16 code[1].

The answer of the slaves includes:

- Data address of the slave.
- Modbus function code (16 Registers writing).
- Starting Data Address.
- Written registers number.
- CRC-16 code[1].

Addressing modes

Broadcast addressing mode

Broadcast addressing mode allows the master to access at the same time to all of the slaves connected to the Modbus network. The Modbus function code that admits this global addressing mode is:

FUNCTION	DESCRIPTION
16	Registers Writing

In order to access to all of the equipment connected in a Modbus network. you must use the address 0.

When this address is used. all of the slaves in the Modbus network make the required task but they do not prepare any answer.

[1] CRC is only required for serial communication (R232, RS485). It does not apply for TCP communication.

Summary of Modbus addresses

Common area parameter

ADDRESS	PARAMETER	SCALE	UNIT	R/W	VALUES
0x0000	Inverter model	–	–	R	E: SD150
0x0001	Inverter capacity	–	–	R	0002: 0.4kW-1 000B: 2.2kW-2 0003: 0.8kW-1 000F: 0.4kW-4 0004: 1.5kW-1 0010: 0.8kW-4 0005: 2.2kW-1 0011: 1.5kW-4 000A: 1.5kW-2 0012: 2.2kW-4
0x0002	Inverter input voltage	–	–	R	0: 230 V – single phase
0x0003	Version	–	–	R	Example 0x0010: Version 1.01
0x0004	Parameter setting	–	–	R/W	0 : Forbid communication settings 1 : Allow communication settings
0x0005	Command Frequency	0.01	Hz	R/W	Start frequency - Maximum frequency
0x0006	Operation command	–	–	R	B15, B14, B13: Reserved
					B12, B11, B10, B9, B8: Frequency command information 0: Keypad-1, Keypad-2 1: Reserved 2: Multi-step speed 1 3: Multi-step speed 2 4: Multi-step speed 3 5: Multi-step speed 4 6: Multi-step speed 5 7: Multi-step speed 6 8: Multi-step speed 7 9: Up 10: Down 11: Up/down zero 12: V0 13: V1 14: I2(I) 15: I2(V) 16: V0+I2(I) 17: V0+I2(V) 18: V0+I2(V) 19: Communication operation
					B7, B6 : Operation command information.
					0: Terminal block 1: Keypad 3: Communication
				R/W	B5: Reserved B4: Emergency stop B3: Fault reset B2: Reverse operation B1: Forward operation B0: Stop
0x0007	Acceleration time	0.1	s	R/W	Refer to the table of functions.
0x0008	Deceleration time	0.1	s	R/W	Refer to the table of functions.
0x0009	Current	0.1	A	R	Refer to the table of functions.

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ADDRESS	PARAMETER	SCALE	UNIT	R/W	VALUES
0x000A	Output frequency	0.01	Hz	R	Refer to the table of functions.
0x000B	Output voltage	1	V	R	Refer to the table of functions.
0x000C	DC Link voltage	1	V	R	Refer to the table of functions.
0x000D	Output power	0.1	kW	R	Refer to the table of functions.
0x000E	Operation status	–	–	R	B15: Reserved B14: Reserved B13: Reserved B12: Reverse command B11: Forward command B10: Brake release signal B9: Reserved B8: Drive stopped B7: DC Braking B6: Speed reached B5: Decelerating B4: Accelerating B2: Operating in reverse direction B1: Operating in forward direction B0: Stopped
0x000F	Fault trip information-A	–	–	R	B15: LVT B14: IOLT B13: POT B12: FAN B11: EEP B10: EXT-B B9: Reserved B8: OLT B7: ETH B6: OHT B5: GFT B4: COL B3: ETX(BX) B2: EXT-A B1: OVT B0: Reserved
0x0010	Input terminal information	–	–	R	B15–B5: Reserved B4: P5 B3: P4 B2: P3 B1: P2 B0: P1
0x0011	Output terminal information	–	–	R	B4: Others 3ABC: Reserved
0x0012	V1	–	–	R	The value corresponds to the 0–10 V input (0x0000 – 0x03FF).
0x0013	V0	–	–	R	0 – 5V KPD Volume (0x0000 – 0x03FF)
0x0014	I	–	–	R	The value corresponds to the 0–20 mA input (0x0000 – 0x03FF)
0x0015	RPM	–	–	R	Refer to the table of functions.
0x001A	Unit display	–	–	R	Not used.
0x001B	Number of poles	–	–	R	Not used.

ADDRESS	PARAMETER	SCALE	UNIT	R/W	VALUES
0x001C	Custom Version	–	–	R	Not used.
0x001D	Fault trip information B	–	–	R	B9: ROT B7: Reserved B6: Reserved B5: NBR B4: OCT B3: REEP B2: NTC B1: Reserved B0: COM
0x001E	PID Feedback	–	–	R	When feedback is set to communication in PID operation, the amount of feedback is written and read in 0,1% increments.
0x0100 – 0x0107	Read address registration	–	–	R	0h0100: CM-31 0h0101: CM-32 0h0102: CM-33 0h0103: CM-34 0h0104: CM-35 0h0105: CM-36 0h0106: CM-37 0h0107: CM-38
0x0108– 0x010F:	Write address registration	–	–	R	0h0108: CM-51 0h0109: CM-52 0h010A: CM-53 0h010B: CM-54 0h010C: CM-55 0h010D: CM-56 0h010E: CM-57 0h010F: CM-58

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Programming parameters

SCREEN	DESCRIPTION	MODBUS DECIMAL	ADDRESS HEXADECIMAL	RANGE	MODBUS RANGE
0.00	Command frequency	47936	0h1F00	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
ACC	Acceleration time	47937	0h1F01	0.0 to 6000s	0.0 – 6000s
dEC	Deceleration time	47938	0h1F02		
drv	Start/stop control	47939	0h1F03	Keypad Fx/Rx-1 Fx/Rx-1 RS-485 communication	0 1 2 3
Frq	Frequency setting mode	47940	0h1F04	Keypad 1 Keypad 2 V0: 0-5V V1: 0-10V I2(I): 0-20V I2(I): 0-10V V0 + I2 (I) V0 + I2 (V) V0 + V1 S-485 communication Up-Down operation	0 1 2 3 4 5 6 7 8 9 10
MkW	Motor rated power	47941	0h1F05	0.4kW 0.75kW 1.1kW 1.5kW 2.2kW	0.4 0.75 1.1 1.5 2.2
MrC	Rated motor current	47942	0h1F06	0.1 to 150.0A	0.1 to 150.0A
MbF	Motor base frequency	47943	0h1F07	30.00 to 400.00Hz	30.00 to 400.00Hz
FrM	Maximum frequency	47944	0h1F08	40.00 to 400.00Hz	40.00 to 400.00Hz
IOv	Output voltage setting	47945	0h1F09	0.170 ~ 264V	0.170 ~ 264V
Ftb	Forward boost	47946	0h1F0A	0.0 to 20.0%	0.0 to 20.0%
rtb	Reverse boost	47947	0h1F0B		
CUr	Output current	47948	0h1F0C	-	-
rPM	Motor RPM	47949	0h1F0D		
dCL	Inverter DC voltage	47950	0h1F0E		
vOL, POr, tOr, v1M, I2M	User select signal	-	vOL	Output voltaje Output power Output torque Analog V1 terminal Input Analog I2 terminal input	VOL Por tOr V1M I2M
nOn	Currently out of order	47952	0h1F10	-	-
OGr	Open hidden groups	47953	0h1F11	Hide Enable	0 1
dr 9	Control mode	47954	0h1109	V/F schedule control Slip compensation control	0 1
dr 11	Jog frequency	44363	0h110B	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
dr 15	Torque boost	44367	0h110F	Manual torque boost Automatic torque boost	0 1
dr 19	Start frequency	44371	0h1113	0.10 to 10.00Hz	0.10 to 10.00Hz
dr 20	Select rotation direction	44372	0h1114	Forward run Reverse run	F R
dr 26	Automatic torque boost filter gain	44378	0h111A	1 to 1000	1 to 1000
dr 27	Automatic torque boost motoring gain	44379	0h111B	0.0 to 300.0%	0.0 to 300.0%

SCREEN	DESCRIPTION	MODBUS DECIMAL	ADDRESS HEXADECIMAL	RANGE	MODBUS RANGE
dr 28	Automatic torque boost regeneration gain	44380	0h111C	0.0 to 300.0%	0.0 to 300.0%
dr 81	Select Monitor code	44433	0h1151	Output voltage vOL [V] Output power (POr) [kW] Torque (tOr) [kgf*m] Analog V1 terminal input [v1M] Analog I2 terminal input (I2M) [mA/V].	0 1 2 3 4
dr 85	Read Parameters	-	-	No Yes	0 1
dr 86	Write Parameters	-	-	No Yes	0 1
dr 91	Smart Copier	-	-	None Reserved Reserved SmartUpLoad	0 1 2 3
bA 4	Command source 2	44612	0h1204	Keypad Fx/Rx-1 Fx/Rx-2 RS-485 communication	0 1 2 3
bA 5	Frequency source 2	44613	0h1205	Keypad 1 Keypad 2 V0: 0–5 V V1: 0–10 V I2 (I): 0–20mA I2(V): 0–10V Volume +I2 (I) Volume+ I2 (V) Volume + V1 RS-485 communication Up-down operation	0 1 2 3 4 5 6 7 8 9 10
bA 7	V/F pattern	44615	0h1207	Linear Square reduction User defined V/F pattern	0 1 2
bA 8	Unit of acc/dec time setting	44616	0h1208	0.01 to 20.0s 0.1 to 6000.0s 1 to 60000s	0 1 2
bA 9	Acc/dec frequency reference	44617	0h1209	Maximum frequency (400.00 Hz) Delta frequency	0 1
bA 11	Number of motor poles	44619	0h120B	2 to 12	2 to 12
bA 12	Motor no load current	44620	0h120C	0.00 to 10.00Hz	0.00 to 10.00Hz
bA 14	Motor efficiency	44622	0h120E	0.1 to 100.0A	0.1 to 100.0A
bA 15	Motor efficiency	44623	0h120F	50 to 100%	50 to 100%
bA 16	Load inertia rate	44624	0h1210	Less than ten times Ten times More than ten times	0 1 2
bA 19	Input voltage adjustment	44627	0h1213	170 to 240V	170 to 240V
bA 25	Slip gain	44633	0h1219	0.0 to 150.0%	0.0 to 150.0%
bA 41	User V/F frequency 1	44649	0h1229	0.00 Hz to 400.00 Hz	0.00 Hz to 400.00 Hz
bA 42	User V/F voltage 1	44650	0h122A	0 to100%	0 to100%
bA 43	User V/F frequency 2	44651	0h122B	0.00 Hz to 400.00 Hz	0.00Hz to 400.00 Hz
bA 44	User V/F voltage 2	44652	0h122C	0 to100%	0 to100%

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SCREEN	DESCRIPTION	MODBUS DECIMAL	ADDRESS HEXADECIMAL	RANGE	MODBUS RANGE
bA 45	User V/F frequency 3	44653	0h122D	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
bA 46	User V/F voltage 3	44654	0h122E	0 to100%	0 to100%
bA 47	User V/F frequency 4	44655	0h122F	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
bA 48	User V/F voltage 4	44656	0h1230	0 to100%	0 to100%
bA 50	Multi-step frequency 1	44658	0h1232	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
bA 51	Multi-step frequency 2	44659	0h1233	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
bA 52	Multi-step frequency 3	44660	0h1234		
bA 53	Multi-step frequency 4	44661	0h1235		
bA 54	Multi-step frequency 5	44662	0h1236		
bA 55	Multi-step frequency 6	44663	0h1237		
bA 56	Multi-step frequency 7	44664	0h1238		
bA 70	Multi-step acceleration time 1	44678	0h1246	0.00 to 6000.0s	0.00 to 6000.0s
bA 71	Multi-step deceleration time 1	44679	0h1247		
bA 72	Multi-step acceleration time 2	44680	0h1248		
bA 73	Multi-step deceleration time 2	44681	0h1249		
bA 74	Multi-step acceleration time 3	44682	0h124A		
bA 75	Multi-step deceleration time 3	44683	0h124B		
bA 76	Multi-step acceleration time 4	44684	0h124C		
bA 77	Multi-step deceleration time 4	44685	0h124D		
bA 78	Multi-step acceleration time 5	44686	0h124E		
bA 79	Multi-step deceleration time 5	44687	0h124F		
bA 80	Multi-step acceleration time 6	44688	0h1250		
bA 81	Multi-step deceleration time 6	44688	0h1251		
bA 82	Multi-step acceleration time 7	44688	0h1252		
bA 83	Multi-step deceleration time 7	44688	0h1253		
Ad 1	Acceleration pattern	44865	0h1301	Linear pattern S pattern	0 1
Ad 2	Deceleration pattern	44866	0h1302	Linear S-curve	0 1
Ad 3	S-curve start point gradient	44867	0h1303	1 to 100%	1 to 100%
Ad 4	S-curve end point gradient	44868	0h1304	1 to 100%	1 to 100%

SCREEN	DESCRIPTION	MODBUS DECIMAL	ADDRESS HEXADECIMAL	RANGE	MODBUS RANGE
Ad 8	Stop mode	44872	0h1308	Deceleration stops DC braking stops Free run stops	0 1 2
Ad 9	Forward and reverse run prevention	44873	0h1309	Allows forward and reverse run Prevents forward run Prevents reverse run	0 1 2
Ad 10	Start after low voltage	44874	0h130A	No Yes	0 1
Ad 12	DC braking time at startup	44876	0h130C	0.0 to 60.0s	0.0 to 60.0s
Ad 13	DC braking rate at startup	44877	0h130D	0 to 200%	0 to 200%
Ad 14	Output blocking time before DC braking	44878	0h130E	0.00 to 60.00s	0.00 to 60.00s
Ad 15	DC braking time	44879	0h130F	0.0 to 60.0s	0.0 to 60.0s
Ad 16	DC braking rate	44880	0h1310	0 to 200%	0 to 200%
Ad 17	DC braking frequency	44881	0h1311	dr19 to 60.00Hz	dr19 to 60.00Hz
Ad 20	Frequency	44884	0h1314	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
Ad 21	Dwell time	44885	0h1315	0.0 to 10.0s	0.0 to 10.0s
Ad 24	Use frequency limits		0h1318	Frequency limit off Frequency limit on	0 1
Ad 25	Frequency lower limit	44888	0h1319	0.00Hz to Ad26	0.00Hz to Ad26
Ad 26	Frequency higher limit	44890	0h131A	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
Ad 27	Frequency jump	44891	0h131B	Jump deactivated Jump activated	0 1
Ad 28	Frequency jump lower limit 1	44892	0h131C	0.00 to Ad29	0.00 to Ad29
Ad 29	Frequency jump upper limit 1	44893	0h131D	Ad28 to 400.00 Hz	Ad28 to 400.00 Hz
Ad 30	Frequency jump lower limit 2	44894	0h131E	0.00Hz to Ad31	0.00Hz to Ad31
Ad 31	Frequency jump upper limit 2	44895	0h131F	Ad30 to 400.00 Hz	Ad30 to 400.00 Hz
Ad 32	Frequency jump lower limit 3	44896	0h1320	0.00Hz to Ad33	0.00Hz to Ad33
Ad 33	Frequency jump upper limit 3	44897	0h1321	Ad32 to 400.00 Hz	Ad32 to 400.00 Hz
Ad 41	Brake open current	44905	0h1329	0.0 to 180.0%	0.0 to 180.0%
Ad 42	Brake open delay time	44906	0h132A	0.00 to 10.00s	0.00 to 10.00s
Ad 44	Brake open forward frequency	44908	0h132C	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
Ad 45	Brake open reverse frequency	44909	0h132D	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
Ad 46	Brake close delay time	44910	0h132E	0.00 to10.00s	0.00 to10.00s
Ad 47	Brake close frequency	44911	0h132F	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
Ad 51	Energy saving operation	44915	0h1333	0 to 30%	0 to 30%
Ad 63	Motor RPM display gain	44927	0h133F	1 to 1000%	1 to 1000%
Ad 64	Up-down operation frequency save	44928	0h1340	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
Ad 65	Up-down operation frequency save selection	44929	0h1341	Save the frequency Configures frequency saving	0 1

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SCREEN	DESCRIPTION	MODBUS DECIMAL	ADDRESS HEXADECIMAL	RANGE	MODBUS RANGE
Ad 66	Up-down operation mode selection	44930	0h1342	Maximum/minimum frequency reference Increase or decrease Mixed function	0 1 2
Ad 67	Up-down operation step frequency	44931	0h1343	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
Ad 79	DB operation voltage (Dynamic Braking)	44943	0h134F	300 to 400V	300 to 400V
Cn 4	Modulation frequency	45124	0h1404	1.0 to 15.0Hz	1.0 to 15.0Hz
Cn 71	Speed search selection	45191	0h1447	General acceleration After fault trip Restart Power on	0001 0010 0100 1000
Cn 72	Speed search current level	45192	0h1448	80 to 200%	80 to 200%
Cn 73	Speed search P gain	45193	0h1449	0 to 9999s	0 to 9999s
Cn 74	Speed search I gain	45194	0h144A	0 to 9999s	0 to 9999s
In 7	Time constant of V1 input filter	45383	0h1507	0 to 9999s	0 to 9999s
In 8	V1 Minimum input voltage	45384	0h1508	0.00 to 10.00V	0.00 to 10.00V
In 9	Frequency corresponding to V1 minimum input voltage	45385	0h1509	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
In 10	V1 Maximum input voltage	45386	0h150A	0.00 to 10.00V	0.00 to 10.00V
In 11	Frequency corresponding to V1 maximum input voltage	445387	0h150B	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
In 37	Time constant of V0 input filter	45413	0h1525	0 to 9999s	0 to 9999s
In 38	V0 Minimum input voltage	45414	0h1526	0.00 to 5.00V	0.00 to 5.00V
In 39	Frequency corresponding to V0 minimum input voltage	45415	0h1527	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
In 40	V0 Maximum input voltage	45416	0h1528	0.00 to 5.00V	0.00 to 5.00V
In 41	Frequency corresponding to V0 maximum input voltage	45417	0h1529	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
In 52	I2 input filter time constant	45428	0h1534	0 to 9999s	0 to 9999s
In 53	I2 minimum current	45429	0h1535	4.00 to 20.00mA	4.00 to 20.00mA
In 54	I2 minimum frequency reference	45430	0h1536	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
In 55	I2 maximum current	45431	0h1537	4.00 to 20.00mA	4.00 to 20.00mA
In 56	I2 maximum frequency reference	45432	0h1538	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
In 57	V input filter time constant	45433	0h1539	0 to 9999s	0 to 9999s
In 58	V mínimum input voltage	45434	0h153A	0.00 to10.00V	0.00 to10.00V
In 59	Frequency corresponding to V minimum input voltage	45435	0h153B	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
In 60	V maximum input voltaje	45436	0h153C	0.00 to10.00V	0.00 to10.00V

SCREEN	DESCRIPTION	MODBUS DECIMAL	ADDRESS HEXADECIMAL	RANGE	MODBUS RANGE
In 61	Frequency corresponding to V maximum input voltage	45437	0h153D	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
In 65	Multifunction input terminal P1 function setting	45441	0h1541	FX RX Emergency stop RESET JOG Multi-step speed - low Multi-step speed - middle Multi-step speed - high Multi-step acc/dec - low Multi-step acc/dec - middle Multi-step acc/dec - high DC braking during stop command 2nd motor selection Reserved Reserved Up Down 3-wire operation A terminal (EtA) B terminal (EtB) Reserved Transition from PID to general operation 2nd Source Fix analog command frequency Acceleration/deceleration stop command Initialize saved up-down frequency JOG-FX JOG-RX	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
In 66	Multifunction input terminal P2 function setting	45442	0h1542		
In 67	Multifunction input terminal P3 function setting	45443	0h1543		
In 68	Multifunction input terminal P4 function setting	45444	0h1544		
In 69	Multifunction input terminal P5 function setting	45445	0h1545		
In 70	PNP/NPN selection switch	45446	0h1546	PNP NPN	0 1
In 85	Multifunction input terminal filter time constant	45461	0h1555	1 to 15	1 to 15
In 87	Multifunction input contact selection	45463	0h1557	A contact (NO) B contact (NC)	0 1
In 90	Input terminal block status display	45466	0h155A	P5 P4 P3 P2 P1	BIT4 BIT3 BIT2 BIT1 BIT0
OU 1	Multifunction input terminal P1 function setting	45633	0h1601	Output frequency Current Output Voltage DC voltage	0 1 2 3
OU 2	Analog output level adjustment	45634	0h1602	10 to 200%	10 to 200%
OU 30	Fault output setting	45662	0h161E	Low voltage trip Another fault trip Number of automatic restarts	001 010 100

SCREEN	DESCRIPTION	MODBUS DECIMAL	ADDRESS HEXADECIMAL	RANGE	MODBUS RANGE
OU 31	Multi function relay setting	45663	0h161F	FDT-1 FDT-2 FDT-3 FDT-4 FDT-5 Overload (OL) Inverter Overload (IOL) Motor stall (STALL) Over voltage (Ovt) Low voltage (Lvt) Inverter cooling fan overheat Lost command Run Stop At constant speed Speed search Ready Fault output setting Abnormal cooling fan alarm Brake signal setting	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
OU 32	Multifunction output 2 feature selection	45664	0h1620		
OU 41	Output terminal block status display	45673	0h1629	Relay1 Relay2 / Open collector output	00 01 11
OU 52	Multifunction output/relay contact selection	45684	0h1634	A contact (NO) B Contact (NC)	0 1
OU 57	Detection frequency	45689	0h1639	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
OU 58	Detection frequency band	45690	0h163A	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
CM 1	Inverter station ID		0h1701	1 to 250	1 to 250
CM 2	Communication protocol setting		0h1702	Modbus-RTU Communication protocol	0 1
CM 3	Communication speed		0h1703	1,200 bps 2,400 bps 4,800 bps 9,600 bps 19,200 bps 38,400 bps	0 1 2 3 4 5
CM 4	Parity/stop bit setting		0h1704	D8/PN/S1 D8/PN/S2 D8/PE/S1 D8/PO/S1	0 1 2 3
CM 5	Communication time setting		0h1705	2 a 100ms	2 a 100ms
CM 31	Read address registration 1 to 8	-	0h171F	0000 to A4FF	0000 to A4FF
CM 32		-	0h1720		
CM 33		-	0h1721		
CM 34		-	0h1722		
CM 35		-	0h1723		
CM 36		-	0h1724		
CM 37		-	0h1725		
CM 38		-	0h1726		
CM 51	Write address registration 1 to 8	-	0h1733	0000 to A4FF	0000 to A4FF
CM 52		-	0h1734		
CM 53		-	0h1735		
CM 54		-	0h1736		
CM 55		-	0h1737		
CM 56		-	0h1738		
CM 57		-	0h1739		
CM 58		-	0h173A		
AP 1	PID control setting	46145	0h1801	No Yes	0 1

SCREEN	DESCRIPTION	MODBUS DECIMAL	ADDRESS HEXADECIMAL	RANGE	MODBUS RANGE
AP 2	PID units selection	46146	0h1802	Frequency (Hz) Percentage (%)	0 1
AP 18	Amount of PID feedback	46162	0h1812	0.00 to 400.00Hz 0.0 to 100.0%	0 1
AP 19	PID reference	46163	0h1813	0.00Hz to 400.00 Hz 0.0 to 100.0%	0 1
AP 20	PID reference setting	46164	0h1814	Keypad 1 Keypad 2 V1: 0 – 10V I2(I): 0 - 20mA I2(I): 0 - 10mA RS - 485 communication	0 1 2 3 4 5
AP 21	PID feedback setting	46165	0h1815	I2(I): 0 - 20mA I2(I): 0 - 10mA V1: 0 – 10V RS - 485 communication	0 1 2 3
AP 22	PID controller P gain	46166	0h1816	0.0 to 999.9%	0.0 to 999.9%
AP 23	PID controller integral time (I gain)	46167	0h1817	0.10 to 32.00s	0.10 to 32.00s
AP 24	PID controller differentiation time (D gain)	46168	0h1818	0.00 to 30.00s	0.00 to 30.00s
AP 28	PID mode	46172	0h181C	Normal PID control Process PID control	0 1
AP 29	PID output upper limit frequency	46173	0h181D	AP30 a 400.00 Hz	AP30 a 400.00 Hz
AP 30	PID output lower limit frequency	46174	0h181E	0.00Hz to AP29	0.00Hz to AP29
AP 37	Sleep mode activation delay	46181	0h1825	0.0 to 2000.0s	0.0 to 2000.0s
AP 38	Sleep mode activation speed	46182	0h1826	0.00Hz to 400.00 Hz	0.00Hz to 400.00 Hz
AP 39	Wake-up level	46183	0h1827	0.0 to 100.0%	0.0 to 100.0%
AP 70	Draw operation mode selection	46214	0h1846	V1 (0 – 10V) V0 (0 – 5V) I2 (0 – 20V) I2 (0 – 10V)	0 1 2 3
AP 22	Draw percentage	46166	0h1816	0.0 to100.0%	0.0 to100.0%
Pr 5	Output openphase protection setting	46405	0h1905	No Yes	0 1
Pr 8	Operation on reset after fault trip	46408	0h1908	No Yes	0 1
Pr 9	Number of automatic restarts after fault trip	46409	0h1909	0 to 10 times	0 to 10 times
Pr 10	Automatic restart delay time after fault trip	46410	0h190A	0.0 to 60.0s	0.0 to 60.0s
Pr 12	Motion at speed command loss	46412	0h190C	Continue run Free run stop (output block) Deceleration stop	0 1 2
Pr 13	Time to decide speed command loss	46413	0h190D	0.1 to 120.0s	0.1 to 120.0s
Pr 15	Time to determine analog speed command loss	46415	0h190F	Not operating Half specified value Below specified value	0 1 2

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SCREEN	DESCRIPTION	MODBUS DECIMAL	ADDRESS HEXADECIMAL	RANGE	MODBUS RANGE
Pr 18	Overload alarm level	46418	0h1912	30 to 150%	30 to 150%
Pr 19	Overload warning time	46419	0h1913	0.0 to 30.0s	0.0 to 30.0s
Pr 20	Overload warning selection	46420	0h1914	Protection is disabled Blocks the output	0 1
Pr 21	Overload fault level	46421	0h1915	30 to 200%	30 to 200%
Pr 22	Overload fault time	46422	0h1916	0.0 to 60.0s	0.0 to 60.0s
Pr 40	ETH selection	46440	0h1928	ETH not active ETH active	0 1
Pr 41	Motor cooling type	46441	0h1929	Cooler attached to its axis Motor that supplies separate power to the cooled	0 1
Pr 42	Electronic thermal 1minute level	46442	0h192A	Pr43 to 200%	Pr43 to 200%
Pr 43	Electronic thermal continuous operation level	46443	0h192B	50 to Pr42	50 to Pr42
Pr 50	Stall prevention selection	46450	0h1932	Accelerating At a constant speed Decelerating	001 010 100
Pr 52	Stall prevention level	46452	0h1934	30 to 200%	30 to 200%
Pr 53	Voltage limit when using stall prevention during deceleration	46453	0h1935	Activated Not activated	0 1
Pr 65	DB (*Dynamic Braking*) resistor warning level limit setting	46465	0h1941	DB without level limit DB during the time set at Pr66	0 1
Pr 66	DB resistor warning level	46466	0h1942	0 to 30%	0 to 30%
Pr 79	Operation at fan fault	46479	0h194F	Run continuously Stop operation	0 1
Pr 80	Initial charging circuit trip protection (ROT)	46480	0h1950	Activated Not activated	0 1
Pr 91	Fault history 1	46491	0h195B	-	-
Pr 92	Fault history 2	46492	0h195C	-	-
Pr 93	Fault history 3	46493	0h195D	-	-
Pr 94	Fault history 4	46494	0h195E	-	-
Pr 95	Fault history 5	46495	0h195F	-	-
Pr 96	Deletion of fault history	46496	0h1960	Maintain history Delete history	0 1
M2 4	Second motor acceleration time	46660	0h1A04	0.0 to 6000.0s	0.0 to 6000.0s
M2 5	Second motor deceleration time	46661	0h1A05		
M2 7	Second motor base frequency	46663	0h1A07	0.1Hz to 400.00 Hz	0.1Hz to 400.00 Hz
M2 12	Second motor rated current	46668	0h1A0C	0.1 to 100.0A	0.1 to 100.0A
M2 25	2nd motor V/F pattern	46681	0h1A19	Linear Square reduction User V/F	0 1 2
M2 26	Second motor forward torque boost	46682	0h1A1A	0.0 to 15.0%	0.0 to 15.0%
M2 27	Second motor reverse torque boost	46683	0h1A1B		

SCREEN	DESCRIPTION	MODBUS DECIMAL	ADDRESS HEXADECIMAL	RANGE	MODBUS RANGE
M2 28	Second motor stall prevention level	46684	0h1A1C	30 to 150%	30 to 150%
M2 29	Second motor electronic thermal 1 minute level	46685	0h1A1D	100 to 200%	100 to 200%
M2 30	Second motor electronic thermal continuous operation level	46686	0h1A1E	50 to 150%	50 to 150%
CF 1	Display after power on	46913	0h1B01	Command Frequency Acceleration time Deceleration time Command source Frequency setting method Motor selection Rated motor current Base frequency Maximum frequency Output voltage adjustment Forward boost Reverse boost Output current Motor RPM Inverter DC voltage Users select signal Currently out of order Open hidden groups	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
CF 2	I/O Type	46914	0h1B02	Standard I/O Advanced I/O	0 1
CF 79	Software version	46991	0h1B4F	-	-
CF 93	Parameter initialization	47005	0h1B5D	Do not initialize Initialize all Initialize operation group Initialize dr group Initialize bA group Initialize Ad group Initialize Cn group Initialize In group Initialize OU group Initialize CM group Initialize AP group Initialize Pr group Initialize M2 group Initialize CF group	0 1 2 3 4 5 6 7 8 9 10 11 12 13
CF 94	Password registration	47006	0h1B5E	0000 to FFFF	0000 to FFFF
CF 95	Parameter lock	47007	0h1B5F	Unlock parameter Lock parameter	UL L

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15. COMMONLY USED CONFIGURATIONS

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NOTICE

The following instructions are based on the assumption that all parameters are set to the factory default values. Results may be different if parameter values have been modified. In this case, set all parameters back to their default value and follow the instructions.

Start/Stop command and speed setting from keyboard

Parameter configuration

PARAMETER	DEFAULT VALUE	DESCRIPTION	SET VALUE
0.00	0.00Hz	Frequency reference	x.xxHz (set the frequency reference)
ACC	20.0s	Acceleration time	10.0s
dEC	30.0s	Deceleration time	10.0s
drv	1	Start/Stop control	0: Start/Stop from keyboard
Frq	0	Frequency setting mode	0: Reference will be introduced from keyboard
Ad 8	0	Stop mode	0: Stop with deceleration ramp 1: DC brake to stop 2: Free run to stop 4: Regenerative brake to stop
Ad 10	0	Start after low voltage	0: NO (Drive does not start after power loss) 1: YES (Drive starts after power loss)
Ad 24	0	Use frequency limits	0: NO (Limits are set by maximum frequency and start frequency) 1: YES (Limits are set by the higher and lower frequency limits)
Ad 25	0.50Hz	Frequency lower limit	0.00Hz
Ad 26	50.00Hz	Frequency higher limit	50.00Hz
MrC	–	Rated motor current	See the motor nameplate.
MkW	Motor rated power	–	0.4 to 2.2kW. See the motor nameplate.
dr 15	0	Torque boost	0: Manual torque boost (both directions can be configured separately, in Ftb → 'Forward boost' and in rtb → 'Reverse boost' 1: Automatic torque boost (the drive calculates the voltage to be applied at the start using the motor's parameters)

PARAMETER	DEFAULT VALUE	DESCRIPTION	SET VALUE
MbF	60.00 Hz	Motor base frequency	50.00 Hz
dr 19	0.50Hz	Start frequency	0.10Hz
FrM	60.00 Hz	Maximum frequency	50.00 Hz
CF 93	0	Parameter initialization	1: Initialize all parameters back to factory values (only if required)
CF 79	–	Software version	–
Cn 4	3kHz	Modulation frequency	5kHz

Start/Stop command from keyboard and speed setting by analogue input

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Parameter configuration

PARAMETER	DEFAULT VALUE	DESCRIPTION	SET VALUE
0.00	0.00Hz	Frequency reference	x.xxHz (set the frequency reference)
ACC	20.0s	Acceleration time	10.0s
dEC	30.0s	Deceleration time	10.0s
drv	1	Start/Stop control	0: Start/Stop from keyboard
Frq	0	Frequency setting mode	3: Reference will be introduced through analogue input V1 [0..10V] 4: Reference will be introduced through analogue input I2 [4..20mA]
Ad 8	0	Stop mode	0: Stop with deceleration ramp 1: DC brake to stop 2: Free run to stop
Ad 10	0	Start after low voltage.	0: NO (Drive does not start after power loss). 1: YES (Drive starts after power loss).
Ad 24	0	Use frequency limits	0: NO (Limits are set by maximum frequency and start frequency) 1: YES (Limits are set by the higher and lower frequency limits)
Ad 25	0.50Hz	Frequency lower limit	0.10Hz
Ad 26	50.00Hz	Frequency higher limit	50.00Hz
MrC	–	Motor rated current	See the motor nameplate.
MkW	Motor rated power	–	0.4 to 2.2kW. See the motor nameplate.
MbF	60.00Hz	Motor base frequency	50.00Hz
dr 19	0.50Hz	Start frequency	0.10Hz
FrM	60.00 Hz	Maximum frequency	50.00Hz

PARAMETER	DEFAULT VALUE	DESCRIPTION	SET VALUE
CF 93	0	Parameter initialization	1: Initialize all parameters back to factory values
CF 79	-	Software version	-
Cn 4	3.0kHz	Modulation frequency	5kHz
In 7	10ms	V1 input filter time constant	10ms (Low pass filter for V1)
In 8	0V	V1 minimum voltage	0.00V (V1 minimum voltage adjustment)
In 9	0.00Hz	V1 minimum frequency reference	0.00Hz (V1 minimum frequency adjustment)
In 10	10V	V1 maximum voltage	10.00V (V1 maximum voltage adjustment)
In 11	60.00Hz	V1 maximum frequency reference	50.00Hz (V1 maximum frequency adjustment)
In 52	10ms	I2 input filter time constant	10ms (Low pass filter for V1)
In 53	4.00mA	I2 minimum current	4.00mA (I2 minimum current adjustment)
In 54	0.00Hz	I2 minimum frequency reference	0.00Hz (I2 minimum frequency adjustment)
In 55	20.00mA	I2 maximum current	20.00mA (I2 maximum current adjustment)
In 56	60.00Hz	I2 maximum frequency reference	50.00Hz (I2 maximum frequency adjustment)

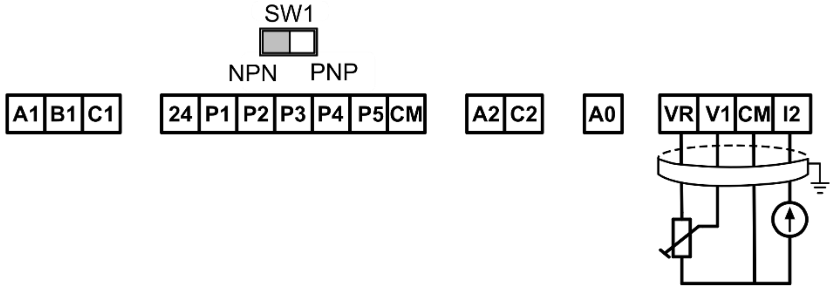
Connection scheme

Terminal VR: 10V supply.

Terminal V1: Analogue input 0-10V (speed reference).

Terminal I2: Analogue input 4-20mA (speed reference).

Terminal CM: Common terminal 0V.



SD15DTC004A

Start/Stop command from terminals and speed setting by analogue input

Parameter configuration

PARAMETER	DEFAULT VALUE	DESCRIPTION	SET VALUE
0.00	0.00Hz	Frequency reference	x.xxHz (set the frequency reference)
ACC	20.0s	Acceleration time	10.0s
dEC	30.0s	Deceleration time	10.0s
drv	1	Start/Stop control	1: Start/stop from terminals Fx - Forward o Rx - Reverse
Frq	0	Frequency setting mode	3: Reference will be introduced through analogue input V1 [0..10V] 4: Reference will be introduced through analogue input I2 [4..20mA]
Ad 8	0	Stop mode	0: Stop with deceleration ramp 1: DC brake to stop 2: Free run to stop
Ad 10	0	Start after low voltage	0: NO (Drive does not start after power loss) 1: YES (Drive starts after power loss)
Ad 24	0	Use frequency limits	0: NO (Limits are set by maximum frequency and start frequency) 1: YES (Limits are set by the higher and lower frequency limits)
Ad 25	0.50Hz	Frequency lower limit	0.00Hz
Ad 26	50.00Hz	Frequency higher limit	50.00Hz
MrC	–	Motor rated current	See the motor nameplate.
MkW	Motor rated power	–	0.4 to 2.2kW. See the motor nameplate.
dr 15	0	Torque boost	0: Manual torque boost (both directions can be configured separately, in Ftb → 'Forward boost' and in rtb → 'Reverse boost' 1: Automatic torque boost (the drive calculates the voltage to be applied at the start using the motor's parameters)
MbF	60.00Hz	Motor frequency	50.00Hz
dr19	0.50Hz	Start frequency	0.10Hz
FrM	60.00Hz	Maximum frequency	50.00Hz
CF 93	0	Parameter initialization	1: Initialize all parameters back to factory values (only if required)
CF 79	–	Software version	–
Cn 4	3kHz	Modulation frequency	5kHz
In 1	50.00Hz	Analog input max. freq	50.00Hz

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PARAMETER	DEFAULT VALUE	DESCRIPTION	SET VALUE
In 7	10ms	V1 input filter time constant	10ms (Low pass filter for V1)
In 8	0V	V1 minimum voltage	0.00V (V1 minimum voltage adjustment)
In 9	0.00Hz	V1 minimum frequency reference	0.00Hz (V1 minimum frequency adjustment)
In 10	10V	V1 maximum voltage	10.00V (V1 maximum voltage adjustment)
In 11	60.00Hz	V1 maximum frequency reference	50.00Hz (V1 maximum frequency adjustment)
In 52	10ms	I2 input filter time constant	10ms (Low pass filter for V1)
In 53	4.00mA	I2 minimum current	4.00mA (I2 minimum current adjustment)
In 54	0.00Hz	I2 minimum frequency reference	0.00Hz (I2 minimum frequency adjustment)
In 55	20.00mA	I2 maximum current	20.00mA (I2 maximum current adjustment)
In 56	60.00Hz	I2 maximum frequency reference	50.00Hz (I2 maximum frequency adjustment)
In 65	0	Digital input P1	0: Forward start command (Fx)

Connection scheme

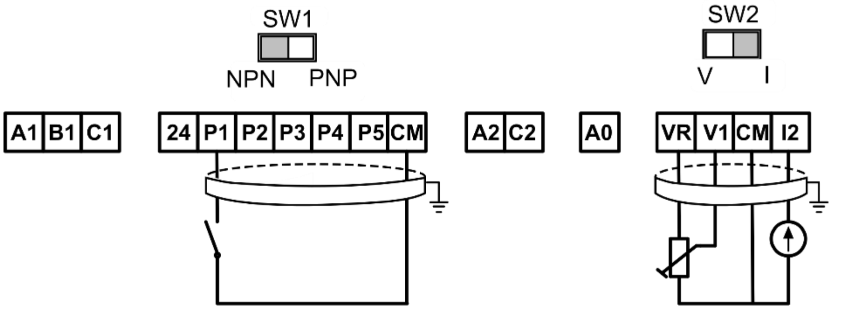
Terminal VR: 10V supply.

Terminal V1: Analogue input 0-10V (speed reference).

Terminal I2: Analogue input 4-20mA (speed reference).

Terminal CM: Common terminal 0V.

Terminal P1: Digital input (Run/Stop).



SD15DTC005A

Multi-speed commands (multi-step frequencies) using P5, P6 and P7

Parameter configuration

PARAMETER	DEFAULT VALUE	DESCRIPTION	SET VALUE
0.00	0.00Hz	Frequency reference	x.xxHz (set the frequency reference)
ACC	20.0s	Acceleration time	10.0s
dEC	30.0s	Deceleration time	10.0s
drv	1	Start/Stop control	1: Start/Stop from terminals FX – Forward o Rx – Reverse.
Frq	0	Frequency setting mode	0: Reference will be introduced from keyboard.
Ad 8	0	Stop mode	0: Stop with deceleration ramp 1: DC brake to stop 2: Free run to stop
Ad 10	0	Start after low voltage	0: NO (Drive does not start after power loss). 1: YES (Drive starts after power loss).
Ad 24	0	Use frequency limits	0: NO (Limits are set by maximum frequency and start frequency). 1: YES (Limits are set by the higher and lower frequency limits).
Ad 25	0.50Hz	Frequency lower limit	0.00Hz
Ad 26	50.00Hz	Frequency higher limit	50.00Hz
MrC	–	Motor rated current	See the motor nameplate.
MkW	Motor rated power	–	0.4 to 2.2kW. See the motor nameplate.
dr 15	0	Torque boost	0: Manual torque boost (both directions can be configured separately, in Ftb → 'Forward boost' and in rtb → 'Reverse boost' 1: Automatic torque boost (the drive calculates the voltage to be applied at the start using the motor's parameters)
MbF	60.00 Hz	Motor frequency	50.00Hz
dr 19	0.50Hz	Start frequency	0.10Hz
FrM	60.00Hz	Maximum frequency	50.00Hz
CF 93	0	Parameter initialization	1: Initialize all parameters back to factory values (only if required)
CF 79	–	Software version	–
Cn 4	3kHz	Modulation frequency	5kHz
In 65	0	Digital input P1	0: Forward start command (Fx)

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PARAMETER	DEFAULT VALUE	DESCRIPTION	SET VALUE
In 67	2	Digital input P3	5: Multi-step speed (low bit)
In 68	3	Digital input P4	6: Multi-step speed (medium bit)
In 69	4	Digital input P5	7: Multi-step speed (high bit)
bA 50	10.00Hz	Multi-reference speed 1	30.00Hz (Multi-speed 1)
bA 51	20.00Hz	Multi-reference speed 2	35.00Hz (Multi-speed 2)
bA 52	30.00Hz	Multi-reference speed 3	40.00Hz (Multi-speed 3)
bA 53	40.00Hz	Multi-reference speed 4	45.00Hz (Multi-speed 4)
bA 54	50.00Hz	Multi-reference speed 5	50.00Hz (Multi-speed 5)
bA 55	60.00Hz	Multi-reference speed 6	47.00Hz (Multi-speed 6)
bA 56	60.00Hz	Multi-reference speed 7	42.00Hz (Multi-speed 7)

Depending on the state of inputs P5, P6 y P7, the different configured frequencies can be selected:

PROGRAMMED FREQUENCY	PARAMETER	HIGH SPEED (P7)	MEDIUM SPEED (P6)	LOW SPEED (P5)
50.00Hz	0.00	0	0	0
30.00Hz	St1	0	0	1
35.00Hz	St2	0	1	0
40.00Hz	St3	0	1	1
45.00Hz	bA 53	1	0	0
50.00Hz	bA 54	1	0	1
47.00Hz	bA 55	1	1	0
42.00Hz	bA 56	1	1	1

Connection scheme

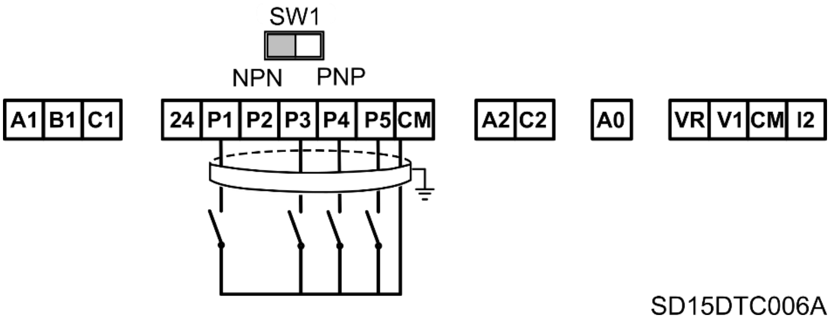
Terminal P1: Digital input 1 (Run/Stop).

Terminal P3: Digital input 3 (Multi-step speed low bit).

Terminal P4: Digital input 4 (Multi-step speed medium bit).

Terminal P5: Digital input 5 (Multi-step speed high bit).

Terminal CM: Common terminal 0V.



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Constant pressure control and automatic stop at zero level flow

Parameter configuration

PARAMETER	DEFAULT VALUE	DESCRIPTION	SET VALUE
ACC	20.0s	Acceleration time	10.0s
dEC	30.0s	Deceleration time	10.0s
drv	1	Start/Stop control	1: Start/Stop from terminals FX – Forward o Rx – Reverse.
Frq	0	Frequency setting mode	0: Reference will be set by keyboard
Ad 8	0	Stop mode	0: Stop with deceleration ramp 1: DC brake to stop 2: Free run to stop
Ad 10	0	Start after low voltage	0: NO (Drive does not start after power loss) 1: YES (Drive starts after power loss)
Ad 24	0	Use frequency limits	0: NO (Limits are set by maximum frequency and start frequency). 1: YES (Limits are set by the higher and lower frequency limits).
Ad 25	0.50Hz	Frequency lower limit	0.10Hz
Ad 26	50.00Hz	Frequency higher limit	50.00Hz
MrC	–	Motor rated current	See the motor nameplate.
MkW	Motor rated power	–	0.4 to 2.2kW. See the motor nameplate.
MbF	60.00Hz	Motor frequency	50.00Hz

PARAMETER	DEFAULT VALUE	DESCRIPTION	SET VALUE
dr 19	0.50Hz	Start frequency	0.10Hz
FrM	60.00Hz	Maximum frequency	50.00Hz
CF 93	0	Parameter initialization	1: Initialize all parameters back to factory values (only if required)
CF 79	–	Software version	–
Cn 4	3kHz	Modulation frequency	5kHz
AP 1	0	PID control setting	1: PID control enabled
AP 19	0.0	PID units selection	40.0% (adjust desired PID setpoint)
AP 20	0	PID reference	0: PID reference introduced from keyboard
AP 21	0	PID reference setting	0*: I2 current input (feedback of 0...20 mA)
AP 22	50.0	PID feedback setting	50.0%
AP 23	10.0	PID controller integral time (I gain)	10.00s
AP 24	0.00s	PID controller derivative time (D gain)	0.00s
AP 28	0	PID mode	0:Normal 1: Process
AP 29	60.00Hz	PID output upper limit frequency	50.00Hz
AP 30	0.50 Hz	PID output lower limit frequency	0.10 Hz
AP 37	60.0 s	Sleep mode activation delay	40.0s (delay time before the drive stops)
AP 38	0.00 Hz	Sleep mode activation speed	10.00Hz (frequency to stop operating and enter in sleep mode)
AP 39	35.0%	Wake-up level	10.0% (of the feedback to start back again)
In 52	10ms	I2 input filter time constant	10ms (low pass filter for V1)
In 53	4.00 mA	I2 minimum current	4.00mA (I2 minimum current adjustment)
In 54	0.00Hz	I2 minimum frequency reference	0.00Hz (I2 minimum frequency adjustment)
In 55	20.00mA	I2 maximum current	20.00mA (I2 maximum current adjustment)
In 56	60.00Hz	I2 maximum frequency reference	50.00Hz (I2 maximum frequency adjustment)
In 65	0	Digital input P1	0: Forward start command (Fx)

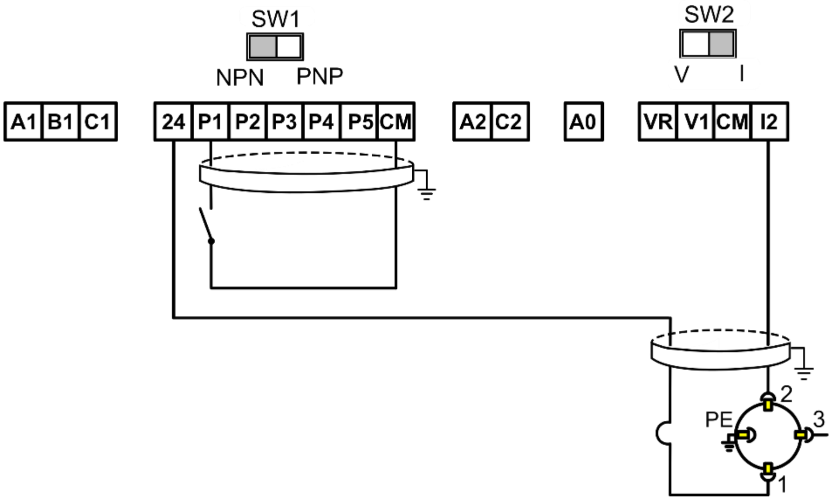
Connection scheme

Terminal P1: Digital input 1 (Run/Stop).

Terminal CM: Common terminal 0V.

Terminal 24V: 24V supply.

Terminal I2: Analogue input 4-20mA (pressure transducers).



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Speed control (up/down potentiometer) and Start/Stop commands by terminals

Parameter configuration

PARAMETER	DEFAULT VALUE	DESCRIPTION	SET VALUE
0.00	0.00 Hz	Frequency reference	x.xxHz (set the frequency reference)
ACC	20.0s	Acceleration time	10.0s
dEC	30.0s	Deceleration time	10.0s
drv	1	Start/Stop control	1: Start/Stop from terminals FX – Forward o Rx – Reverse
Frq	0	Frequency setting mode	0: Local
Ad 8	0	Stop mode	0: Stop with deceleration ramp 1: DC brake to stop 2: Free run to stop
Ad 10	0	Start after low voltage.	0: NO (Drive does not start after power loss) 1: YES (Drive starts after power loss)
Ad 24	0	Use frequency limits	0: NO (Limits are set by maximum frequency and start frequency) 1:YES (Limits are set by the higher and lower frequency limits)
Ad 25	0.50Hz	Frequency lower limit	0.10Hz

PARAMETER	DEFAULT VALUE	DESCRIPTION	SET VALUE
Ad 26	50.00Hz	Frequency higher limit	50.00Hz
MrC	–	Motor rated current	See the motor nameplate.
MkW	Motor rated power	–	0.4 to 2.2kW. See the motor nameplate.
dr 15	0	Torque boost	0: Manual torque boost (both directions can be configured separately, in Ftb → 'Forward boost' and in rtb → 'Reverse boost' 1: Automatic torque boost (the drive calculates the voltage to be applied at the start using the motor's parameters)
MbF	60.00Hz	Motor frequency	50.00Hz
dr 19	0.50Hz	Start frequency	0.10Hz
FrM	60.00Hz	Maximum frequency	50.00Hz
CF 93	0	Parameter initialization	1: Initialize all parameters back to factory values (only if required)
CF 79	–	Software version	–
Cn 4	3.0kHz	Modulation frequency	5kHz
Ad 65	0	Up-down operation freq save	0: NO (does not save last frequency operation point on deceleration or low voltage) 1:YES (saves last frequency operation point on deceleration or low voltage)"
Ad 66	0	Up-down operation mode	0: Maximum/minimun frequency reference 1: Increase/decrease based on the step frequency (Ad 67) 2: Mixed function of 0 and 1
Ad 67	0.00Hz	Up-down operation step frequency	10.00Hz (frequency step every up-down)
In 65	0	Digital input P1	0: Forward start command (Fx)
In 66	1	Digital input P2	15: Frequency increase command (UP)
In 67	2	Digital input P3	15: Frequency decrease command (DOWN)

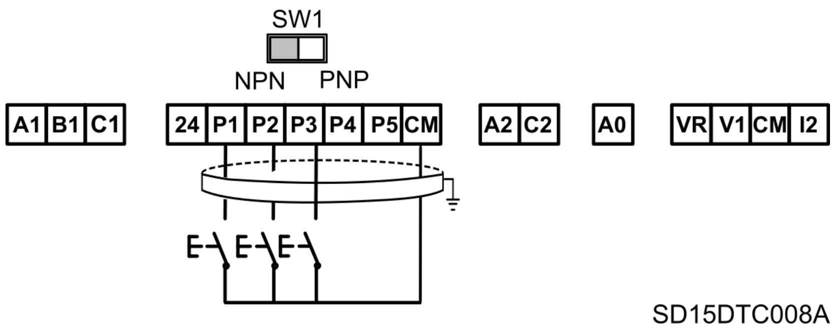
Connection scheme

Terminal P1: Digital input P1 (Run/Stop).

Terminal P2: Digital input P2 (frequency step UP).

Terminal P3: Digital input P3 (frequency step DOWN).

Terminal CM: Common terminal 0V.



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