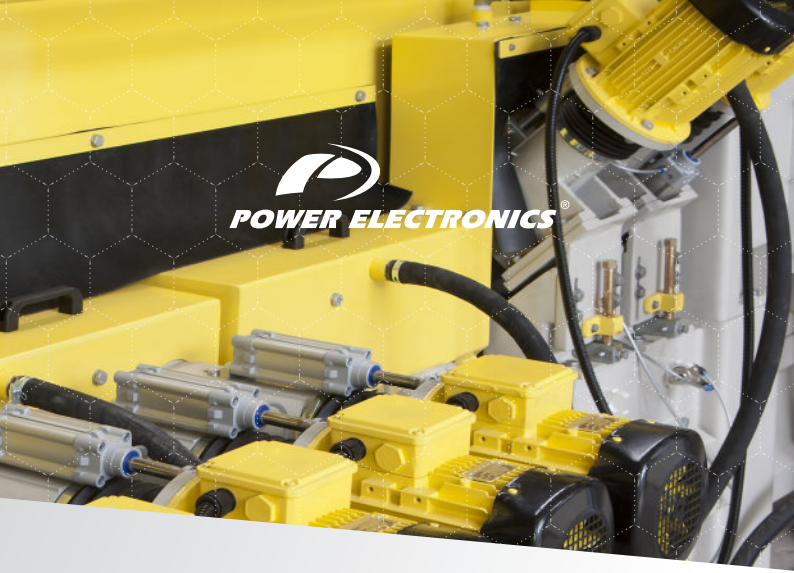

POWER ELECTRONICS®

SD300 ACCESORIES

I/O EXPANSION BOARD

GETTING STARTED MANUAL

SD300

ACCESORIES

Variable Speed Drive

I/O Expansion Board

Edition: August 2017

SD30IM02AI Rev.A

ABOUT

PURPOSE

This manual contains important instructions for the installation and operation of the optional I/O expansion board for Power Electronics' SD300 variable speed drives.

AUDIENCE

This manual is intended for qualified customers who will install, operate and maintain the I/O expansion board for SD300 drives.

Only trained electricians approved by Power Electronics may install and commission the drives.

REFERENCE MANUALS

The following reference manuals are available for the SD300 variable speed drives:

- SD300 Programming and Software Manual.
- SD300 Hardware and Installation Manual.
- SD300 Getting Started Manual

POWER ELECTRONICS CONTACT INFORMATION

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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 CAUTION 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.

Revisions

Date	Revision	Description
07 / 08 / 2017	A	First edition.

The equipment and technical documentation are periodically updated. Power Electronics reserves the right to modify all or part of the contents of this manual without previous notice. To consult the most updated information of this product, you may access through our website www.power-electronics.com, where the latest version of this manual can be downloaded.

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SAFETY INSTRUCTIONS

IMPORTANT!

Read carefully this manual to maximize the performance of the product and to ensure its safe use.

In order to appropriately use the drive, please, follow all instructions described in the installation manual which refer to transportation, installation, electrical connection and commissioning of the equipment.

Power Electronics accepts no responsibility or liability for partial or total damages resulting from incorrect use of equipment.

Please, pay careful attention to the following recommendations:

WARNING

Do not remove the cover while power supply is connected or the drive is operating.
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. 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.

Before opening the covers for wiring or periodic inspections, ensure DC voltage has been fully discharged. Check with a multimeter the following measures:
Measure between the output power busbars U, V, W and the cabinet and check that the voltage is around 0V.
Measure that the DC link terminals +, - and chassis voltage are below 30VDC.
Otherwise, you may 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.

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.

The inverter becomes hot during operation. Wait until it cools down before performing any actions.
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.

NOTICE

RECEPTION

- The SD300 are carefully tested and perfectly packed before delivering.
- In the event of transport damage, 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 24hrs 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

Equipment packaging 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 environments (Second Environment). It achieves compliance with C3 category defined in IEC/EN 61800-3 standard when the installation recommendation within this manual are followed.
- Select communication and control system according to the drive EMC environment. Otherwise, systems could suffer from interferences due to a low EMS level.

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 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 SD300 drives contain static sensitive printed circuits boards. Use static safety procedures when handling these boards.
- Avoid installing the drive under 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 SD300 Series will be damaged if the incoming power is connected and applied to the output terminals (U, V, W).
- Do not use power factor correction capacitor banks, surge suppressors, or RFI filters on the output side of the drive. Doing so may damage these components.
- Before wiring the terminals, make sure that the inverter keypad display is turned off and the front cover is off as well. The inverter may hold a high voltage electric charge long after the power supply has been turned off.

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 screws 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).

TRIAL RUN

- 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.

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.

1. INTRODUCTION

The input and output optional board (from now on, “I/O expansion board”) offers the possibility to increase the analogue and digital inputs and outputs number for the inverters of the SD300 series. This board includes:

- 3 Digital configurable inputs.
- 2 Digital configurable outputs.
- 2 Analogue configurable inputs.
- 1 Analogue configurable outputs.

The installation of this board increases the number of inputs and outputs of the SD300 VFD. All this gives the SD300 great versatility and flexibility.

The expansion board kit consists on:

- 1 I/O Expansion Board.
- 1 brass supporter (M3xL17.3).
- 1 brass supporter (M3xL23).
- 2 screws (M3xL8).
- Other parts

2. SPECIFICATIONS

FUNCTION		LABEL	NAME	DESCRIPTION
INPUT	Multi-function terminal configuration	P8 ~ P10	Multi-function Input 8~10	Configurable for multi -function input terminals
		CM	Common Sequence	Common terminal for analogue terminal inputs and outputs
	Analogue input configuration	V3	Voltage input for frequency reference input	Used to setup or modify a frequency reference via analogue voltage input terminal. ▪ I/O Expansion Board. ▪ Getting Started manual.
		I4	Voltage/current input for frequency reference input	Use to setup or modify a frequency reference via analogue voltage input terminals. Switch between voltage (V4) and current (I4) modes using a control board switch (SW2). V4 Mode: ▪ Unipolar: 0–10V (12V Max.) I4 Mode: ▪ Input current: 4–20mA ▪ Maximum Input current: 24mA ▪ Input resistance: 249Ω
OUTPUT	Analogue Outpu	AO3	Voltage/current Output	Devices: Output frequency, output current, output voltage, or a DC voltage. Operates Switch (SW3) to select the signal output type (voltage or current) at the AO terminal. Output Signal Specifications: ▪ Output voltage: 0–10V ▪ Maximum output voltage/current: 12V/10mA ▪ Output current: 0–20mA ▪ Maximum output current: 24mA ▪ Factory default output: Frequency
	Digital Output	CM	Common Sequence	Common terminal for analogue terminal inputs and outputs.
		A3, C3, B3.	Fault signal output	Sends out alarm signals when the drive's safety features are activated (AC 250V < 1A, DC30V < 1A). Fault condition: A3 and C3 contacts are connected (B3 and C3 open connection) Normal operation: B3 and C3 contacts are connected (A3 and C3 open connection)
		A4, C4, B4.	Fault signal output	Sends out alarm signals when the drive's safety features are activated (AC 250V < 1A, DC30V < 1A). Fault condition: A4 and C3 contacts are connected (B3 and C3 open connection) Normal operation: B4 and C4 contacts are connected (A4 and C4 open connection)

3. INSTALLATION AND CONNECTION

3.1. Installation of the I/O Expansion Board

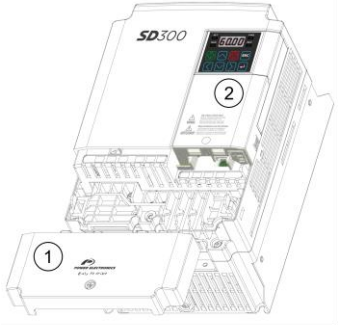
WARNING

Turn off the SD300 drive before connecting or removing any communication network. Otherwise, the drive and the communication module may get damaged.

The I/O expansion board is connected to the SD300 Series inverters of Power Electronics directly (through a connector). Once the board is connected to the drive, the new inputs and outputs will be enabled. These can be set as the I/O of the serial drive.

To install the I/O expansion board:

① Take off power supply. Unfasten the front cover fixing bolt to remove the front cover and ② remove the I/O cover.



SD30ITM0025A

Figure 3.1 Installation of the board. Steps 1 and 2.

③ Remove the keypad

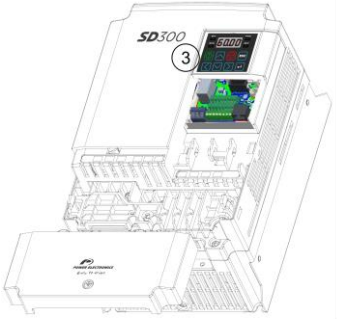


Figure 3.2 Installation of the board. Step 3.

Unfasten the screw from I/O the board and fasten the prepared brass bars ④ M3xL23 ⑤ and M3xL17.3.

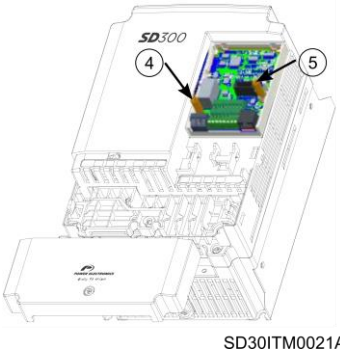


Figure 3.3 Installation of the board. Steps 4 and 5.

⑥ Mount the Extension I/O and ⑦ fasten the two brass bar screws (one was removed in step 4; the second is included in the kit).

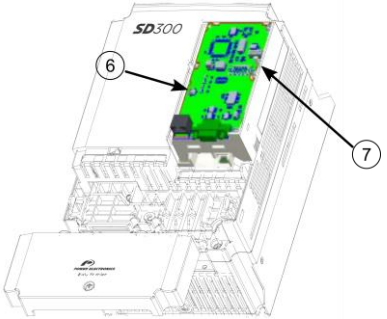
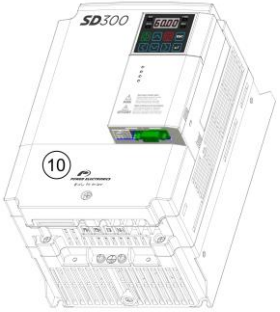


Figure 3.4 Installation of the board. Steps 6 and 7.

⑧ Install the keypad and ⑧ the communication module cover.

Figure 3.5 Installation of the board. Steps 8 and 9

⑩ Install the front cover again. Installation is now complete.



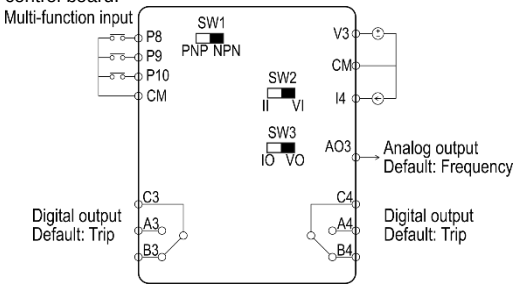
SD30ITM0024A

Figure 3.6 Installation of the board. Step 10.

3.2. Connection of the I/O Expansion Board

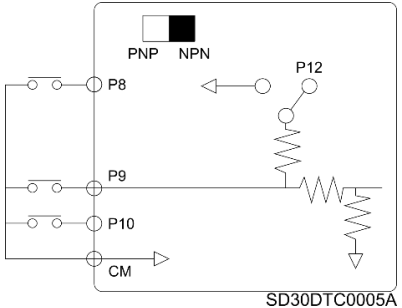
3.2.1. NPN/PNP Selector Configuration

The SD300 Extension I/O supports both PNP (Source) and NPN (Sink) modes for sequence inputs at the terminal. Select an appropriate mode to suit requirements using the PNP/NPN selection switch (SW1) on the control board.



NPN Mode (Sink)

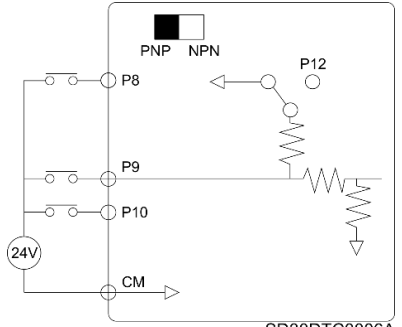
Select NPN using the PNP/NPN selection switch (SW1). Note that the factory setting is NPN mode. CM is the common ground terminal for all analogue inputs at the terminal, and P12 is the 12V internal source.



SD30DTC0005A

PNP Mode (Source)

Select PNP using the PNP/NPN selection switch (SW1). Note that the factory default setting is NPN mode. CM is the common ground terminal for all analogue inputs at the terminal, and P12 is 12V internal source (-) and the CM terminal in case of PNP, you should apply more than 3V source for on state and less than 2V for off state.



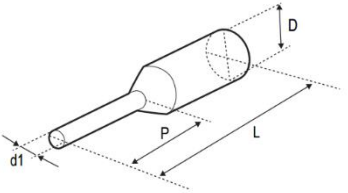
SD30DTC0006A

3.2.2. Control Cable Specifications

Terminals	Signal Cable			
	Without Crimp Terminal Connectors (Bare Wire)		With Crimp Terminal Connectors (Bootlace Ferrule)	
	mm²	AWG	mm²	AWG
P8~P10/CM/V3/I4/AO3	0.75	18	0.5	20
A3/B3/C3 A4/B4/C4	1.0	17	1.5	15

Preinsulated Crimp Terminal Connectors (Bootlace Ferrule)

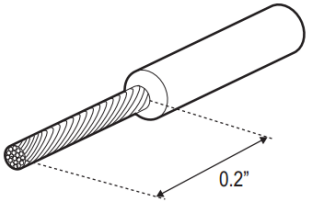
Use the preinsulated crimp terminal connectors to increase reliability of the control terminal wiring. Refer to the specifications below to determine the crimp terminals to fit various cable sizes.



P/N	Cable Spec		Dimensions (inches/mm)			
	AWG	mm²	L*	P	d1	D
CE002506	26	0.25	10.4	0.4/0.6	0.04/1.1	0.1/2.5
CE002508			12.4	0.5/0.8		
CE005006	22	0.50	12.0	0.45/6.0	0.05/1.3	0.125/3.2
CE007506	20	0.75	12.0	0.45/6.0	0.06/1.5	0.13/3.4

* If the length (L) of the crimp terminals exceeds 0.5" (12.7mm) after wiring, the control terminal cover may not close fully

To connect cables to the control terminals without using crimp terminals, refer to the following illustration detailing the correct length of exposed conductor at the end of the control cable.



NOTICE

While making wiring connections at the control terminals, ensure that the total cable length does not exceed 50m (165ft).

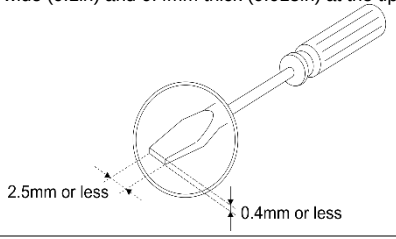
Ensure that the length of any safety related wiring does not exceed 30m (100ft).

Ensure that the cable length between an LCD keypad and the drive does not exceed 3.04m (10ft). Longer cable connections may cause signal errors.

Use ferrite material to protect signal cables from electro-magnetic interference.

Take care when supporting cables using cable ties, to apply the cable ties no closer than 6 inches from the drive. This provides sufficient access to fully close the front cover.

When making control terminal cable connections, use a small flat-tip screw driver (2.5mm wide (0.1in) and 0.4mm thick (0.015in) at the tip).



4. DESCRIPTION OF PROGRAMMING PARAMETERS

The different parameters of the SD300 are organized in groups, all detailed in the *Programming and Software* and *Getting Started* manuals.

This section summarizes those parameters which are directly related to the use of the I/O expansion module will be explained. Should more information about parameters be required, please refer to the previously mentioned manuals.

4.1. Group 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>ACC</td><td>Acceleration time</td><td>20.0s</td><td>0.0 to 600.0s</td><td>Set the acceleration time.</td><td>YES</td></tr>
<tr><td>dEC</td><td>Deceleration time</td><td>30.0s</td><td>0.0 to 600.0s</td><td>Set the deceleration time.</td><td>YES</td></tr>
<tr><td>Frq</td><td>Frequency reference source</td><td>LOCAL</td><td>0 to 16</td><td>Select the source for the speed reference.
<table>
<tr><th>OPT.</th><th>DESCR.</th><th>FUNCTION</th></tr>
<tr><td>0</td><td>LOCAL</td><td>Reference will be given by keypad and set in dr.1.</td></tr>
<tr><td>2</td><td>V1</td><td>Reference will be introduced through voltage analogue input 1.</td></tr>
<tr><td>4</td><td>V2</td><td>Reference will be introduced through voltage AI2.</td></tr>
<tr><td>5</td><td>I2</td><td>Reference will be introduced through current AI2.</td></tr>
<tr><td>6</td><td>MODBUS</td><td>The reference will be introduced through Modbus.</td></tr>
<tr><td>8</td><td>COMMS</td><td>The reference will be introduced through the communications.</td></tr>
<tr><td>9</td><td>PLC</td><td>The common area can be linked with user sequence output and can be used as command.</td></tr>
<tr><td>12</td><td>PULSE</td><td>Reference will be introduced through the Pulse input.</td></tr>
<tr><td>13</td><td>V3</td><td>The reference will be introduced through terminal V3.</td></tr>
<tr><td>15</td><td>V4</td><td>The reference will be introduced through terminal V4.</td></tr>
<tr><td>16</td><td>I4</td><td>The reference will be introduced through terminal I4.</td></tr>
</table></td><td>NO</td></tr>
</table>

Screen	Description	Default value	Range	Function	Set on RUN
St1	Multi-step speed frequency 1	**10.00Hz**	0.00 to dr.20	Configure multi-step frequency1–3. If an LCD keypad is in use, bA.50–52 is used instead of St1–St3 (multi-step frequency 1–3).	YES
St2	Multi-step speed frequency 2	**20.00Hz**	0.00 to dr.20		YES
St3	Multi-step speed frequency 3	**30.00Hz**	0.00 to dr.20		YES

4.2. Group Drive (dr)

Screen	Description	Default value	Range	Function	Set on RUN
dr.19	Start frequency	0.50Hz	0.01 to 10.00Hz	Set the start frequency. A start frequency is a frequency at which the drive starts voltage output. The drive does not produce output voltage while the frequency reference is lower than the set frequency. However, if a deceleration stop is made while operating above the start frequency, output voltage will continue until the operation frequency reaches a full-stop (0Hz).	NO
dr.20	Max speed limit	60.00Hz	40.00 to 400.00 Hz	Set upper and lower frequency limits. All frequency selections are restricted to frequencies from within the upper and lower limits. This restriction also applies when you in input a frequency reference using the keypad.	NO

4.3. Group Basic Functions (bA)

Screen	Description	Default value	Range	Function	Set on RUN
bA.53[1]	Multi-step speed frequency 4	40.00Hz	0.00 to dr.20	Configure multi-step frequencies 4-7.	YES
bA.54[1]	Multi-step speed frequency 5	50.00Hz			
bA.55[1]	Multi-step speed frequency 6	dr.20Hz			
bA.56[1]	Multi-step speed frequency 7	dr.20Hz			

[1] Displayed if one of In.65-71 is set to Speed–L/M/H

Screen	Description	Default value	Range	Function	Set on RUN
bA.70	Multi-step acceleration time 1	20.0s	0.0 to 600.0s	Set multi-step acceleration time 1.	NO
bA.71	Multi-step deceleration time 1	20.0s	0.0 to 600.0s	Set multi-step deceleration time 1.	NO
bA.72[2]	Multi-step acceleration time 2	30.0s	0.0 to 600.0s	Set multi-step acceleration and deceleration times 2–7.	NO
bA.73[2]	Multi-step deceleration time 2	30.0s	0.0 to 600.0s		NO
bA.74[2]	Multi-step acceleration time 3	40.0s	0.0 to 600.0s		NO
bA.75[2]	Multi-step deceleration time 3	40.0s	0.0 to 600.0s		NO
bA.76[2]	Multi-step acceleration time 4	50.0s	0.0 to 600.0s		NO
bA.77[2]	Multi-step deceleration time 4	50.0s	0.0 to 600.0s		NO
bA.78[2]	Multi-step acceleration time 5	40.0s	0.0 to 600.0s		NO
bA.79[2]	Multi-step deceleration time 5	40.0s	0.0 to 600.0s		NO
bA.80[2]	Multi-step acceleration time 6	30.0s	0.0 to 600.0s		NO
bA.81[2]	Multi-step deceleration time 6	30.0s	0.0 to 600.0s		NO
bA.82[2]	Multi-step acceleration time 7	20.0s	0.0 to 600.0s		NO
bA.83[2]	Multi-step deceleration time 7	20.0s	0.0 to 600.0s		NO

[2] Displayed if one of In.65-71 is set to Xcel–L/M/H

4.4. Group Inputs (In)

<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.1</td><td>Analogue input max. freq</td><td>dr.20</td><td>dr.19 to dr.20</td><td>Set drive operating frequency for the maximum voltage input of the analogue input.</td><td>YES</td></tr>
<tr><td>In.65</td><td>P1 terminal function setting</td><td>1: START(+)</td><td rowspan="2">0 to 54</td><td rowspan="2">Configure P1 – P7 terminals.

<table>
<tr><th>OPT.</th><th>DESCR.</th><th>FUNCTION</th></tr>
<tr><td>0</td><td>None</td><td>Not programmed entry.</td></tr>
<tr><td>1</td><td>START(+)</td><td>Send the start command through an open contactor (NO). The operation of the Digital Input varies when ‘3 WIRE’ is selected.</td></tr>
<tr><td>2</td><td>START(-)</td><td>Send the reverse start command through an open contactor (NO). The operation of the Digital Input varies when ‘3 WIRE’ is selected.</td></tr>
<tr><td>3</td><td>RESET</td><td>Send a ‘Reset’ command through digital inputs. (NO)</td></tr>
<tr><td>4</td><td>EXTTRIP</td><td>Trigger an external fault to stop the drive through digital inputs (NO). Is advisable to invert the digital input logic configured as Extreme Fault and set it as contact (NC). See parameter In.87.</td></tr>
<tr><td>5</td><td>DISSTART</td><td>Stop the drive by removing the motor output power supply, forcing a stop by inertia. (NO)</td></tr>
<tr><td>6</td><td>INCH1</td><td>Enable the speed reference programmed in dr.11. (NO)</td></tr>
<tr><td>7</td><td>SPEED-L</td><td>Bit 0 speed reference. Allows selecting the multiple preconfigured speed references. See St1-St3 and bA.53 -bA.56 (NO).</td></tr>
<tr><td>8</td><td>SPEED-M</td><td>Bit 1 speed reference. Allows selecting the multiple preconfigured speed references. See St1-St3 and bA.53 -bA.56 (NO).</td></tr>
</table>

Note: Continues in the next page.</td><td>NO</td></tr>
<tr><td>In.66</td><td>P2 terminal function setting</td><td>2: START(-)</td><td>NO</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>In.67</td><td>P3 terminal function setting</td><td>5: DISSTART</td><td rowspan="2"></td><td>Note: Comes from the previous page.

<table>
<tr><th>OPT.</th><th>DESCR.</th><th>FUNCTION</th></tr>
<tr><td>9</td><td>SPEED-H</td><td>Bit 2 speed reference. Allows selecting the multiple preconfigured speed references. See St1-St3 and bA.53 -bA.56 (NO).</td></tr>
<tr><td>11</td><td>XCEL-L</td><td>Bit 0 for alternative acceleration ramps. Allows the selection of the multiple preconfigured acceleration / deceleration ramps.
See bA.70 to bA.83.</td></tr>
<tr><td>12</td><td>XCEL-M</td><td>Bit 1 for alternative acceleration ramps. Allows the selection of the multiple preconfigured acceleration / deceleration ramps.
See bA.70 to bA.83.</td></tr>
<tr><td>13</td><td>RUNEnable</td><td>Sets the digital input to safe operation mode.</td></tr>
<tr><td>14</td><td>3-WIRE</td><td>Configure digital inputs for a behavior with pushbuttons. This input is set as NC and acts as stop to a start command.
Example:
DI1 = 1➔ START(+) (NO)
DI2 = 14➔ 3 WIRE (NC)
DI3 = 18➔ DOWN (NO)
This way, the DI1 button orders to start and the DI2 orders to stop. The DI3 button decreases the speed.</td></tr>
<tr><td>15</td><td>CTR/REF2</td><td>Enable the alternative control mode programmed in bA.4 (NO).</td></tr>
</table>

Note: Continues in the next page.</td><td>NO</td></tr>
<tr><td>In.68</td><td>P4 terminal function setting</td><td>3: RESET</td><td>NO</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>In.69</td><td>P5 terminal function setting</td><td>7: SPEED-L</td><td rowspan="2"></td><td rowspan="2">
Note: Comes from the previous page.
<table>
<tr><th>OPT.</th><th>DESCR.</th><th>FUNCTION</th></tr>
<tr><td>16</td><td>Exchange</td><td>This option switches motor power supply from the drive with direct network supply. To do this, digital output options 17 ‘Line in’ and 18 ‘Line Co’ are used. While the digital input is open, the digital output configured as 17 ‘Line in’ remains active. Once this digital input is closed, the relay ‘Line in’ is disabled, waits for 500ms and enables ‘Line Co’. When this digital input in disabled, ‘Line Co’ is disabled, waits for 500ms, enables ‘Line In’ and performs a speed search to synchronize with the motor. See Figure 14.7.</td></tr>
<tr><td>17</td><td>UP</td><td>Assign the function to increase the speed reference through a button (NO) to the digital input. reference limits are those set in dr group.</td></tr>
<tr><td>18</td><td>DOWN</td><td>Set digital input to decrease the speed reference by the use of a button (NO). The reference limits will be those set on dr group</td></tr>
<tr><td>20</td><td>POTCLEAR</td><td>Reset to 0 the speed reference of the motorized potentiometer. This way, even if parameter Ad.65 is set to NO, when restarting the drive, the drive will operate at the reference set in dr.1.</td></tr>
<tr><td>21</td><td>AnalogHLD</td><td>Set a speed reference from an analog input to the present activation time value. When this digital input is active, the drive will ignore any change produced in the analog input reference (NO).</td></tr>
</table>
Note: Continues in the next page.
</td><td>NO</td></tr>
<tr><td>In.70</td><td>P6 terminal function setting</td><td>0: None</td><td>NO</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>In.71</td><td>P7 terminal function setting</td><td>0: None</td><td rowspan="2"></td><td rowspan="2">Note: Comes from the previous page.

<table>
<tr><th>OPT.</th><th>DESCR.</th><th>FUNCTION</th></tr>
<tr><td>22</td><td>I-Term Clear</td><td>Reset the accumulated error by the integral PID function.</td></tr>
<tr><td>23</td><td>PIDOPLoop</td><td>Allow disabling the PID function. When it is disabled, the control PID will be resumed.
Note: This option must be used when the PID reference is set by analogue input. If PID reference is set by display, use option ‘INCH1’.</td></tr>
<tr><td>24</td><td>PGain2</td><td>Set the proportional gain 2 for PID operation.</td></tr>
<tr><td>25</td><td>XCEL Stop</td><td>Sets the digital input to stop acceleration or deceleration. See Figure 14.8</td></tr>
<tr><td>26</td><td>2ndMotor</td><td>Set the digital input as 2nd motor operation, which is used when a single drive switch operates two motors.</td></tr>
<tr><td>34</td><td>Pre-Excit</td><td>Enable the motor pre-excitation activation, before start. The user can adjust this functionality in parameters Ad.7, Ad.1 and Ad.13.</td></tr>
<tr><td>38</td><td>TimerIN</td><td>Set the function for the temporized digital output. If option 28 “Timer-Ou” is selected in OU.31 or OU.33, the digital output will be enabled once the time set in OU.56 has elapsed. Once this digital input is disabled, the digital output will be disabled once the time set in OU.57 has elapsed.</td></tr>
</table>
Note: Continues in the next page.</td><td>NO</td></tr>
<tr><td>In.72</td><td>P8 terminal function setting</td><td>0: None</td><td>NO</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>In.73</td><td>P9 terminal function setting</td><td>0: None</td><td rowspan="2"></td><td rowspan="2">Note: Comes from the previous page.
<table><tr><th>OPT.</th><th>DESCR.</th><th>FUNCTION</th></tr><tr><td>40</td><td>disAuxRef.</td><td>This digital input sets the main reference + alternative reference functionality. When drive speed is controlled by the main reference source, if this input is enabled, the speed reference will be calculated according to parameter ba.2.</td></tr><tr><td>46</td><td>INCH(+)</td><td rowspan="2">Enable the direct starting fix speed reference to the one set in parameter dr.11.</td></tr><tr><td>47</td><td>INCH(-)</td></tr><tr><td>49</td><td>XCEL-H</td><td>Bit 2 for alternative acceleration ramps. Allows the selection of the multiple preconfigured acceleration/deceleration ramps. See bA.70 to 83.</td></tr><tr><td>50</td><td>PLC</td><td>Enables the user to implement simple sequences using various function blocks.</td></tr><tr><td>51</td><td>FireMode</td><td>The drive runs in Fire mode when Ad.80 is set to 2 and the multifunction terminal (In 65-71) configured for Fire mode is turned on.</td></tr><tr><td>52</td><td>KEB1Sel</td><td>For kinetic energy buffering operation, select the multifunction terminal, set it to ‘KEB1Sel’ and enable the digital input.</td></tr><tr><td>54</td><td>TI</td><td>In IP66 equipment, pulse input TI and Multi-function terminal P5 share the same terminal. In this case, set parameter In.69 to 54(TI).</td></tr></table></td><td>NO</td></tr>
<tr><td>In.74</td><td>P10 terminal function setting</td><td>0: None</td><td>NO</td></tr>
<tr><td>In.85</td><td>Multi-function input terminal On filter</td><td>10ms</td><td>0-10000ms</td><td rowspan="2">If the input terminals state is not changed during the set time, when the terminal receives an input, it is recognized as On or Off.</td><td>NO</td></tr>
<tr><td>In.86</td><td>Multi-function input terminal Off filter</td><td>3ms</td><td>0-10000ms</td><td>NO</td></tr>
</table>

Screen	Description	Default value	Range	Function	Set on RUN
In.87	Multi-function input terminal selection	00000	0: Off 1: On	Select terminal contact types for each input terminal. The position of the indicator light corresponds to the segment that is on as shown in the table below. With the bottom segment on, it indicates that the terminal is configured as a A terminal (Normally Open) contact. With the top segment on, it indicates that the terminal is configured as a B terminal (Normally Closed) contact. From right to left side, there are P1~P7 terminals. In case of installation of extension I/O, P8/P9/P10 terminals are added.	YES
In.89	Multi-step command delay time	1ms	1–5000ms	Set a time interval for the drive to check for additional terminal block inputs after receiving an input signal.	YES
In.90	Multi-function input terminal status	00000	0: Off 1: On	Display the configuration of each contact. When a segment is configured as A terminal using dr.87, the “On” condition is indicated by the top segment turning on. The Off condition is indicated when the bottom segment is turned on. When contacts are configured as B terminals, the segment is turned on. When contacts are configured as B terminals, the segment lights behave conversely. From the right to left side, there are P1~P7 terminals. In case of installation of extension I/O, P8/P9/P10 terminals are added.	YES

4.5. Group Outputs (OU)

Screen	Description	Default value	Range	Function	Set on RUN
OU.30	Relay fault output	010	000 to 111	This parameter allows setting when the relay output is set as 29 ‘FAULT’: **OPC** / **FUNCTION** 001 — Fault due to low voltage. 010 — Any faults other than low voltage. 100 — Automatic restart final failure. Final fault automatic restart. The relay will enable whenever all restart attempts (Pr.9) have been carried out or time set in Pr.10 has elapsed.	YES

<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.34</td><td>Multi-function relay3 setting</td><td>29: Trip</td><td>0 to 38</td><td>Set relay (Relay 3 and Relay 4, respectively) output options.

<table>
<tr><th>OPT.</th><th>DESC.</th><th>FUNCTION</th></tr>
<tr><td>0</td><td>None</td><td>The output has no effect.</td></tr>
<tr><td>1</td><td>FDT-1</td><td>Check when the output frequency has reached the user defined frequency. The relay will be enabled if the following equation is satisfied:
F output > frequency – (Pr.2 / 2).</td></tr>
<tr><td>2</td><td>FDT-2</td><td>The relay is active whenever the reference frequency is set to Pr.1 and is Pr.2 in bandwidth</td></tr>
<tr><td>3</td><td>FDT-3</td><td>The relay will enable in the frequencies:
Pr.1 – (Pr.2/2) to Pr.1 + (Pr.2/2).</td></tr>
<tr><td>4</td><td>FDT-4</td><td>The relay will be active whenever the output frequency is greater than Pr.1 remains closed until it decreases below Pr.1 – (Pr.2/2).</td></tr>
<tr><td>5</td><td>OverLoad</td><td>The relay will be active when the motor is in overload.</td></tr>
<tr><td>6</td><td>IOL</td><td>The relay will be active in case a fault due to overload protection occurs.</td></tr>
<tr><td>7</td><td>UndrLoad</td><td>The relay will be active in case of an underload warning.</td></tr>
<tr><td>8</td><td>VentWarn</td><td>The relay will be active in case a fan fault occurs and parameter Pr.79 is set as 1 ‘WARN’.</td></tr>
<tr><td>9</td><td>Stall</td><td>Digital output will be enable when the motor is blocked and overcharged.</td></tr>
<tr><td>10</td><td>OverVolt</td><td>The relay will enable whenever the drive DC bus voltage is higher than the protection voltage.</td></tr>
<tr><td>11</td><td>LowVolt</td><td>The relay will be active whenever the drive DC link voltage drops below the low voltage protection level.</td></tr>
<tr><td>12</td><td>OverHeat</td><td>The relay will enable when the drive temperature reaches a dangerous level.</td></tr>
</table>

Note: continues on the next page.</td><td>YES</td></tr>
</table>

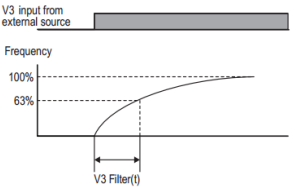
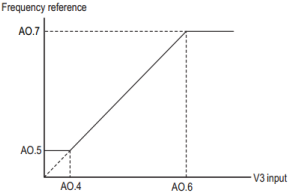
OU.35	Multi-function relay4 setting	29: Trip	0 to 38	**Note**: comes from the previous page	YES

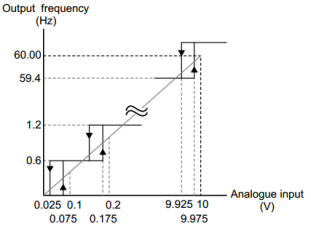
OPT.	DESC.	FUNCTION
13	Lost Command	Communications have been interrupted.
14	Run	The relay will enable with the start command. However, it will not enable during the DC brake.
15	Stop	The relay will always enable whenever no start command has been sent and no output voltage is present within the drive.
16	Steady	The relay will enable when the reference frequency matches the output frequency, this is, when the drive has reached the reference frequency.
17	Inv. Line	Outputs a signal while the motor is driven by the inverter line
18	Comm Line	Outputs a signal while the motor is controlled from the communications network. See option 16 “Exchange” of digital inputs configuration (parameters In.65-71).
19	Spd Srch	The relay will be active during a speed search operation.
22	Ready	The relay will enable whenever the drive is ready to start (without any warnings or trips).
28	Timer Out	The relay will be enabled after the set time has elapsed.
29	Trip	Relay is enabled when a fault trip occurs.
31	DBWarn %ED	Sets the configuration of the braking resistor (%ED: Duty cycle).
34	Comparat	Sends a signal using the value of the digital input.
35	BRCtrl	Used to control the brake opening.
36	CAP Exch.	The relay will enable CAP exchange options according to the setting of Pr.62.
37	FAN Exch.	The relay will enable FAN exchange according to the setting of Pr.87.
38	Fire Mode	Fire mode configuration.

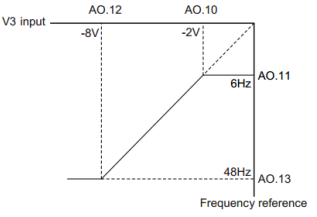
Screen	Description	Default value	Range	Function	Set on RUN
OU.41	Digital outputs status	00	00 to 11	Multi-function output monitor. **OPT. / FUNCTION** 00 — No outputs enabled 01 — Output 1 enabled 10 — Output 1 enabled 11 — Output 1 and 2 enabled	YES
OU.50	Digital output connection delay	0.00s	0.00 to 100.00s	The user can specify a delay in the digital output 1 and relays disconnection. If during the connection delay time the activation condition disappears, the relay will not be enabled.	YES
OU.51	Digital output disconnection delay	0.00s	0.00 to 100.00s	The user can specify a delay within the digital output 1 and relays disconnection. If during the disconnection delay time, the disable condition disappears, the relay will not be disabled.	YES
OU.52	Select multi-function output terminal	00	00 to 11	Select terminal type for relay and multi-function output terminal. An additional three terminal type selection bits at the terminal block will be added when an expansion I/O is added. By setting the relevant bit to 0, it will operate A terminal (Normally Open), and setting it to 1 will operate B terminal (Normally Closed).	NO
OU.53	Digital output connection delay on fault	0.00s	0.00 to 100.00s	If a fault trip occurs, trip relay or multi-function output operates after the time delay set in OU.53. Terminal is off with the input initialized after the time delay set in OU.54.	YES
OU.54	Digital output disconnection delay on fault	0.00s	0.00 to 100.00s		YES
OU.57	Relay FDT level	30.00Hz	0.00 to dr.20	Value of the output frequency for digital outputs FDT options.	YES
OU.58	Relay FDT band	10.00Hz	0.00 to dr.20	Detection frequency band for digital outputs FDT options.	YES

4.6. Group Extension I/O Function (AO)

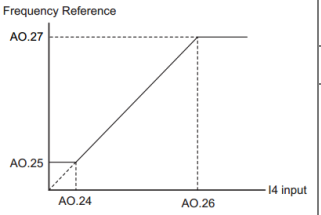
Screen	Description	Default value	Range	Function	Set on RUN
AO.1	V3 input monitor	0.00V	0.00 to 12.00V	Configure the drive to monitor the input voltage at V3.	YES
AO.2	V3 polarity options	0: Unipolar	0 to 1	0 Unipolar 1: Bipolar	YES

Screen	Description	Default value	Range	Function	Set on RUN
AO.3	V3 input filter time constant	10ms	0 to 10000ms	V3 Filter may be used when there are large variations between reference frequencies. Variations can be mitigated by increasing the time constant, but this will require an increased response time. The value t (time) indicates the time required for the frequency to reach 63% of the reference, when external input voltages are provided in multiple steps. 	NO
AO.4	V3 minimum input voltage	0.00V	0.00 to 10.00V	These parameters are used to configure the gradient level and offset values of the Output Frequency, based on the Input Voltage. 	NO
AO.5	V3 output at minimum voltage (%)	0.00%	0.00 to 100.00%		NO
AO.6	V3 maximum input voltage	10.00V	0.00 to 12.00V		NO
AO.7	V3 output at maximum voltage (%)	100.00%	0 to 100%		NO
AO.8	V3 Inverting	0	No Yes	Inverts the direction of rotation. Set this parameter to 1 (Yes) if you need the motor to run in the opposite direction from the current rotation.	NO
AO.9	V3 Quantizing level	0.04%	0.00*, 0.04 to 10.00%	Quantizing may be used when the noise level is high in the analogue input (V3 terminal) signal. Quantizing is useful when you are operating a noise-sensitive system, because it suppresses any signal noise. However, quantizing will diminish system sensitivity (resultant power of the output frequency will decrease based on the analogue input). **Note**: continues on the next page.	YES

Screen	Description	Default value	Range	Function	Set on RUN
				Note: comes from the previous page. You can also turn on the low-pass filter using parameter AO.3 to reduce the noise, but increasing the value will reduce responsiveness and may cause pulsations (ripples) in the output frequency. Parameter values for quantizing refer to a percentage based on the maximum input. Therefore, if the value is set to 1% of the analogue maximum input (60Hz), the output frequency will increase or decrease by 0.6Hz per 0.1V difference. When the analogue input is increased, an increase to the input equal to 75% of the set value will change the output frequency, and then the frequency will increase according to the set value. Likewise, when the analogue input decreases, a decrease in the input equal to 75% of the set value will make an initial change to the output frequency. As a result, the output frequency will be different at acceleration and deceleration, mitigating the effect of analogue input changes over the output frequency.  * Quantizing is disabled if '0' is selected.	

Screen	Description	Default value	Range	Function	Set on RUN
AO.10	V3 minimum input voltage	0.00V	10.00 to 0.00V	Set the gradient level and off-set value of the output frequency in relation to the input voltage. These parameters are displayed only when AO.2 is set to 1 (bipolar). As an example, if the minimum input voltage (at V3) is set to -2 (V) with 10% output ratio, and the maximum voltage is set to -8 (V) with 80% output ratio respectively, the output frequency will vary within the range of 6 - 48 Hz.	NO
AO.11	V3 output at minimum voltage (%)	0.00%	-100.00 to 0.00%		NO
AO.12	V3 maximum input voltage	-10.00V	-12.00 to 0.00V		NO
AO.13	V3 output at maximum voltage (%)	-100.00%	-100.00 to 0.00%		NO
AO.14[3]	V4 input display	0.00V	0.00-12.00V	Set and modify a frequency reference using input voltage at I4 (V4 terminal by setting SW2 to V4. Set the Frq (Frequency reference source) parameter in the Operation group to 15 (V4) and apply 0-12V input voltage to I4 (=V4, Analogue current/voltage input terminal).	YES
AO.15[3]	V4 input filter time constant	10ms	0-10000ms		NO
AO.16[3]	Minimum V4 input voltage	0.00V	0.00-10.00V		NO
AO.17[3]	Output% at minimum V4 voltage	0.00%	0.00-100.00%		NO
AO.18[3]	Maximum V4 input voltage	10.00V	0.00-10.00V		NO
AO.19[3]	Output% at maximum V4 voltage	100.00%	0.00-100.00%		NO
AO.20[3]	Invert V4 rotational direction	0	0: NO 1: YES		NO
AO.21[3]	V4 quantizing level	0.04	0.00*, 0.04-10.00%		NO
AO.22	I4 input monitor	0.00	0.00-24.00mA	Used to monitor input current at I4.	YES

[3] Parameters AO.14-21 will not be displayed when I4 is set to receive current input (Frq parameter is set to 16).
* Quantizing is disabled if '0' is selected.

<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>AO.23</td><td>I4 input filter time constant</td><td>10</td><td>0-10000ms</td><td>Configure the time for the operation frequency to reach 63% of target frequency based on the input current at I4.</td><td>NO</td></tr>
<tr><td>AO.24</td><td>I4 minimum input current</td><td>4.00</td><td>0.00-20.00mA</td><td rowspan="3">Configure the gradient level and offset value of the output frequency.
 
</td><td>NO</td></tr>
<tr><td>AO.25</td><td>I4 output at minimum current (%)</td><td>0.00</td><td>0-100%</td><td>NO</td></tr>
<tr><td>AO.26</td><td>I4 maximum input current</td><td>20.00</td><td>0.00-24.00mA</td><td>NO</td></tr>
<tr><td>AO.27</td><td>I4 output maximum current (%)</td><td>100.00</td><td>0.00-100.00%</td><td></td><td>NO</td></tr>
<tr><td>AO.28</td><td>I4 rotation direction options</td><td>0</td><td>No</td><td>Same as AO.8, but for the current analogue input 4.</td><td>NO</td></tr>
<tr><td>AO.29</td><td>I4 Quantizing level</td><td>0.04</td><td>0*, 0.04–10.00%</td><td>Same as AO.9, but for the current analogue input 4.</td><td>NO</td></tr>
<tr><td>AO.30</td><td>Analogue output3</td><td>0: Frequency</td><td>0–15</td><td>Select a constant value for output according to the following table:
<table>
<tr><th>OPT.</th><th>VALUE</th></tr>
<tr><td>0</td><td>Frequency</td></tr>
<tr><td>1</td><td>Output Current</td></tr>
<tr><td>2</td><td>Output Voltage</td></tr>
<tr><td>3</td><td>DCLink Voltage</td></tr>
<tr><td>4</td><td>Torque</td></tr>
<tr><td>5</td><td>Output Power</td></tr>
<tr><td>6</td><td>Idse</td></tr>
<tr><td>7</td><td>Iqse</td></tr>
<tr><td>8</td><td>Target Freq</td></tr>
<tr><td>9</td><td>Ramp Freq</td></tr>
<tr><td>10</td><td>Speed Fdb</td></tr>
<tr><td>12</td><td>PID Ref Value</td></tr>
<tr><td>13</td><td>PID Fdb Value</td></tr>
<tr><td>14</td><td>PID Output</td></tr>
<tr><td>15</td><td>Constant</td></tr>
</table></td><td>NO</td></tr>
<tr><td>AO.31</td><td>Analogue output 3 gain</td><td>100.0%</td><td>-1000.0–1000.0</td><td>Adjust output vale and offset. If frequency is selected as an output item, it will operate as shown below.
$AO3 = \frac{Frequency}{MaFreq} \times AO3\ Gain + AO3\ Bias$</td><td>NO</td></tr>
<tr><td>AO.32</td><td>Analogue output 3 bias</td><td>0.0%</td><td>-100.0–100.0</td><td>The analogue voltage output (AO3) changes depend on AO.31 (AO3 Gain) and AO.31 (AO3 Bias) values.</td><td>NO</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>AO.33</td><td>Analogue output 3 filter</td><td>5ms</td><td>0-10000</td><td>Set filter time constant on analogue output.</td><td>NO</td></tr>
<tr><td>AO.34</td><td>Analogue constant output 3</td><td>0.0%</td><td>0.0-100.0</td><td>If analogue output at AO.30 (AO3 Mode) is set to 15 (Constant), the analogue voltage output is dependent on the set parameter values (0-100%).</td><td>NO</td></tr>
<tr><td>AO.35</td><td>Analogue output 3 monitor</td><td>0.0%</td><td>0.0-1000.0</td><td>Monitor analogue output value. Displays the maximum output voltage as a percentage (%) with 10V as the standard.</td><td>YES</td></tr>
<tr><td>AO.36</td><td>Ext IO Switch</td><td>01</td><td>00 to 11</td><td><table><tr><th>OPT.</th><th>FUNCTION</th></tr><tr><td>00</td><td>NPN,V4</td></tr><tr><td>01</td><td>NPN,I4</td></tr><tr><td>10</td><td>PNP,V4</td></tr><tr><td>11</td><td>PNP,I4</td></tr></table></td><td>YES</td></tr>
<tr><td>AO.37</td><td>Ext I/O SW Ver</td><td>-</td><td>-</td><td>Show the software version.</td><td>YES</td></tr>
</table>

5. PROGRAMMING PARAMETERS ADDRESSES

Drive parameters directly related to I/O Expansion Board are listed below.

For a full list of all other SD300 programming parameters, please refer to the *Programming and Software Manual*, or the *Getting Started Manual*.

Screen	Description	Modbus Address		Range	Modbus Range
		Decimal	Hexadecimal		
ACC	Acceleration time	**47937**	**0h1F01**	0.0 to 600.0s	0 to 6000
dEC	Deceleration time	**47938**	**0h1F02**	0.0 to 600.0s	0 to 6000
Frq	Frequency reference source	**47940**	**0h1F04**	0 to 16	0 to 16
St1	Multi-step speed frequency 1	**47941**	**0h1F05**	0.00 to dr.20	0 to dr.20
St2	Multi-step speed frequency 2	**47942**	**0h1F06**	0.00 to dr.20	0 to dr.20
St3	Multi-step speed frequency 3	**47943**	**0h1F07**	0.00 to dr.20	0 to dr.20
dr.19	Start frequency	**44371**	**0h1113**	0.01 to 10.00Hz	0 to 1000
dr.20	Max speed limit	**44372**	**0h1114**	40.00 to 400.00 Hz	4000 to 40000
bA.53	Multi-step speed frequency 4	**44661**	**0h1235**	0.00 to dr.20Hz	0 to dr.20
bA.54	Multi-step speed frequency 5	**44662**	**0h1236**	0.00 to dr.20Hz	0 to dr.20
bA.55	Multi-step speed frequency 6	**44663**	**0h1237**	0.00 to dr.20Hz	0 to dr.20
bA.56	Multi-step speed frequency 7	**44664**	**0h1238**	0.00 to dr.20Hz	0 to dr.20
bA.70	Multi-step acceleration time 1	**44678**	**0h1246**	0.0 to 600.0s	0 to 6000
bA.71	Multi-step deceleration time 1	**44679**	**0h1247**	0.0 to 600.0s	0 to 6000
bA.72	Multi-step acceleration time 2	**44680**	**0h1248**	0.0 to 600.0s	0 to 6000
bA.73	Multi-step deceleration time 2	**44681**	**0h1249**	0.0 to 600.0s	0 to 6000
bA.74	Multi-step acceleration time 3	**44682**	**0h124A**	0.0 to 600.0s	0 to 6000
bA.75	Multi-step deceleration time 3	**44683**	**0h124B**	0.0 to 600.0s	0 to 6000
bA.76	Multi-step acceleration time 4	**44684**	**0h124C**	0.0 to 600.0s	0 to 6000
bA.77	Multi-step deceleration time 4	**44685**	**0h124D**	0.0 to 600.0s	0 to 6000
bA.78	Multi-step acceleration time 5	**44686**	**0h124E**	0.0 to 600.0s	0 to 6000
bA.79	Multi-step deceleration time 5	**44687**	**0h124F**	0.0 to 600.0s	0 to 6000
bA.80	Multi-step acceleration time 6	**44688**	**0h1250**	0.0 to 600.0s	0 to 6000
bA.81	Multi-step deceleration time 6	**44689**	**0h1251**	0.0 to 600.0s	0 to 6000

Screen	Description	Modbus Address		Range	Modbus Range
		Decimal	Hexadecimal		
bA.82	Multi-step acceleration time 7	**44690**	**0h1252**	0.0 to 600.0s	0 to 6000
bA.83	Multi-step deceleration time 7	**44691**	**0h1253**	0.0 to 600.0s	0 to 6000
In.1	Analogue input max. freq	**45337**	**0h1501**	dr.19 to dr.20	dr.19 to dr.20
In.65	P1 terminal function setting	**45441**	**0h1541**	None START(+) START(-) RESET EXT TRIP DIS START INCH 1 SPEED-L SPEED-M SPEED-H XCEL-L XCEL-M RUN Enable 3-WIRE CTR/REF 2 Exchange UP DOWN RESERVED POT CLEAR AnalogHLD PIDOPLoop P Gain 2 XCEL Stop 2nd Motor Pre-Excit Timer IN disAuxRef. INCH(+) INCH(-) XCEL-H PLC Fire Mode KEB1 Sel TI	0 1 2 3 4 5 6 7 8 9 11 12 13 14 15 16 17 18 19 20 21 22 24 25 26 34 38 40 46 47 49 50 51 52 54
In.66	P2 terminal function setting	**45442**	**0h1542**		
In.67	P3 terminal function setting	**45443**	**0h1543**		
In.68	P4 terminal function setting	**45444**	**0h1544**		
In.69	P5 terminal function setting	**45445**	**0h1545**		
In.70	P6 terminal function setting	**45446**	**0h1546**		
In.71	P7 terminal function setting	**45447**	**0h1547**		
In.72	P8 terminal function setting	**45448**	**0h1548**		
In.73	P9 terminal function setting	**45449**	**0h1549**		
In.74	P10 terminal function setting	**45450**	**0h154A**		
In.85	Multi-function input terminal On filter	**45461**	**0h1555**	0 to 10000ms	0 to 10000
In.86	Multi-function input terminal Off filter	**54462**	**0h1556**	0 to 10000ms	0 to 1000s
In.87	Multi-function input terminal selection	**45463**	**0h1557**	0 to 1	0 to 1
In.89	Multi-step command delay time	**45465**	**0h1559**	1 to 5000ms	1 to 5000
In.90	Multi-function input terminal status	**45466**	**0h155A**	0 to 1	0 to 1

Screen	Description	Modbus Address		Range	Modbus Range
		Decimal	Hexadecimal		
OU.30	Relay fault output	**45662**	**0h161E**	000 to 111	000 to 111
OU.34	Multi-function relay3 setting	**45666**	**0h1622**	None FDT-1 FDT-2 FDT-3 FDT-4 OverLoad IOL UndrLoad VentWarn Stall OverVolt LowVolt OverHeat Lost Command Run	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
OU.35	Multi-function relay4 setting	**45667**	**0h1623**	Stop Steady Inv. Line Comm Line Spd Srch Ready Timer Out Trip DBWarn%ED COMPARAT BRCtrl CAP Exch. FAN Exch. Fire Mode	15 16 17 18 19 22 28 29 31 34 35 36 37 38
OU.41	Digital outputs status	**45673**	**0h1629**	00 to 11	00 to 11
OU.50	Digital output connection delay	**45682**	**0h1632**	0.00 to 100.00s	0 to 10000
OU.51	Digital output disconnection delay	**45683**	**0h1633**	0.00 to 100.00s	0 to 10000
OU.52	Select multi-function output terminal	**45684**	**0h1634**	00 to 11	00 to 11
OU.53	DO connection delay on fault	**45685**	**0h1635**	0.00 to 100.00s	0 to 10000
OU.54	DO disconnection delay on fault	**45686**	**0h1636**	0.00 to 100.00s	0 to 10000
OU.57	Relay FDT level	**45689**	**0h1639**	0.00 to dr.20	0 to dr.20
OU.58	Relay FDT band	**45690**	**0h163A**	0.00 to dr.20	0 to dr.20
AO.1	V3 input voltage display	**46657**	**0h1A01**	-12.00 to 12.00V	-1200 to 1200
AO.2	V3 input polarity selection	**46658**	**0h1A02**	0 to 2	0 to 2
AO.3	Time constant of V3 input filter	**46659**	**0h1A03**	0 to 10000ms	0 to 10000
AO.4	V3 Minimum input voltage	**46660**	**0h1A04**	0.00 to 10.00V	0 to 1000

Screen	Description	Modbus Address		Range	Modbus Range
		Decimal	Hexadecimal		
AO.5	V3 output at Minimum voltage (%)	**46661**	**0h1A05**	0.00 to 10.00%	0 to 1000
AO.6	V3 Maximum input voltage	**46662**	**0h1A06**	0.00 to 12.00V	0 to 1200
AO.7	V3 output at Maximum voltage (%)	**46663**	**0h1A07**	0.00 to 100.00%	0 to 10000
AO.8	V3 rotation direction change	**46664**	**0h1A08**	0 to 1	0 to 1
AO.9	V3 rotation direction change	**46665**	**0h1A09**	0.04 to 10.00%	4 to 1000
AO.10	V3 Minimum input voltage	**46666**	**0h1A0A**	-10.00 to 0.00V	-10 to 0
AO.11	V3 output at Minimum voltage (%)	**46667**	**0h1A0B**	-100.00 to 0.00%	-100 to 0
AO.12	V3 Maximum input voltage	**46668**	**0h1A0C**	-12.00 to 0.00V	-1200 to 0
AO.13	V3 output at Maximum voltage (%)	**46669**	**0h1A0D**	-100.00 to 0.00	-100 to 000
AO.14	V4 input voltage display	**46670**	**0h1A0E**	0.00 to 12.00V	0 to 1200
AO.15	Time constant of V4 input filter	**46671**	**0h1A0F**	0 to 10000ms	0 to 10000
AO.16	V4 Minimum input voltage	**46672**	**0h1A10**	0.00 to 10.00V	0 to 1000
AO.17	V4 output at Minimum voltage (%)	**46673**	**0h1A11**	0.00 to 100.00%	0 to 10000
AO.18	V4 Maximum input voltage	**46674**	**0h1A12**	0.00 to 10.00V	0 to 1000
AO.19	V4 output at Maximum voltage (%)	**46675**	**0h1A13**	0.00 to 100.00%	0 to 10000
AO.20	V4 rotation direction change	**46676**	**0h1A14**	0 to 1	0 to 1
AO.21	V4 quantization level	**46677**	**0h1A15**	0.04 to 10.00%	0.04 to 1000
AO.22	I4 input current display	**46678**	**0h1A16**	0 to 24mA	0 to 24
AO.23	I4 input filter time constant	**46679**	**0h1A17**	0 to 10000ms	0 to 10000
AO.24	I4 minimum input current	**46680**	**0h1A18**	0.00 to 20.00mA	0 to 2000
AO.25	I4 output at Minimum current (%)	**46681**	**0h1A19**	0.00 to 100.00%	0 to 10000
AO.26	I4 maximum input current	**46682**	**0h1A1A**	0.00 to 24.00mA	0 to 2400
AO.27	I4 output at Maximum current (%)	**46683**	**0h1A1B**	0.00 to 100.00%	0 to 10000
AO.28	Changing rotation direction of I4	**46684**	**0h1A1C**	0 to 1	0 to 1
AO.29	I4 quantization level	**46685**	**0h1A1D**	0.04 to 10.00%	4 to 1000
AO.30	Analogue output 3 item	**46686**	**0h1A1E**	0 to 15	0 to 15
AO.31	Analogue output 3 gain	**46687**	**0h1A1F**	-1000.0 to 1000.0%	-10000 to 10000
AO.32	Analogue output 3 bias	**46688**	**0h1A20**	-100.0 to 100.0%	-1000 to 1000
AO.33	Analogue output 3 filter	**46689**	**0h1A21**	0 to 10000ms	0 to 10000ms
AO.34	Analogue constant output 3	**46690**	**0h1A22**	0.0 to 100.0%	0 to 1000
AO.35	Analogue output 3 monitor	**46691**	**0h1A23**	0.0 to 1000.0%	0 to 10000
AO.36	Ext IO Switch	**46692**	**0h1A24**	00 to 11	00 to 11
AO.37	Ext I/O SW Ver	**46693**	**0h1A25**	-	-

6. TYPICAL CONFIGURATIONS

6.1. Basic Function

Basic Function	Example
Frequency reference source configuration for the terminal block (input voltage)	Configures the drive to allow input voltages at the terminal block (V3, V4) and to setup or modify a frequency reference.
Frequency reference source configuration for the terminal block (input current)	Configures the drive to allow input currents at the terminal block (I4) and to setup or modify a frequency reference.
Multi-step speed (frequency) configuration	Configures multi-step frequency operations by receiving an input at the terminals defined for each step frequency.
Multi-step Acc/Dec time configuration using the multi-function terminal	Configures multi-stage acceleration and deceleration times for a motor based on defined parameters for the multi-function terminals.
Command source configuration for terminal block inputs	Configures the drive to accept inputs at the FX/RX terminals.
Multi-function input terminal control configuration	Enables the user to improve the responsiveness of the multi-function input terminals.

6.2. Setting Frequency Reference

6.2.1. V3 Terminal as the Source

You can set and modify a frequency reference by setting voltage inputs when using the V3 terminal. Use voltage inputs ranging from 0 to 10V (unipolar) for forward only operation. Use voltage inputs ranging from -10 to +10V (bipolar) for both directions, where negative voltage inputs are used reverse operations.

Setting a Frequency Reference for 0–10V Input

Set the Frq (Frequency reference source) parameter in the Operation group to 13 (V3), and then set parameter AO.2 (V3 Polarity) to 0 (unipolar) in the AO group. Use a voltage output from an external source or use the voltage output from the VR terminal (Standard I/O) to provide inputs to V3. Refer to the diagrams below for the wiring required for each application.

Parameter	Value
Frq	13 (V3)
In.1	100.00%
AO.1	0.00
AO.2	0 (Unipolar)
AO.3	10
AO.4	0.00
AO.5	0.00
AO.6	10.00
AO.7	100.00
AO.8	0
AO.9	0.04

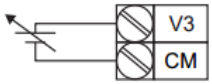


Figure 6.1 External source application

0–10V Input Voltage Setting Details

Parameters: In.1, AO.1, AO.3, AO.4 – AO.7, AO.8, AO.9.

Set In.1 Freq at 100% to configure the frequency reference at the maximum input voltage when a potentiometer is connected to the control terminal block. A frequency set with parameter In.1 becomes the maximum frequency only if the value set in parameter AO.7 (or AO.13) is 100(%).

- Set parameter In.1 to 40.00 and use default values for parameters AO.1-AO.9. Motor will run at 40.00Hz when a 10V input is provided at V3.
- Set parameter AO.7 to 50.00 and use default values for parameters In.1-AO.9. Motor will run at 30.00Hz (50% of the default maximum frequency-60Hz) when a 10V input is provided at V3.

Setting a Frequency Reference for -10–10V Input

Set the Frq (Frequency reference source) parameter in the Operation group to 13 (V3), and then set parameter AO.2 (V3 Polarity) to 1 (bipolar) in the APO group (AO). Use the output voltage from an external source to provide input to V3

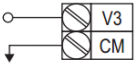


Figure 6.2 V3 terminal wiring

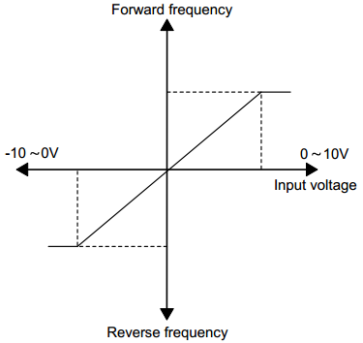


Figure 6.3 Bipolar input voltage and output frequency

Rotational Directions for Different Voltage Inputs

Command / Voltage Input	Input voltage	
	0-10V	-10-0V
FWD	Forward	Reverse
REV	Reverse	Forward

-10–10V Voltage Input Setting Details

Parameters AO.10 – AO.13 are used.

Setting a Reference Frequency using Input Current (I4)

You can set and modify a frequency reference using input current at the I4 terminal after selecting current input at SW 2. Set the Frq (Frequency reference source) parameter in the Operation group to 16 (I4) and apply 4–20mA input current to I4.
In.1 = 60.00Hz.

Parameter	Value
Frq	16 (I4)
In.1	60.00
AO.22	0.00
AO.23	10
AO.24	4.00
AO.25	0.00
AO.26	20.00
AO.27	100.00
AO.28	0 (No)
AO.29	0.04

Input current (I4) Setting Details

Parameters: In.1, AO.22, AO.23, In.24, In.25, In.26, In.27.

In.1 Freq at 100% configures the frequency reference for operation at the maximum current (when AO.27 is set to 100%).

- If In.1 is set to 40.00Hz, and default settings are used for AO.24–27, 20mA input current (max) to I4 will produce a frequency reference of 40.00Hz.
- If AO.27 is set to 50.00 (%), and default settings are used for In.1 (60Hz) and AO.24–26, 20mA input current (max) to I4 will produce a frequency reference of 30.00Hz (50% of 60Hz).

6.2.2. Setting a Frequency Reference with Input Voltage (Terminal I4)

Set and modify a frequency reference using input voltage at I4 (V4 terminal by setting SW2 to V4. Set the Frq (Frequency reference source) parameter in the Operation group to 15 (V4) and apply 0-12V input voltage to I4 (=V4, Analogue current/voltage input terminal). Parameters AO.14-21 will not be displayed when I4 is set to receive current input (Frq parameter is set to 16).

Parameter	Setting
Frq	15 (V4)
AO.14	0.00
AO.15	10
AO.16	0.00
AO.17	0.00
AO.18	10.00
AO.19	100.00
AO.20	0 (No)
AO.21	0.04

6.3. Analogue Output

An analogue output terminal provides output of 0-10V voltage, 4-20mA current.

An output size can be adjusted by selecting and output option at AO3 (Analogue Output3) terminal. Set the analogue voltage/current output terminal setting switch (SW3) to change the output type (voltage/current).

Parameter	Setting
AO.30	0 (Frequency)
AO.31	100.0%
AO.32	0.0%
AO.33	5ms
AO.34	0.0%
AO.35	0.0%

Voltage and Current Analogue Output Setting Details

The figure below shows an example of this function. Y-axis is analogue output voltage (0-10V), and X-axis is % value of the output item. If the maximum frequency set at dr.20 (Max Freq) is 60Hz and the present output frequency is 30Hz, then the x-axis value on the next graph is 50%. Use parameters:AO.30 – AO.35.

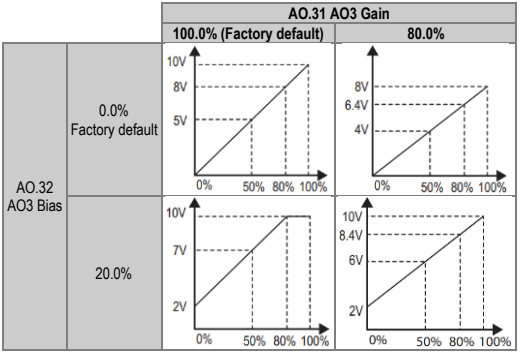


Figure 6.4 AO3 Voltage output depending on AO3 gain and AO3 bias

6.4. Digital Output

6.4.1. Multi-function Output Terminal and Relay Settings

Parameter	Parameter Setting
OU.30	010[1].
OU.34	29 (Trip)
OU.35	29 (Trip)
OU.41	-
OU.57	30.00Hz
OU.58	10.00Hz
In.65-74	16 (Exchange)

Set output terminal and relay functions according to OU.57 FDT (Frequency), OU.58 (FDT Band) settings and fault trip conditions.

[1] Displayed as on the keypad.

6.4.2. Fault Trip Output using Multi-Function Output Terminal and Relay

The inverter can trigger a fault trip state using multi-function output terminal (Q1) and relay (Relay 3, 4).

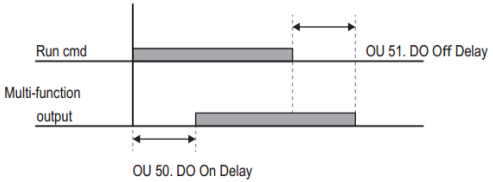
Parameter	Parameter Setting
OU.30	010 [1]
OU.34	29 (Trip)
OU.35	29 (Trip)
OU.53	0.00s
OU.54	0.00s

6.4.3. Multi-function Output Terminal Delay Time Settings

Set on-delay and off-delay times separately to control the output terminal and relay operation times. The delay time set at parameters OU.50-51 applies to multi-function output terminal (Q1), relay (Relay 1, 3, 4) except when the multi-function output function is in fault trip mode.

Parameter	Parameter Setting
OU.50	0.00s
OU.51	0.00s
OU.52	00[2]

The following figure illustrates this function:



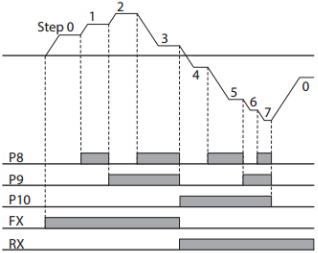
[2] Displayed as on keypad. On the 7-seg screen of multi-function output contact parameter, clicking of left/right key switches between extension I/O and built-in I/O 7-seg screen. is extension I/O 7-seg screen.

6.5. Setting Multi-Step Frequency

Multi-step operations can be carried out by assigning different speeds (or frequencies) to the Px terminals. Step 0 uses the frequency reference source set with the Frq parameter in the Operation group. Px terminal parameter values 7 (Speed-L), 8 (Speed-M) and 9 (Speed-H) are recognized as binary commands and work in combination with Fx or Rx run commands. The drive operates according to the frequencies set with St.1–3 (multi-step frequency 1–3), bA.53–56 (multi-step frequency 4–7) and the binary command combinations.

Parameter	Parameter Setting	
St1-St3	-	
bA.53–56	-	
In.72–74	7	Speed-L
	8	Speed-M
	9	Speed-H
In.89	1ms	

Choose the terminals to setup as multi-step inputs, and then set the relevant codes (In.72-74) to 7(Speed-L), 8(Speed-M), or 9(Speed-H). Provided that terminals P3, P4 and P5 have been set to Speed-L, Speed-M and Speed-H respectively, the following multi-step operation will be available:



Speed	Fx/Rx	P5	P4	P3
0	✓	-	-	-
1	✓	-	-	✓
2	✓	-	✓	-
3	✓	-	✓	✓
4	✓	✓	-	-
5	✓	✓	-	✓
6	✓	✓	✓	-
7	✓	✓	✓	✓

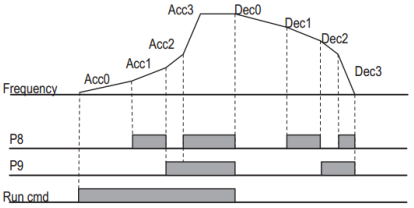
After adjusting In.89 to 100ms and an input signal is received at P8, the inverter will search for inputs at other terminals for 100ms, before proceeding to accelerate or decelerate based on P8 configuration.

6.6. Multi-Step Acc/Dec Time Configuration

Acc/Dec times can be configured via a multi-function terminal by setting the ACC (acceleration time) and dEC (deceleration time) parameters in the Operation group.

Parameter	Parameter Setting	
ACC	20.0s	
dEC	30.0s	
bA.70-82	x.xx	
bA.71-83	x.xx	
In.72-74	11	XCEL-L
	12	XCEL-M
	49	XCEL-H
In.89	1ms	

Acc/Dec commands are recognized as binary parameter inputs and will control the acceleration and deceleration based on parameter values set with bA.70-82 and bA.71-83.
If, for example, the P8 and P9 terminals are set as XCEL-L and XCEL respectively, the following operation will be available:



Acc/Dec time	P5	P4
0	-	-
1	-	✓
2	✓	-
3	✓	✓

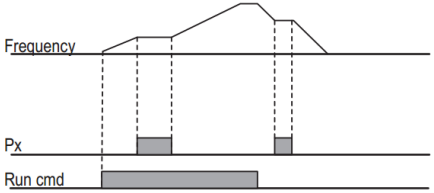
If In.89 is set to 100ms and a signal is supplied to the P8 terminal, the drive searches for other inputs over the next 100ms. When the time expires, the Acc/Dec time will be set based on the input received at P8.

6.7. Stopping the Acc/Dec Operation

Configure the multi-function input terminals to stop acceleration or deceleration and operate the drive at a fixed frequency.

Parameter	Parameter Setting	
In.65-71	25	XCEL Stop

The figure below illustrates this function:



6.8. Multi-function Input Terminal Control

Filter time constants and the type of multi-function input terminals can be configured to improve the response of input terminals

Parameter	Parameter Setting
In.85	10ms
In.86	3ms
In.87	0 0000[3]
In.90	0 0000[2]

[3] Displayed as on the keypad. On the 7-seg screen of multi.function input state/contact parameter, clicking of left/right key switches between extension I/O and built-in I/O 7-seg screen. is extension I/O 7-seg screen.

7. CONFIGURATION REGISTER

VARIABLE SPEED DRIVE: SD300.
SERIAL Nº: MODEL:
APPLICATION:
DATE:
CUSTOMER:
NOTES:

PARAMETER	DEFAULT VALUE	SETTING 1	SETTING 2
ACC Acceleration time	20.0s		
dEC Deceleration time	30.0s		
Frq Frequency reference source	LOCAL		
St1 Multi-step speed frequency 1	10.00Hz		
St2 Multi-step speed frequency 2	20.00Hz		
St3 Multi-step speed frequency 3	30.00Hz		
dr.19 Start frequency	0.50Hz		
dr.20 Max speed limit	60.00Hz		
bA.53 Multi-step speed frequency 4	40.00Hz		
bA.54 Multi-step speed frequency 5	50.00Hz		
bA.55 Multi-step speed frequency 6	dr.20Hz		

PARAMETER	DEFAULT VALUE	SETTING 1	SETTING 2
bA.56 Multi-step speed frequency 7	dr.20Hz		
bA.70 Multi-step acceleration time 1	20.0s		
bA.71 Multi-step deceleration time 1	20.0s		
bA.72 Multi-step acceleration time 2	30.0s		
bA.73 Multi-step deceleration time 2	30.0s		
bA.74 Multi-step acceleration time 3	40.0s		
bA.75 Multi-step deceleration time 3	40.0s		
bA.76 Multi-step acceleration time 4	50.0s		
bA.77 Multi-step deceleration time 4	50.0s		
bA.78 Multi-step acceleration time 5	40.0s		
bA.79 Multi-step deceleration time 5	40.0s		
bA.80 Multi-step acceleration time 6	30.0s		
bA.81 Multi-step deceleration time 6	30.0s		
bA.82 Multi-step acceleration time 7	20.0s		
bA.83 Multi-step deceleration time 7	20.0s		
In.1 Analogue input max. freq	dr.20		
In.65 P1 terminal function setting	1: START(+)		
In.66 P2 terminal function setting	2: START(-)		
In.67 P3 terminal function setting	5: DISSTART		
In.68 P4 terminal function setting	3: RESET		

PARAMETER	DEFAULT VALUE	SETTING 1	SETTING 2
In.69 P5 terminal function setting	7: SPEED-L		
In.70 P6 terminal function setting	0: None		
In.71 P7 terminal function setting	0: None		
In.72 P8 terminal function setting	0: None		
In.73 P9 terminal function setting	0: None		
In.74 P10 terminal function setting	0: None		
In.85 Multi-function input terminal On filter	10ms		
In.86 Multi-function input terminal Off filter	3ms		
In.87 Multi-function input terminal selection	0		
In.89 Multi-step command delay time	1ms		
In.90 Multi-function input terminal status	0		
OU.30 Relay fault output	10		
OU.34 Multi-function relay3 setting	29: Trip		
OU.35 Multi-function relay4 setting	29: Trip		
OU.41 Digital outputs status	0		
OU.50 Digital output connection delay	0.00s		
OU.51 Digital output disconnection delay	0.00s		
OU.52 Select multi-function output terminal	0		
OU.53 Digital output connection delay on fault	0.00s		
OU.54	0.00s		

PARAMETER	DEFAULT VALUE	SETTING 1	SETTING 2
Digital output disconnection delay on fault			
OU.57 Relay FDT level	30.00Hz		
OU.58 Relay FDT band	10.00Hz		
AO.1 V3 input voltage display	0.00V		
AO.2 V3 input polarity selection	0		
AO.3 Time constant of V3 input filter	10ms		
AO.4 V3 Minimum input voltage	0.00V		
AO.5 V3 output at Minimum voltage (%)	0.00%		
AO.6 V3 Maximum input voltage	10.00V		
AO.7 V3 output at Maximum voltage (%)	100.00%		
AO.8 V3 rotation direction change	0		
AO.9 V3 rotation direction change	0.04%		
AO.10 V3 Minimum input voltage	0.00V		
AO.11 V3 output at Minimum voltage (%)	0.00%		
AO.12 V3 Maximum input voltage	-10.00V		
AO.13 V3 output at Maximum voltage (%)	-100.00		
AO.14 V4 input voltage display	0.00V		
AO.15 Time constant of V4 input filter	10ms		
AO.16 V4 Minimum input voltage	0.00V		
AO.17 V4 output at Minimum voltage (%)	0.00%		

PARAMETER	DEFAULT VALUE	SETTING 1	SETTING 2
AO.18 V4 Maximum input voltage	10V		
AO.19 V4 output at Maximum voltage (%)	100.00%		
AO.20 V4 rotation direction change	0		
AO.21 V4 quantization level	0.04%		
AO.22 I4 input current display	0.00Ma		
AO.23 I4 input filter time constant	10ms		
AO.24 I4 minimum input current	4.00		
AO.25 I4 output at Minimum current (%)	0.00%		
AO.26 I4 maximum input current	20.00mA		
AO.27 I4 output at Maximum current (%)	100.00%		
AO.28 Changing rotation direction of I4	0		
AO.29 I4 quantization level	0.04%		
AO.30 Analogue output 3 item	0		
AO.31 Analogue output 3 gain	100.0%		
AO.32 Analogue output 3 bias	0.0%		
AO.33 Analogue output 3 filter	5ms		
AO.34 Analogue constant output 3	0.0%		
AO.35 Analogue output 3 monitor	0.0%		
AO.36 Ext IO Switch	01		
AO.37 Ext I/O SW Ver	1.00		

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