PowerXL™

Modbus RTU Communication manual for Variable Frequency Drives / Variable Speed Starters DA1, DC1, DE1

Modbus

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Original Operating Instructions
The German-language edition of this document is the original operating manual.

Translation of the original operating manual
All editions of this document other than those in German language are translations of the original German manual.

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Danger!
Dangerous electrical voltage!

Before commencing the installation

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit the device.
- Cover or enclose any adjacent live components.
- Follow the engineering instructions (AWA/IL) for the device concerned.
- Only suitably qualified personnel in accordance with EN 50110-1/-2 (VDE 0105 Part 100) may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- The functional earth (FE, PES) must be connected to the protective earth (PE) or the potential equalisation. The system installer is responsible for implementing this connection.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference does not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that an open circuit on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the extra-low voltage of the 24 V supply. Only use power supply units complying with IEC 60364-4-41 (VDE 0100 Part 410) or HD384.4.41 S2.
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.
- Emergency stop devices complying with IEC/EN 60204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause a restart.
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed and with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.
- Wherever faults in the automation system may cause injury or material damage, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks etc.).
- Depending on their degree of protection, frequency inverters may contain live bright metal parts, moving or rotating components or hot surfaces during and immediately after operation.
- Removal of the required covers, improper installation or incorrect operation of motor or frequency inverter may cause the failure of the device and may lead to serious injury or damage.
- The applicable national accident prevention and safety regulations apply to all work carried on live frequency inverters.
- The electrical installation must be carried out in accordance with the relevant regulations (e. g. with regard to cable cross sections, fuses, PE).
- Transport, installation, commissioning and maintenance work must be carried out only by qualified personnel (IEC 60364, HD 384 and national occupational safety regulations).
- Installations containing frequency inverters must be provided with additional monitoring and protective devices in accordance with the applicable safety regulations. Modifications to the frequency inverters using the operating software are permitted.
- All covers and doors must be kept closed during operation.
- To reduce the hazards for people or equipment, the user must include in the machine design measures that restrict the consequences of a malfunction or failure of the drive (increased motor speed or sudden standstill of motor). These measures include:
  - Other independent devices for monitoring safety-related variables (speed, travel, end positions etc.).
  - Electrical or non-electrical system-wide measures (electrical or mechanical interlocks).
  - Never touch live parts or cable connections of the frequency inverter after it has been disconnected from the power supply. Due to the charge in the capacitors, these parts may still be live after disconnection. Fit appropriate warning signs.

Table of contents

0 About this manual

0.1 Target group

This manual describes the Modbus RTU connection for DA1 and DC1 variable frequency drives and DE1 variable speed starters.

It is intended for experienced drive specialists and automation engineers and technicians. It also assumes that readers are thoroughly familiar with the Modbus RTU fieldbus and with how to program a Modbus master. Likewise, it assumes that readers are familiar with how to operate DA1/DC1 variable frequency drives and/or DE1 variable speed starters as applicable.

Please read this manual carefully before commissioning a Modbus RTU connection.

We assume that you have a good knowledge of engineering fundamentals, and that you are familiar with handling electrical systems and machines, as well as with reading technical drawings.

0.2 List of revisions

The following significant amendments have been introduced since previous issues:

Publication date	Page	Keyword	new	modified	deleted
09/16	22	„Control signal terminal configuration for DC1…E1 variable frequency drives“	✓		
	31	„Output process data“	✓		
	54	„Parameters for DC1…E1 variable speed starters“	✓		
01/16		Initial issue			

0.2.1 Writing conventions

Symbols used in this manual have the following meanings:

▶ Indicates instructions to be followed.

Indicates useful tips and
More Info

0.2.2 Hazard warnings of material damages

NOTICE

Warns about the possibility of material damage.

0.2.3 Hazard warnings of personal injury

CAUTION

Warns of the possibility of hazardous situations that may possibly cause slight injury.

DANGER

Warns of hazardous situations that result in serious injury or death.

DANGER – CONTROL FAILURE

When engineering your control diagram, make sure to take all potential control path faults into account.
When it comes to critical control functions, make sure that a safe state can be reached after a control path fails. –
Critical control function examples include:

- Emergency shutdown (emergency stop),
- Overtravel stop
- Power supply failure
- Restart.

Provide separate or redundant control paths.
Make sure that system control paths include communication connections.
Take the effect of unforeseen transmission delays and connection problems into account.
Carefully and individually test every implementation of a product before putting it into operation.
Observe all general accident prevention and local safety regulations.
Information for the USA:
For more information, please refer to the latest issue of NEMA ICS 1.1, "Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control," and the latest issue of NEMA ICS 7.1, "Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems."

In addition to property damage, failure to observe the above instructions may result in serious bodily injury or even death.

For greater clarity, the name of the current chapter and the name of the current section are shown in the page header.

→ To make it easier to understand some of the images included in this manual, the housing and other safety-relevant parts have been left out.
The components described here must be used only with a properly fitted housing and all necessary safety-relevant parts.

→ Please follow the installation instructions in the relevant instruction leaflets.

→ All the specifications in this manual refer to the hardware and software versions documented in it.

→ More information on the devices described here can be found on the Internet under: www.eaton.eu/powerxl
as well as: www.eaton.eu/documentation

1 Engineering

The following diagram shows an example illustrating how to set up the connection for a variable frequency drive (a DA1 in this specific case).

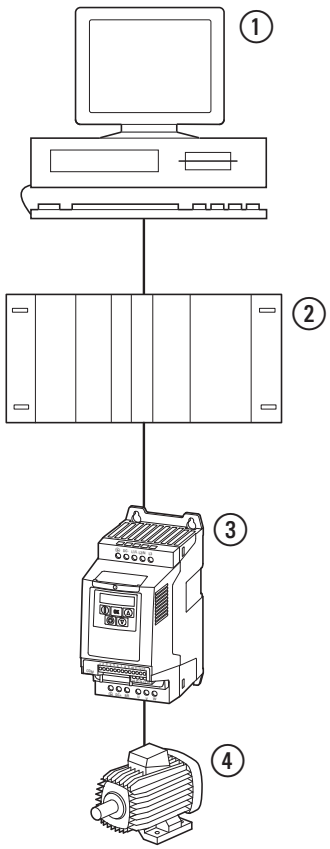


Figure 1: Engineering

① PC (with configuration tool)
② Head-end controller
③ Variable frequency drive
④ Motor

2 Modbus RTU

2.1 General

Modbus is a centrally polled bus system in which a so-called master (PLC) controls the entire data transfer on the bus. Internode communication between the individual modules (slaves) is not possible.

Every single data transfer operation is initiated by the master with a request. Only one request can be sent on the cable at a time.
Slaves are not able to initiate transfers, and are only able to respond to requests.

Two types of dialog are possible between master and slave:

- The master sends a request to a slave and waits for a response.
- The master sends a request to all slaves and does not wait for a response (broadcast).

→ More information on Modbus can be found under www.modbus.org.

2.2 Communications

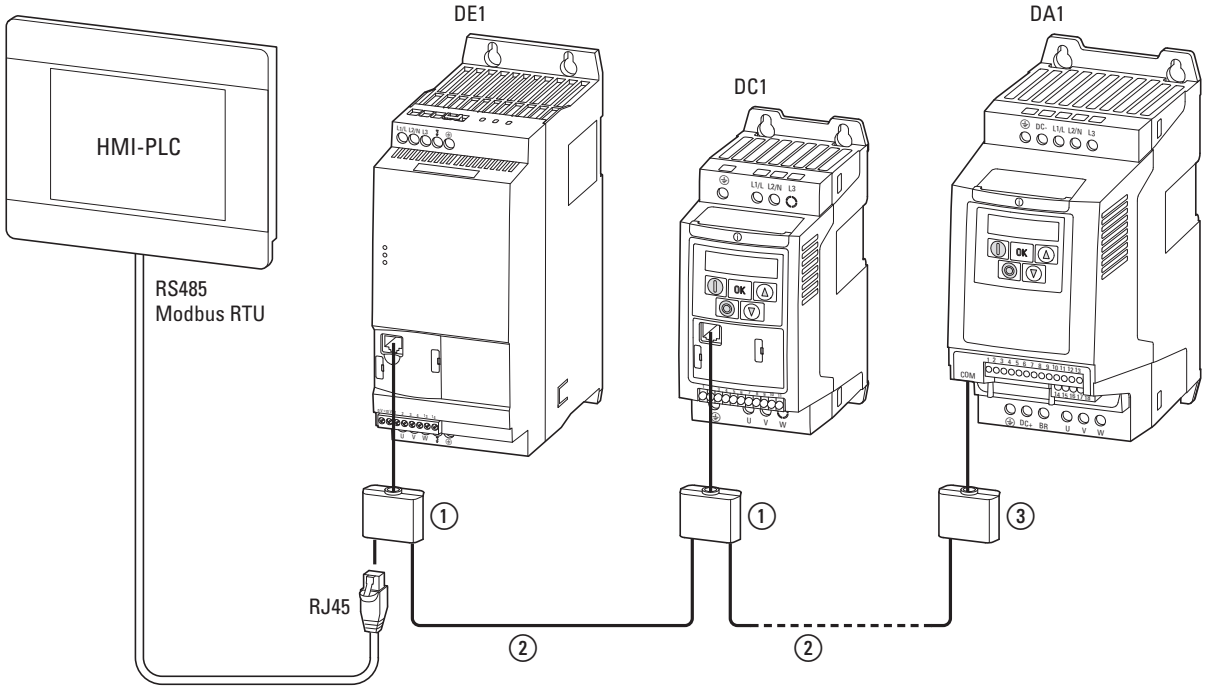


Figure 2: Modbus line with variable frequency drives/variable speed starters

① Splitter DX-SPL-RJ45… (T-plug connector)
② DX-CBL-RJ45… connection cable
③ DX-SPL-RJ45… splitter with bus termination resistor

Figure 2 shows a typical setup with a host computer (master) and any number (a maximum of 63 nodes) of variable frequency drives (slaves). Each variable frequency drive has a unique address on the network.

Addresses are assigned to each variable frequency drive individually with the use of a system parameter and are independent of the drive's physical connection (position) within the network.

The aforementioned system parameter used to assign addresses is:

- P5-01 for DA1 variable frequency drive,
- P-36 for DC1 variable frequency drive,
- P-34 for DE1 variable speed starter.

A DX-CBL-RJ45… connection cable with an RJ45 connector needs to be used in order to establish communications between the master and slave ②.

If multiple slaves are being used, they need to be connected in parallel using DX-SPL-RJ45… splitters ①.

A bus termination resistor is required at the last module on the Modbus line ③.

2.3 RJ 45 interface

The master and slave communicate with each other via RJ45 cables.
If multiple slaves are being used, they need to be connected in parallel using RJ45 cables and splitters.

The integrated RJ45 port (COM port) in DA1 and DC1 variable frequency drives and DE1 variable speed starters supports the Modbus RTU protocol, allowing for a direct network connection without the need for an additional interface module.

A bus termination resistor with a resistance of 120 Ω needs to be connected at each physical end (last node) of the network cable in order to prevent signal reflection and the associated transmission errors.

EASY-NT-R resistors can be plugged into the corresponding splitter.

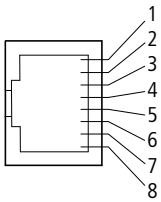
	PIN	Significance
	1	CAN- **Note:** Not used in DE1 variable speed starters (with the exception of DE11).
	2	CAN+ **Note:** Not used in DE1 variable speed starters (with the exception of DE11).
	3	0 V
	4	OP bus (operation bus) / External keypad / PC connection -
	5	OP bus (operation bus) / External keypad / PC connection +
	6	24 V DC power supply
	7	RS485- Modbus RTU
	8	RS485+ Modbus RTU

Figure 3: RJ45 socket wiring

2.3.1 Enable

DA1

The start signal is sent via the bus.

DC1

If using Modbus, there must always be a high signal at DI1.

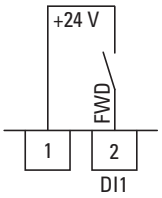


Figure 4: Enable signal for bus mode in DC1 variable frequency drives

DE1

If using Modbus, there must always be a high signal at DI1.

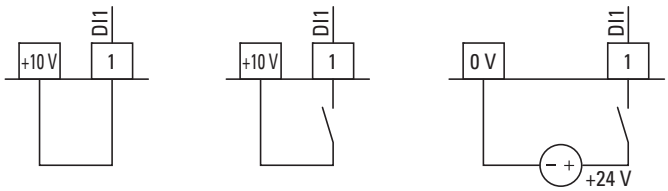


Figure 5: Enable signal for bus mode in DE1 variable speed starters

2.3.2 Data format

DA1

When using DA1 variable frequency drives, the data format can be selected using parameter P5-04.

The default setting is as follows:

- No parity
- 1 start bit
- 1 stop bit
- 8 data bits

DC1, DE1

The data format is fixed for DC1 variable frequency drives and DE1 variable speed starters and cannot be changed.

- No parity
- 1 start bit
- 1 stop bit
- 8 data bits

2.4 Communication parameters

The following tables list the communication parameters (sent to the PLC) for DA1 and DC1 variable frequency drives and DE1 variable speed starters.

Abbreviation	Significance
ID	The parameter's identification number in Modbus (identification number)
RUN	The parameter can be accessed during operation (Run signal)
ro/rw	Parameter read and write permissions: ro = read only rw = read and write
DS	Default setting (the parameter's value when using the device's factory settings)

2.4.1 Communication parameters for DA1 variable frequency drives

Table 1: Communication parameters for DA1

Display	ID	Access right		Designation	Value range	Description	DS
		RUN	ro/rw				
P1-12		–	rw	Control level	0, …, 6, 9, 10, 11, 13	Local Configuration of Command and Reference Sources Possible values: • **0**: Terminal Control. The drive responds directly to signals applied to the control terminals. • **1**: Uni-directional digital reference. The drive can be controlled in the forward direction only using a digital reference (via internal or remote Keypad or terminals) • **2**: Bi-directional digital reference. The drive can be controlled in the forward and reverse directions using a digital reference (via internal or remote Keypad or terminals). Pressing the keypad START button toggles between forward and reverse. • **3**: PID controller. The output frequency will be controlled by the internal PID controller • **4**: Fieldbus Control. Control via Modbus RTU if no fieldbus option is present, otherwise control from the fieldbus option module • **5**: Slave Mode. The Variable Frequency Drive acts as a slave to a connected drive operating in Master Mode. • **6**: CANopen Control. Control via the CANopen bus connected to the RJ45 serial interface connector. • **7**: Reserved • **8**: Reserved • **9**: SmartWire Device Control and speed ref. • **10**: SmartWire Device Control and terminal speed ref. • **11**: Terminal Control and SmartWire Device speed ref. • **12**: not permissible • **13**: SmartWire Device Control and speed ref. Digital input sets enable.	0
P5-01	501	✓	rw	Variable frequency drive slave address	0 - 63	The drive's unique address on a communication network	1
P5-03	503	✓	rw	Modbus RTU Baud rate	0, 1, …, 4	RS485 Baudrate Possible values: • **0**: 9.6 kBit/s • **1**: 19.2 kBit/s • **2**: 38.4 kBit/s • **3**: 57.6 kBit/s • **4**: 115.2 kBit/s	4
P5-04	504	✓	rw	Modbus RTU data format – Parity type	0, 1, 2, 3	RS485 0 Parity Type Possible values: • **0**: No parity, 1 stop bit (N-1) • **1**: No parity, 2 stop bits (N-2) • **2**: Odd parity, 1 stop bit (0-1) • **3**: Even parity, 1 stop bit (E-1)	n-1

Display	ID	Access right		Designation	Value range	Description	DS
		RUN	ro/rw				
P5-05	505	✓	rw	Timeout – Communications dropout		Timeout With an active communication link, if a valid telegram is not received by the drive within the period set with this parameter, the drive will react as set in P5-06.	2
P5-06	506	✓	rw	Response in the event of a communications dropout	0, 1, 2, 3	Modbus communication loss error Possible values: • **0**: Switch off • **1**: Ramps down to a full stop and is switched off. • **2**: Ramps down to a full stop; no fault message. • **3**: Ramps to fixed frequency 8 (P2-08).	0
P5-07	507	✓	rw	Ramp via fieldbus	0, 1	Fieldbus Ramp Control Possible values: • **0**: OFF. Ramps are controlled from internal drives parameters • **1**: ON. Ramps are controlled by the fieldbus.	0

2.4.2 Communication parameters for DC1 variable frequency drives

Table 2: Communication parameters for DC1

PNU	ID	Access right		Designation	Value range	Description	DS
		RUN	ro/rw				
P-12	140	–	rw	Local Process Data Source	0, 1, …, 11, 13	Local Configuration of Command and Reference Sources Possible values: • 0: Terminal Control. The drive responds directly to signals applied to the control terminals. • 1: Uni-directional Keypad Control. The drive can be controlled in the forward direction only using an internal/ external or remote Keypad • 2: Bi-directional Keypad Control. The drive can be controlled in the forward and reverse directions using an internal/external or remote Keypad. Pressing the keypad START button toggles between forward and reverse. • 3: Modbus Control.Control via Modbus RTU communication. • 4: Modbus Control. Ramp times via Modbus • 5: PI controller with external actual value • 6: PI controller with external actual value and totalized value of AI1 • 7: CANOpen (internal ramp times) • 8: CANOpen (CANOpen ramp times) • 9: SmartWire Device Control and speed ref. • 10: SmartWire Device Control and terminal speed ref. • 11: Terminal Control and SmartWire Device speed ref. • 12: not permissible • 13: SmartWire Device Control and speed ref. Digital input sets enable	0
P-36	164	–	rw	variable frequency drive slave address	1 - 63	Unique drive address in a communication network.	1
			rw	Baud Rate	2, 3, 4, 5, 6	RS485 Baudrate • 2: 9.6 kbit/s • 3: 19.2 kbit/s • 4: 38.4 kbit/s • 5: 57.6 kbit/s • 6: 115.2 kbit/s	2
			rw	Time Out	0, 1, …, 8	Modbus RTU0 COM Timeout Time between a communication loss and the resulting action. Setting 0 disables the action after communications trip. t: indicates the drive will trip if time exceeded. r: indicates the drive will ramp to stop if time exceeded. Possible values: • 0: no action • 1: t 30 ms • 2: t 100 ms • 3: t 1000 ms • 4: t 3000 ms • 5: r 30 ms • 6: r 100 ms • 7: r 1000 ms • 8: r 3000 ms	3000 ms

2.4.3 Communication parameters for DE1 variable speed starters

Table 3: Communication parameters for DE1

PNU	ID	Access right		Designation	Value range	Description	DS
		RUN	ro/rw				
P-12	140	RUN	rw	Local Process Data Source	0, 1, 2, 3, 4, 9, 10, 11, 13	Local Configuration of Command and Reference Sources • 0: Terminal Control. The drive responds directly to signals applied to the control terminals. • 1: Uni-directional Keypad Control. The drive can be controlled in the forward direction only using an internal/external or remote Keypad • 2: Bi-directional Keypad Control. The drive can be controlled in the forward and reverse directions using an internal/ external or remote Keypad. Pressing the keypad START button toggles between forward and reverse. • 3: Modbus Control.Control via Modbus RTU communication. • 4: CANOpen • 9: SmartWire Device Control and speed ref. • 10: SmartWire Device Control and terminal speed ref. • 11: Terminal Control and SmartWire Device speed ref. • 12: not permissible • 13: SmartWire Device Control and speed ref. Digital input sets enable	0
P-34	162	RUN	rw	PDP-Address	1 - 63	PDP-Address Unique drive address in a communication network.	1
P-35	163	RUN	rw	Modbus Baud rate	0, 1, …, 4	Modbus Baud rate 0: 960 Bit/s 1: 19.2 kbit/s 2: 38.4 kbit/s 3: 57.6 kbit/s 4: 115.2 kbit/s	4
P-36	164	RUN	rw	Modbus RTU0 COM timeout		Modbus RTU0 COM Timeout Time between a communication loss and the resulting action. Setting 0 disables the action after communications trip. t: indicates the drive will trip if time exceeded. r: indicates the drive will ramp to stop if time exceeded. • 0: no action • 1: t 30 ms • 2: t 100 ms • 3: t 1000 ms • 4: t 3000 ms • 5: r 30 ms • 6: r 100 ms • 7: r 1000 ms • 8: r 3000 ms	0

2.5 Configuration of the control signal terminals

The following control signal terminal configuration tables use the abbreviations and acronyms listed below:

Table 4: Abbreviations and acronyms for control signal terminals

Abbreviation	Significance
AI1 REF	Analog input AI1 Used as a speed setpoint input.
AI2 REF	Analog input AI2 Used as a speed setpoint input.
AI2 Torque REF	Analog input AI2 Used as a torque setpoint input.
DIR	Used to select an operating direction Used together with the START command. • Low = Forward (FWD) • High = Anticlockwise operation (REV) **Note:** If there is a wire breakage and the REV operating direction is selected, this will cause the drive to reverse! Alternative: Use configuration with FWD/REV.
DOWN	Used to reduce the speed if a digital setpoint value is selected. Used together with the UP command.
ENA	Variable frequency drive enable signal (ENA = Enable) A start signal (START, FWD, REV) is additionally required for starting. If ENA is removed, the drive will coast.
EXTFLT	Ext Fault/Warning
FWD	Used to start the drive in the forward direction (FWD = Forward)
INV	Change of rotation (INV = Inverse) The operating direction will be reversed as per the configured ramps. • High = invert • Low = Do not reverse
Pulse FWD (NO) Pulse REV (NO) Pulse STOP (NC)	Pulse control
REV	Used to start the drive in the reverse direction (REV = Reverse)
Select Quick-Dec	Quick Stop
Select AI1 REF/AI2 REF	Used to select between the analog setpoint values on AI1 and AI2 • AI1 = Low • AI2 = High
Select AI1 REF/f-Fix	Used to select between analog speed reference values at analog input 1
Select AI1 REF/f-Fix1	Used to select between analog speed reference values at analog input 1
Select BUS REF/AI2 REF	Used to select between setpoint values
Select BUS REF/f-Fix	Used to select between setpoint values
Select BUS REF/f-Fix1	Used to select between setpoint values
Select DIG REF/AI2 REF	Used to select between the digital speed reference value (set with the keypad or with the UP and DOWN commands) and analog setpoint value AI2 REF
Select DIG REF/f-Fix	**DA1 only** Used to select between the digital speed reference value (set with the keypad or with the UP and DOWN commands) and a fixed frequency

<table>
<tr><th>Abbreviation</th><th>Significance</th></tr>
<tr><td>Select DIG REF/f-Fix1</td><td>DA1 only
Used to select between the digital speed reference value (set with the keypad or with the UP and DOWN commands) and fixed frequency 1 (f-Fix1) set with P2-01
• Low = digital setpoint value
• High = Preset Speed 1</td></tr>
<tr><td>Select f-Fix Bit0
Select f-Fix Bit1
Select f-Fix Bit2</td><td>Used to select a fixed frequency with digital commands
Fixed frequencies f-Fix1, …, f-Fix8 are defined with parameters P2-01, …, P2-08.
<table><tr><th>Fixed</th><th>Bit 2</th><th>Bit 1</th><th>Bit 0</th></tr><tr><td>f-Fix1 (P2-01)</td><td>0</td><td>0</td><td>0</td></tr><tr><td>f-Fix2 (P2-02)</td><td>0</td><td>0</td><td>1</td></tr><tr><td>f-Fix3 (P2-03)</td><td>0</td><td>1</td><td>0</td></tr><tr><td>f-Fix4 (P2-04)</td><td>0</td><td>1</td><td>1</td></tr><tr><td>f-Fix5 (P2-05)</td><td>1</td><td>0</td><td>0</td></tr><tr><td>f-Fix6 (P2-06)</td><td>1</td><td>0</td><td>1</td></tr><tr><td>f-Fix7 (P2-07)</td><td>1</td><td>1</td><td>0</td></tr><tr><td>f-Fix8 (P2-08)</td><td>1</td><td>1</td><td>1</td></tr></table>
0 = Low; 1 = High</td></tr>
<tr><td>Select PID REF/AI2 REF</td><td>DA1 only
Used to select between setpoint values
• Low = Setpoint from the PID controller's output
• High = AI2</td></tr>
<tr><td>Select PID REF/f-Fix</td><td>DA1 only
Used to select between setpoint values
• Low = Setpoint from the PID controller's output
• High = Fixed frequency
The fixed frequency itself is selected with the
Select f-Fix Bit0, Select f-Fix Bit1, Select f-Fix Bit2 commands.</td></tr>
<tr><td>Select PID REF/f-Fix1</td><td>DA1 only
Used to select between setpoint values
• Low = Setpoint from the PID controller's output
• High = f-Fix1 (set with P2-01)</td></tr>
<tr><td>Select Quick-dec</td><td>DA1 only
Used to activate a quick stop with the ramp set with P2-25
In order to activate the quick stop, there must be a high signal at both terminals</td></tr>
<tr><td>Select t-dec1/
Select t-dec2</td><td>DA1 only
Used to select between deceleration ramp 1 t-dec1 set with P1-04 and deceleration ramp 2 t-dec2 (P8-11)
• Low = Deceleration ramp 1
• High = Deceleration ramp 2</td></tr>
<tr><td>START</td><td>Used to start/stop the drive</td></tr>
<tr><td>UP</td><td>Used to increase the speed if a digital setpoint is selected
Used together with the DOWN command.</td></tr>
</table>

2.5.1 Control signal terminal configuration for DA1 variable frequency drives

The control signal terminal configuration can be selected using parameter P1-13, i.e., setting P1-13 to a value within a range of 1 to 21 will activate the corresponding predefined terminal configuration. The setting (digital/analog) for terminals 6 and 10 will be set automatically based on the configuration selected with parameter P1-13. In addition to these predefined configurations, it is also possible to configure the terminals freely, in which case P1-13 must be set to a value of 0. The actual configuration can then be set up using menu 9.

P1-12 = 4: Control via fieldbus

Table 5: Control signal terminal configuration for DA1

P1-13	DI1 (terminal 2)	DI2 (terminal 3)	DI3 (terminal 4)	DI4/AI1 (terminal 6)	DI5/AI2 (terminal 10)
0	user-definable	user-definable	user-definable	user-definable	user-definable
1	START	INV	Select BUS REF/f-Fix	No function	Select f-Fix Bit0
2	Not permissible				
3	Not permissible				
4	START	INV	Select BUS REF/f-Fix1	No function	Select t-dec/t-dec2
5	START	INV	Select BUS REF/AI2 REF	No function	AI2 REF
6	START	INV	Select BUS REF/f-Fix1	No function	EXTFLT
7	Not allowed				
8	Not allowed				
9	START	INV	Select f-Fix Bit0	Select f-Fix Bit1	Select BUS REF/f-Fix
10	START	INV	No function	No function	Select BUS REF/f-Fix1
11	Select Quick-dec	Select Quick-dec	Select BUS REF/f-Fix	No function	Select f-Fix Bit0
12	Not permissible				
13	Not permissible				
14	Select Quick-dec	Select Quick-dec	Select BUS REF/f-Fix1	No function	Select t-dec/t-dec2
15	Select Quick-dec	Select Quick-dec	Select BUS REF/AI2 REF	No function	AI2 REF
16	Select Quick-dec	Select Quick-dec	Select BUS REF/f-Fix1	No function	EXTFLT
17	Not permissible				
18	Not permissible				
19	Select Quick-dec	Select Quick-dec	Select f-Fix Bit0	Select f-Fix Bit1	Select BUS REF/f-Fix
20	Select Quick-dec	Select Quick-dec	No function	No function	Select BUS REF/f-Fix1
21	Not permissible				

2.5.2 Control signal terminal configuration for DC1 variable frequency drives

P-12 = 3, 4: Control via fieldbus

Table 6: Control signal terminal configuration for DC1

P-15	DI1 (terminal 2)	DI2 (terminal 3)	DI3/AI2 (terminal 4)	DI4/AI1 (terminal 6)
0	START	No function	No function	No function
1	Not permissible			
2	Not permissible			
3	START	Select BUS REF/f-Fix1	EXTFLT	No function
4	Not permissible			
5	Not permissible			
6	START	Select BUS REF/AI1 REF	EXTFLT	AI1 REF
7	START	Select BUS REF/DIG REF	EXTFLT	No function
8	Not permissible			
9	Not permissible			
10	Not permissible			
11	Not permissible			
12	Not permissible			
13	START	No function	EXTFLT	No function

2.5.3 Control signal terminal configuration for DC1…E1 variable frequency drives

P-12 = 3, 4: Control via Modbus

Table 7: Control signal terminal configuration for DC1…E1

P-15	DI1 (terminal 2)	DI2 (terminal 3)	DI3/AI2 (terminal 4)	DI4/AI1 (terminal 6)
0	START	No function	No function	No function
1	Not permissible			
2	Not permissible			
3	START	Select BUS REF/f-Fix1	EXTFLT	No function
4	Not permissible			
5	Not permissible			
6	START	Select BUS REF/AI1 REF	EXTFLT	AI1 REF
7	START	Select BUS REF/DIG REF	EXTFLT	No function
8	Not permissible			
9	Not permissible			
10	Not permissible			
11	Not permissible			
12	Not permissible			
13	START	No function	EXTFLT	No function
14	Not permissible			
15	FWD	Select f-Fix/BUS REF	Select Fire Mode/Normal OP	Select f-Fix4/f-Fix2
16	FWD	Select f-Fix4/BUS REF	Select Fire Mode/Normal OP	ohne Funktion
17	FWD	Select BUS REF/f-Fix4	Select Fire Mode/Normal OP	ohne Funktion

2.5.4 Control signal terminal configuration for DE1 variable speed starters

P-12 = 3

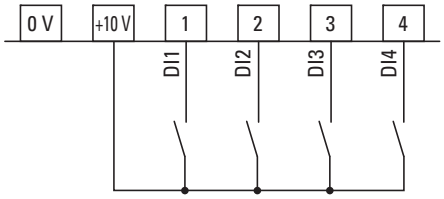


Figure 6: Digital control when P-12 = 3 (example)

Table 8: Control signal terminal configuration for DE1

P-15	DI1	DI2	DI3	DI4
0[1)]	ENA	ENADIR	FF1	n. F.
1	ENA	ENADIR	EXTFLT	n. F.
2[2)]	ENA	ENADIR	FF2[0]	FF2[1]
3[3)]	ENA	FF1	EXTFLT	n. F.
4[2)]	ENA	**UP**	FF1	**DOWN**
5[2)]	ENA	**UP**	EXTFLT	**DOWN**
6[2)]	ENA	ENADIR	**UP**	**DOWN**
7[2)]	ENA	FF2[0]	EXTFLT	FF2[1]
8[1)]	ENA	DIR	FF1	n. F.
9	ENA	DIR	EXTFLT	n. F.

1) Setpoint values sent via Modbus will be ignored if DI3 is active.
2) P-15 = 4, 5, and 6 requires an enable signal (start command) via Modbus and at DI1. Digital reference values sent via Modbus will be ignored in this case. It will only be possible to use UP and DOWN to set a setpoint value.
3) Setpoint values sent via Modbus will be ignored if DI2 is active.

n.F. = No function. When configured this way, the control terminals “n.F.” will have no function whatsoever!

→ If Modbus RTU is being used, there must always be an enable signal (ENA) present at DI1 control signal terminal (or DI2 = ENADIR) before the enable signal sent via Modbus RTU will be accepted, → Figure 5, page 12.

The activated operating direction will depend on the digital input being driven (DI1, DI2) and on the value in command ID1, bit 1.

Table 9: Operating direction based on digital inputs DI1 and DI2

DI1 (ENA)	DI2 (ENADIR)	Modbus RTU command (ID1)		Direction of rotating field (Motor)
H = FWD	L	Bit0 = 1	Bit1 = 0 (FWD) →	FWD (right)
L	H = REV	Bit0 = 1	Bit1 = 0 (FWD) →	REV (left)
H = FWD	L	Bit0 = 1	Bit1 = 1 (REV) →	REV (left)
L	H = REV	Bit0 = 1	Bit1 = 1 (REV) →	FWD (right)

Analog setpoint values for the DE1 device via control signal terminal 4 (AI1) will be disabled. In addition to setpoint values set via Modbus RTU, it will also be possible to set setpoint values directly with the control signal terminals:

- Fixed frequencies (FF1 to FF4), coded in binary with $FF2^0$ and $FF2^1$
- Digitally setting the setpoint value with the UP and DOWN commands (P-15 = 4, 5, 6).

→ If P-13 = 2, 4, 5, 6, 7: Setting the setpoint value with the control signal terminals will disable setting setpoint values via Modbus RTU.

In addition to fixed frequency FF1, which can be activated directly, fixed frequencies (FF1 to FF4) can be selected by using the binary-coded $FF2^0$ and $FF2^1$ inputs.

Table 10: Fixed frequencies

Fixed frequency	$FF2^0$	$FF2^1$	f_2 (DS)	PNU
FF1	L	L	20 hz	P-20
FF2	H	L	30 hz	P-21
FF3	L	H	40 hz	P-22
FF4	H	H	50 Hz	P-23

f_2: DE1 variable speed starter output frequency
Default setting values (DS) with the corresponding parameter numbers (PNUs).

2.6 Operating mode Modbus RTU

The Modbus RTU (Remote Terminal Unit) operating mode transmits data in binary format (higher data throughput) and defines the transfer format for data requests and data responses. Each message byte that is sent contains two hexadecimal characters (0 - 9, A - F).

Data is transmitted between a master (PLC) and the variable frequency drive/ variable speed starter as illustrated in the following diagram:

- Master request: the master sends a Modbus frame to the variable frequency drive/variable speed starter.
- Slave response: The variable frequency drive/variable speed starter sends a protocol frame (Modbus frame) as a response to the master.

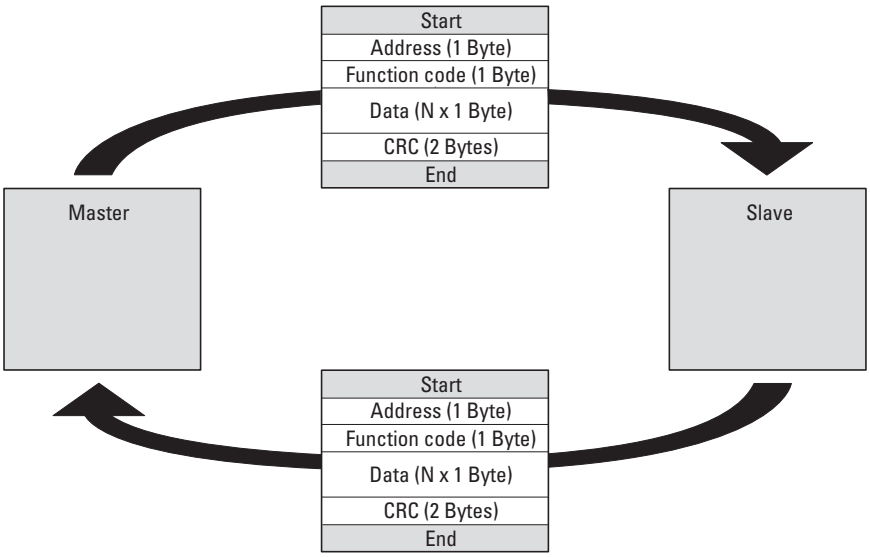


Figure 7: Data exchange between master and slave

The variable frequency drive/variable speed starter (slave) only sends a response if it has received a request from the master beforehand.

2.6.1 Structure of the master request

2.6.1.1 Address

- Parameter **P5-01** (DA1), **P-36** (DC1), or **P-34** (DE1) is used to enter the address (1 to 63) of the variable frequency drive/variable speed starter to which the request is being sent. Only the variable frequency drive/ variable speed starter with this address will be able to respond to the request.
- Address 0 is used for what is referred to as broadcasts (message to all bus nodes) from the master. In this mode, individual nodes cannot be addressed and data cannot be output by the slaves.

2.6.1.2 Function Code

The function code defines the type of message.

The following actions can be performed:

Function code [hex]	Designation	Description
03	Read Holding Registers	Used to read the holding registers (process data, parameters, configuration) in the slave. A master request enables up to 11 registers to be read.
06	Write Single Register	Writing of a holding register in the slave. With a general telegram (Broadcast) the appropriate holding registers are written in all slaves. The register is read back for comparison.

2.6.1.3 Data

The length of the data block (data: N x 1 bytes) depends on the function code. The function code is made up of two hexadecimal values and has a range of 00 to FF. The data block contains additional information for the slave that will enable the latter to perform the operation specified by the master in the function code (this information may specify the parameters that need to be processed, for example).

2.6.1.4 Cyclic redundancy check (CRC)

Frames in the Modbus RTU operating mode include a cyclic redundancy check (CRC). The CRC field is made up of two bytes that contain a binary 16-bit value. The CRC is always performed independently of the parity check for the frame's individual values. The CRC result is appended to the frame by the master. While receiving the frame, the slave performs a new calculation and compares the calculated value to the actual value in the CRC field. If both values are not identical, an error is set.

2.6.2 Structure of the slave response

2.6.2.1 Required transfer time

- The time between the moment a request is received from the master and the variable frequency drive's/variable speed starter's response is at least 3.5 characters (rest time).
- Once the master has received a response from the variable frequency drive/variable speed starter, it must wait for at least the rest time before it can send a new request.

2.6.2.2 Normal slave response

- If the master request contains a write-register function (function code 06), the variable frequency drive/variable speed starter immediately returns the request as a response.
- If the master request contains a read-register function (function code 03), the variable frequency drive/variable speed starter returns the read data with the slave address and the function code as a response.

2.6.2.3 No slave response

In the following cases, the variable frequency drive/variable speed starter ignores the request and does not send a reply:

- on receiving a broadcast request.
- if the request contains a transmission error.
- If the slave address in the request does not match the variable frequency drive's/variable speed starter's address.
- With a CRC or parity error.
- If the time interval between the messages is less than 3.5 characters.

→ The master must be programmed to repeat the request if it does not receive a response within a specified time.

2.6.3 Modbus: Register mapping

Register mapping makes it possible to process, in the variable frequency drive/variable speed starter, the contents in the following table using Modbus RTU.

DA1

Group	Register
parameter	101 - 941
Input process data	1 - 4
Output process data	6 - 43

DC1

Group	Register
parameter	129 - 197
Input process data	1, 2, 4
Output process data	6 - 24

DE1

Group	Register
parameter	129 - 169
Input process data	1 - 2
Output process data	6 - 24

The interface driver in certain controllers (e.g. PLCs) may have an offset of +1 for Modbus RTU communications

The decimal point is not taken into account when processing values!
For example, if the motor current (Register 8) shown on the DA1 variable frequency drive's display is 0.3 A, it will be transmitted as 003_{dec} via Modbus.

2.6.4 Input process data

Input process data is used to control the variable frequency drive/variable speed starter.

ID	Designation	Scaling Factor	Unit
1	Fieldbus command	–	Binary code
2	Fieldbus speed reference value	0.1	Hz
3	Torque reference (**DA1 only**)	0.1	%
4	Modbus ramp time (**DA1, DC1 only**)	0.01	s

2.6.4.1 Command (ID 1)

These bits are used to control the variable frequency drive/variable speed starter. The content can be adapted to your own application and then sent as a control word to the variable frequency drive.

Bit	Description	
	Value = 0	**Value = 1**
0	Stop	Operational
1	Clockwise rotating field (FWD)	Anticlockwise rotating field (REV)
2	No action	Reset Fault
3	No action	Coast to stop
4	Not used	
5	No action	Quick stop (ramp 2)
6	No action	Fixed frequency FF1
7	No action	Overwrite setpoint value with 0
8	Not used	
9	Not used	
10	Not used	
11	Not used	
12	Not used	
13	Not used	
14	Not used	
15	Not used	

2.6.4.2 Speed reference value (ID 2)

The permissible values fall within a range of

- P1-02 (minimum frequency) to P1-01 (maximum frequency) for **DA1**
- P-02 (minimum frequency) to P-01(maximum frequency) for **DC1**
- P-02 (minimum frequency) to P-01(maximum frequency) for **DE1**

In the application, the values will be scaled by a factor of 0.1.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MSB															LSB

2.6.4.3 Torque reference input (ID 3 – DA1 only)

The permissible values fall within a range of 0 - 2000.

In the application, the values will be scaled by a factor of 0.1, i. e. 1000 ≙ 100 %.

2.6.4.4 Modbus ramp times (ID 4 – DA1 annd DC1 only)

The permissible values fall within a range of 0 - 60000.

In the application, the values will be scaled by a factor of 0.01, i. e. 300 ≙ 3 s.

2.6.5 Output process data

Output process data is used to control the variable frequency drive/variable speed starter.

ID	Bezeichnung	Skalierungsfaktor	Einheit/Format
6	Status and fault word	–	Binärcode
7	Actual speed	0,1	Hz
8	Motor current	0,1	A
9	Torque (**DA1, DC1…E1 only**)	0,1	%
10	Output power (**DA1, DC1…E1 only**)	1	kW bzw. HP
11	Digital inputs	–	Binärcode
12	Type	–	WORD
13	Power	1	kW bzw. HP
14	Voltage range	1	V
15	Control section software version	–	WORD
16	Power section software version	–	WORD
17	Variable frequency drive recognition	–	WORD

2.6.5.1 Status and fault word (ID 6)

Device status and fault message information is provided in the status word (bit 0 to bit 7) and fault word (bit 8 to bit 15).

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MSB															LSB
Fault word								status word							

Status word

Bit	Description	
	Value = 0	**Value = 1**
0	Drive not ready	Ready for operation (READY)
1	Stop	Running operation message (RUN)
2	Clockwise rotating field (FWD)	Anticlockwise rotating field (REV)
3	no error	Fault detected (FAULT)
4	Acceleration ramp	Frequency actual value equals setpoint input
5	–	Zero speed
6	Speed control deactivated	Speed control activated
7	**DA1 only:** Inhibit → STO STATUS **DC1, DE1:** Hardware release: no	**DA1 only:** Ready → STO **DC1, DE1:** Hardware release: yes

Fault word

Table 11: Fault messages

Error no. dec	Error no. hex	Device series	Message (display on DA1, DC1)	Possible cause
		DA1, DC1, DE1	StoP	The enable signal for the drive is not active (this is not an error message).
00	00	DA1, DC1, DE1	no-Flt	Shown for P0-13 if there are no messages in the error register.
01	01	DA1, DC1, DE1	OI -b	Excessively high braking current
02	02	DA1, DC1, DE1	OL-br	Thermal overload on braking resistor.
03	03	DA1, DC1, DE1	O-I	Overcurrent at variable frequency drive output
04	04	DA1, DC1, DE1	I.t-trP	Motor overload.
05	05	DA1, DC1, DE1	PS-trP	Overcurrent (Hardware)
06	06	DA1, DC1, DE1	OUolt	Overvoltage in DC link
07	07	DA1, DC1, DE1	UUolt	Undervoltage in DC link.
08	08	DA1, DC1, DE1	O-t	Overtemperature at heat sink.
09	09	DA1, DC1, DE1	U-t	Under-temperature
10	0A	DA1, DC1, DE1	P-dEF	The parameters' default settings have been loaded.
11	0B	DA1, DC1, DE1	E-tr iP	Ext Fault/Warning
12	0C	DA1, DC1, DE1	SC-Obs	Communication error with an external operating unit or with a PC
13	0D	DA1, DC1, DE1	FI 7-dc	Excessively high DC link voltage ripple
14	0E	DA1, DC1, DE1	P-LOSS	Incoming power phase failure (only for devices with a three-phase power supply)
15	0F	DA1, DE1	h O-I	Overcurrent at output
16	0A	DA1, DC1, DE1	7h-Flt	Malfunctioning heat sink thermistor.
17	11	DA1, DC1, DE1	dAtA-F	Error in internal memory
18	12	DA1, DC1, DE1	4-20 F	The analog input's input current does not fall within the specified range.
19	12	DA1, DC1…E1	dAtA-E	Error in internal memory
20	14	DA1	U-dEF	The customer's settings for the parameters have been imported.
21	15	DA1, DC1…E1	F-Ptc	Motor PTC thermistor overtemperature
22	16	DA1, DC1…E1	FAn-F	The device's internal fan is experiencing a fault
23	17	DA1, DC1…E1	O-hEAt	The measured ambient temperature exceeds the specified value.
24	18	DA1	O-torO	Maximum permissible torque exceeded.
25	19	DA1	U-torO	Only active if brake control is enabled in hoisting gear mode (P2-18 = 8). The torque produced before the hoisting gear's mechanical brake is enabled falls below the set threshold.
26	1A	DA1, DC1…E1	OUt-F	Device output fault
29	1D	DA1	Sto-F	Internal STO circuit fault
30	1E	DA1	Enc-01	No communication between the encoder module and the variable frequency drive
31	1F	DA1	Enc-02 SP-Err	The calculated motor speed is different from the measured motor speed
32	20	DA1	Enc-03	The motor speed and the PPR value entered in P6-06 do not match
33	21	DA1	Enc-04	Channel A fault

Error no.		Device series	Message (display on DA1, DC1)	Possible cause
dec	hex			
34	22	DA1	Enc-05	Channel B fault
35	23	DA1	Enc-06	Error on channels A and B
40	28	DA1, DC1…E1	AtF-01	Motor identification failed
41	29	DA1, DC1…E1	AtF-02	Motor identification failed: The measured stator resistance is too large.
42	2A	DA1, DC1…E1	AtF-03	Motor identification failed: The measured motor inductance is too low.
43	2B	DA1, DC1…E1	AtF-04	Motor identification failed: The measured motor inductance is too high.
44	2C	DA1, DC1…E1	AtF-05	Motor identification failed: The measured motor parameters do not match.
49	31	DA1, DC1…E1	OuT-Ph	A phase in the motor cable is not connected or has a discontinuity.
50	32	DA1, DC1…E1	Sc-F01	No valid Modbus frame was received within the time specified
51	33	DA1, DC1…E1	Sc-F02	No valid CANopen frame was received within the time specified
52	34	DA1	Sc-F03	Communications between the device and the plugged-in fieldbus option have dropped out.
53	35	DA1	Sc-F04	Communications between the device and the plugged-in I/O expansion have dropped out.
60	3C	DA1	OF-01	No internal connection to an optional card
61	3D	DA1	OF-02	Optional module in abnormal state
70	46	DA1	PLC-01	Non-supported function block from function block editor
71	47	DA1	PLC-02	Program from function block editor is too big
72	48	DA1	PLC-03	Division by zero
73	49	DA1	PLC-04	Lower limit is higher than upper limit
74	4A	DA1	PLC-05	Overflow table Function block editor

2.6.5.2 Actual speed (ID 7)

The variable frequency drive's actual speed falls within a value range of

- P1-02 (minimum frequency) to P1-01 (maximum frequency) for **DA1**
- P-02 (minimum frequency) to P-01(maximum frequency) for **DC1**
- P-02 (minimum frequency) to P-01(maximum frequency) for **DE1**

In the application, the values will be scaled by a factor of 0.1.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MSB															LSB

2.6.5.3 Current (ID 8)

The current is specified with one decimal place.

Example: 34 ≙ 3.4 A.

2.6.5.4 Torque (ID 9)

The motor torque is specified with one decimal place.

Example: 1000 ≙ 100.0 %

2.6.5.5 Output power (ID 10)

The output power is specified in kW with one decimal place.

Example: 53 ≙ 5.3 kW

2.6.5.6 Digital inputs (ID 11)

This value indicates the digital inputs' state.
The lowest bit indicates the state of DI1.

2.6.5.7 Type (ID 12)

This value indicates the variable frequency drive's/variable speed starter's part no.

DA1

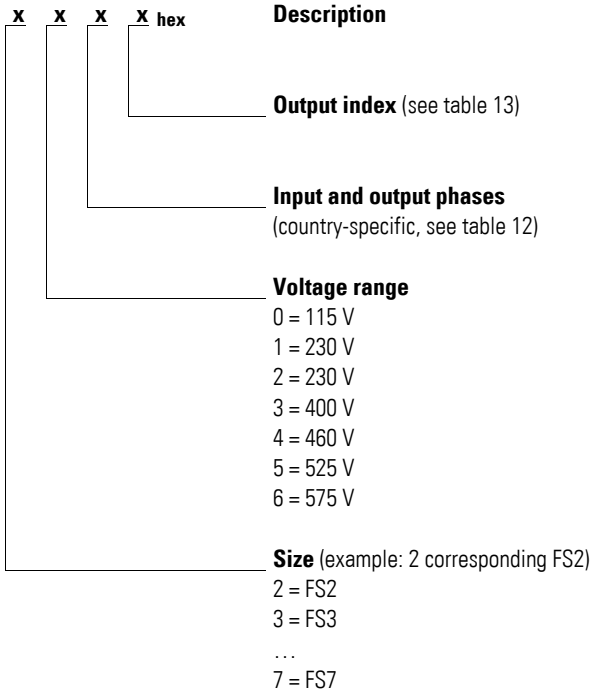


Table 12: Input and output phases

Value	Country-specific default settings	Number of phases on mains side	Number of phases on motor side
0	kW	3	3
1	HP	3	3
2	kW	3	1
3	HP	3	1
4	kW	1	3
5	HP	1	3
6	kW	1	1
7	HP	1	1

Table 13: Assigned ratings

Frame size	Power Index	0	1	2	3	4	5	6	7
FS2	kW	0.75	1.5	2.2	0.75	1.5	2.2	4	–
	HP	1	2	3	1	2	3	5	–
FS3	kW	3	4	5.5	5.5	7.5	11	–	–
	HP	4	5	7.5	7.5	10	15	–	–
FS4	kW	7.5	11	15	18.5	22	–	–	–
	HP	10	15	20	25	30	–	–	–
FS5	kW	15	18.5	22	30	37	45	–	–
	HP	20	25	30	40	50	60	–	–
FS6	kW	22	30	37	45	45	55	75	90
	HP	30	40	50	60	60	75	12	15
FS7	kW	55	75	90	110	132	160	–	–
	HP	75	100	125	175	200	250	–	–

DC1

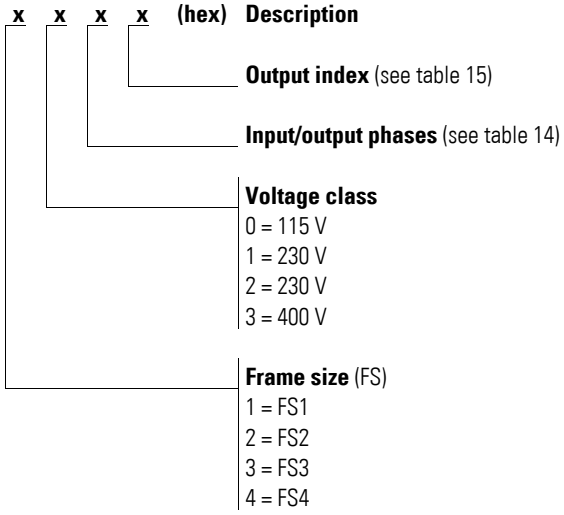


Table 14: Input and output phases

Value	Country-specific default settings	Number of phases on mains side	Number of phases on motor side
0	kW	3	3
1	HP	3	3
2	kW	3	1
3	HP	3	1
4	kW	1	3
5	HP	1	3
6	kW	1	1
7	HP	1	1

Table 15: Assigned ratings

Frame size	Power Index	0	1	2	3	4	5	6	7	8
FS1	kW	0.37	0.75	0.37	0.75	1.5	0.75	1.5	–	–
	HP	0.5	1	0.5	1	2	1	2	–	–
FS2	kW	1.1	0.75	1.5	2.2	0.75	1.5	2.2	4	3
	HP	1.5	1	2	3	1	2	3	5	4
FS3	kW	4	5.5	7.5	11	4	3	5.5	–	–
	HP	5	7.5	10	15	5	4	7.5	–	–
FS4	kW	5.5	7.5	11	11	15	18.5	22	–	–
	HP	7.5	10	15	15	20	25	30	–	–

DE1

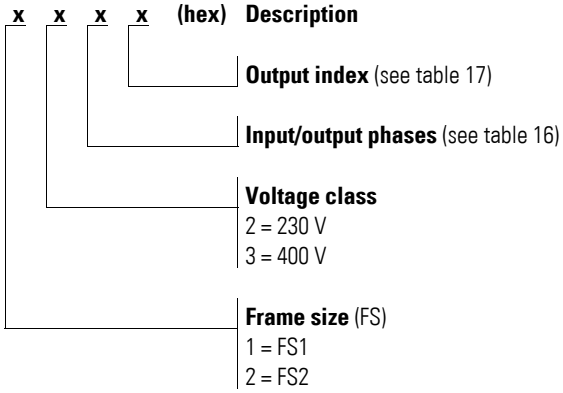


Table 16: Input and output phases

Value	Country-specific default settings	Number of phases on mains side	Number of phases on motor side
0	kW	3	3
1	HP	3	3
2	kW	3	1
3	HP	3	1
4	kW	1	3
5	HP	1	3
6	kW	1	1
7	HP	1	1

Table 17: Assigned ratings

Frame size	Power Index	0	1	2	3	4	5	6	7
FS1	kW	0.25	0.37	0.55	0.75	1.5	3.7	7.5	1.5
	HP	0.3	0.5	0.7	1	2	5	10	2
FS2	kW	2.2	2.2	3.0	4.0	5.5	7.5	–	–
	HP	3	3	4	5	7.5	10		

2.6.5.8 Control section software version (ID 15)

Specifies the software version of the control section with two decimal places.

2.6.5.9 Power section software version (ID 16)

Specifies the software version of the power section with two decimal places.

2.6.5.10 Variable frequency drive recognition/variable speed starter recognition (ID 17)

DA1: 5632

DC1: 10

DE1: 8

DE11: 9

2.6.5.11 Serial Number (ID 25, ID 26, ID 27, ID 28)

The device's unique serial number in the case of DA1 variable frequency drives.

Not available on DC1 variable frequency drives and DE1 variable speed starters.

2.6.6 Explanation of function code

2.6.6.1 Function code 03_{hex}: Reading a holding register

This function reads the content of a number of consecutive holding registers (specified register addresses).

Example:

Reading the status and fault word (ID 6) of the DA1 variable frequency drive with slave address 1.

Master request: 01 03 0005 0001 $940B_{hex}$

Rregister address [hex]	**Type name**
01	Slave address
03	Function code (reading of holding registers)
0005	5_{dec}: The ID is 6, since the motor controller has an offset of +1.
0001	Total number of requested registers
940B	CRC

Slave response: 01 03 02 0000 $B844_{hex}$

Rregister address [hex]	**Type name**
01	Slave address
03	Function code (reading of holding registers)
02	Number of consecutive data bytes (1 register = 2 byte)
0000	Content (2 byte) for register 6: 0
B844	CRC

2.6.6.2 Function code 06_{hex}: Writing a holding register

This function writes data to a holding register.

Example

Writing of the control word (ID 1) of a DA1 variable frequency drive with the slave address 1.

Master request: 01 06 0000 0001 $480A_{hex}$

Rregister address [hex]	Type name
01	Slave address
06	Function code (writing a holding register)
0000	0: The ID of the register for the writing operation is 1, since the master controller has an offset of +1.
0001	Content (2 byte) for register 0000 0000 0000 001_{bin} → RUN
480A	CRC

Slave response: 01 06 0000 0001 480_{hex}

The slave response is a copy of the master request if it is a normal response.

Rregister address [hex]	Type name
01	Slave address
06	Function code (here: writing a holding register)
0000	1: The ID of the register for the writing operation is 1, since the master controller has an offset of +1.
0001	Content (2 byte) for register 0000 0000 0000 001_{bin} → RUN
480A	CRC

→ Function code 06_{hex} can be used for a broadcast.

3 Parameter

3.1 Parameters for DA1 variable frequency drives

Table 18: Parameters for DA1 variable frequency drives

Modbus register	Para-meter	Parameter name	Access		Scaling	Value range	Data format
			rw/ro	RUN/ STOP			
20	P0-01	Analog Input 1	ro	–	4096 ≙ 100.0 %		U16
21	P0-02	Analog Input 2	ro	–	4096 ≙ 100.0 %		U16
11	P0-03	DI status	ro	–	Bit 0 ≙ digital input 1 Bit 1 ≙ digital input 2 …		WORD
22	P0-04	f-PreRamp	ro	–			S16
41	P0-05	Torque Reference	ro	–	1000 ≙ 100.0 %		U16
42	P0-06	MotorPot Reference	ro	–			U16
9	P0-12	Motor Torque	ro	–	1000 ≙ 100.0 %		U16
23	P0-20	DC-Link Voltage	ro	–	600 ≙ 600 V		
24	P0-21	Heatsink Temperature	ro	–	40 ≙ 40 °C		
30	P0-26	kWh Meter	ro	–	100 ≙ 10.0 kWh		U16
33	P0-27	MWh Meter	ro	–			U16
15	P0-28	Application Version	ro	–			
16		Application Version	ro	–			
12	P0-29	Rating ID	ro	–		Bit 0, …, Bit 3: Power Index (Internal Reference)	WORD
				–		Bit 4, …, Bit 7: Power unit (kW/HP)	
				–		Bit 8, …, Bit 11: Input voltage index (voltage rating index)	
				–		Bit 12, …, Bit 15: Frame size	
17		Device Type	ro	–			WORD
25	P0-30	Serial Number	ro	–			
26			ro	–			
27			ro	–			
28			ro	–			
34	P0-31	t-Run	ro	–			U16
35	P0-31	t-min/sec	ro	–			U16
36	P0-34	t-HoursRun Enable	ro	–			U16

Modbus register	Para-meter	Parameter name	Access		Scaling	Value range	Data format
			rw/ro	RUN/ STOP			
101	P1-01	f-max	rw	RUN	3000 ≙ 50.0 Hz	P1-02 - (5 x P1-09) (max.: 500.0 Hz / 30000 rpm)	U16
102	P1-02	f-min	rw	RUN	3000 ≙ 50.0 Hz	0.0 Hz - P1-01	U16
103	P1-03	t-acc	rw	RUN	300 ≙ 30.0 s	0.00 s - 6000 s	U16
104	P1-04	t-dec	rw	RUN	300 ≙ 30.0 s	0.00 s - 6000 s	U16
105	P1-05	Stop Mode	rw	RUN	–	0, 1, 2, 3, 4	U16
106	P1-06	EnergyOptimizer	rw	RUN	–	0, 1	WORD
107	P1-07	Motor Nom Voltage	rw	STOP	230 ≙ 230 V	0 - U_e	U16
108	P1-08	Motor Nom Current	rw	STOP	1 ≙ 0.1 A	(0.1 - 1) x I_e	U16
109	P1-09	Motor Nom Frequency	rw	STOP	50 ≙ 50 Hz	10 Hz - 500 Hz	U16
110	P1-10	Motor Nom Speed	rw	RUN	1500 ≙ 1500 rpm	• 0 • 200 - 30000 rpm	U16
111	P1-11	V-Boost	rw	STOP	-1 ≙ Auto 0 ≙ Disabled 1 ≙ 0.1 %	• 0: Auto • 0 - 30.0 % of P1-07	S16
112	P1-12	Local ProcessData Source	rw	STOP	–	0 - 13	U16
113	P1-13	DI Config Select	rw	STOP	–	0 - 21	U16
114	P1-14	Password	rw	RUN	–	0 - 30000	U16
201	P2-01	f-Fix1	rw	RUN	3000 ≙ 50.0 Hz	P1-02 (min: 0 Hz / 0 rpm) - P1-01 (max: 500.0 Hz / 30000 rpm)	U16
202	P2-02	f-Fix2	rw	RUN	3000 ≙ 50.0 Hz	P1-02 (min: 0 Hz / 0 rpm) - P1-01 (max: 500.0 Hz / 30000 rpm)	U16
203	P2-03	f-Fix3	rw	RUN	3000 ≙ 50.0 Hz	P1-02 (min: 0 Hz / 0 rpm) - P1-01 (max: 500.0 Hz / 30000 rpm)	U16
204	P2-04	f-Fix4	rw	RUN	3000 ≙ 50.0 Hz	P1-02 (min: 0 Hz / 0 rpm) - P1-01 (max: 500.0 Hz / 30000 rpm)	U16
205	P2-05	f-Fix5	rw	RUN	3000 ≙ 50.0 Hz	P1-02 (min: 0 Hz / 0 rpm) - P1-01 (max: 500.0 Hz / 30000 rpm)	U16
206	P2-06	f-Fix6	rw	RUN	3000 ≙ 50.0 Hz	P1-02 (min: 0 Hz / 0 rpm) - P1-01 (max: 500.0 Hz / 30000 rpm)	U16
207	P2-07	f-Fix7	rw	RUN	3000 ≙ 50.0 Hz	P1-02 (min: 0 Hz / 0 rpm) - P1-01 (max: 500.0 Hz / 30000 rpm)	U16
208	P2-08	f-Fix8	rw	RUN	3000 ≙ 50.0 Hz	P1-02 (min: 0 Hz / 0 rpm) - P1-01 (max: 500.0 Hz / 30000 rpm)	U16

Modbus register	Parameter	Parameter name	Access		Scaling	Value range	Data format
			rw/ro	RUN/ STOP			
209	P2-09	f-Skip1	rw	RUN	3000 ≙ 50.0 Hz	P1-02 (min: 0 Hz / 0 rpm) - P1-01 (max: 500.0 Hz / 30000 rpm)	U16
210	P2-10	f-SkipBand1	rw	RUN	3000 ≙ 50.0 Hz	P1-02 (min: 0 Hz / 0 rpm) - P1-01 (max: 500.0 Hz / 30000 rpm)	U16
211	P2-11	ADO1 Function & Mode	rw	RUN	–	0, 1, …, 11	U16
212	P2-12	AO1 SignalFormat	rw	RUN	–	0, 1, …, 5	U16
213	P2-13	ADO2 Function & Mode	rw	RUN	–	0, 1, …, 11	U16
214	P2-14	AO2 SignalFormat	rw	RUN	–	0, 1, …, 5	U16
215	P2-15	RO1 Function	rw	RUN	1 ≙ 1	0, …, 7, 10, 11, 13	U16
216	P2-16	RO1 upper limit	rw	RUN	1 ≙ 0.1 %	P2-17 - 2000	U16
217	P2-17	RO1 lower limit	rw	RUN	1 ≙ 0.1 %	0.0 % - P2-16	U16
218	P2-18	RO2 Function	rw	RUN	1 ≙ 1	0, …, 7, 10, 11, 13	U16
219	P2-19	RO2 upper limit	rw	RUN	1 ≙ 0.1 %	P2-20 - 200 %	U16
220	P2-20	RO2 lower limit	rw	RUN	1 ≙ 0.1 %	0.0 % - P2-19	U16
221	P2-21	Display Scale	rw	RUN	1 ≙ 0.001	-30000 - +30000	U16
222	P2-22	Display Source	rw	RUN	–	0, 1, 2, 3	U16
223	P2-23	t-n=0 Wait	rw	RUN	1 ≙ 0.1	0.0 - 60.0 s	U16
224	P2-24	Switching Frequency	rw	RUN	–	0, 1, …, 5	U16
225	P2-25	t-QuickDec	rw	RUN	FS2, FS3: 1 ≙ 0.01 s FS4, …,FS7: 1 ≙ 0.1 s	0.00 - 240 s	U16
226	P2-26	Spin Start Enable	rw	RUN	1 ≙ 1	0, 1, 2	WORD
227	P2-27	Standby Mode	rw	RUN	1 ≙ 0.01	0.0 - 250 s	U16
228	P2-28	Slave SpeedScalingControl	rw	RUN	–	0, 1, 2, 3	U16
229	P2-29	Slave SpeedScalingFactor	rw	RUN	1 ≙ 0.1	-500.0 - +500.0 %	S16
230	P2-30	AI1 Signal Range	rw	RUN	–	0, 1, …, 7	U16
231	P2-31	AI1 Gain	rw	RUN	1 ≙ 0.1	0.0 - 2000.0 %	U16
232	P2-32	AI1 Offset	rw	RUN	1 ≙ 0.1	-500.0 - +500.0 %	S16
233	P2-33	AI2 Signal Range	rw	RUN	–	0, 1, …, 7	U16
234	P2-34	AI2 Gain	rw	RUN	1 ≙ 0.1	0.0 - 2000.0 %	U16
235	P2-35	AI2 Offset	rw	RUN	1 ≙ 0.1	-5000 - +5000	S16
236	P2-36	Start Mode	rw	RUN	–	0, 1, …, 6	U16
237	P2-37	Digital Reference Reset Mode	rw	RUN	–	0, 1, …, 7	U16
238	P2-38	Action@MainsLoss	rw	RUN	–	0, 1, 2, 3	U16
239	P2-39	Parameter Lock	rw	RUN	–	0, 1	WORD
240	P2-40	Password Level2	rw	RUN	–	0 - 9999	U16

Modbus register	Para-meter	Parameter name	Access		Scaling	Value range	Data format
			rw/ro	RUN/ STOP			
301	P3-01	PID1 Kp	rw	RUN	1 ≙ 0.1	1 - 300	U16
302	P3-02	PID1 Ti	rw	RUN	1 ≙ 0.1	0 - 300 s	U16
303	P3-03	PID1 Kd	rw	RUN	1 ≙ 0.01	0.00 - 100 s	U16
304	P3-04	PID1 Mode	rw	RUN	–	0, 1	WORD
305	P3-05	PID1 Set Point 1 Source	rw	RUN	1 ≙ 1	0, 1, 2	U16
306	P3-06	PID1 Set Point Digital	rw	RUN	1 ≙ 0.1 %	0 - 1000	U16
307	P3-07	PID1 Output upper Limit	rw	RUN	1 ≙ 0.1 %	P3-08 - 1000	U16
308	P3-08	PID1 Output lower Limit	rw	RUN	1 ≙ 0.1 %	0- P3-07	U16
309	P3-09	PID1 Output LimitSelect	rw	RUN	–	0, 1, 2, 3	U16
310	P3-10	PID 1 Feedback 1 Source	rw	RUN	–	0, 1	WORD
311	P3-11	PID1 Error Ramp	rw	RUN	1 ≙ 0.1 %	0 - 250	U16
312	P3-12	PID1 Feedback 1 DispScale	rw	RUN	0: disabled 1 ≙ 0.001	0.00 - 50.000	U16
313	P3-13	PID1 WakeUpLevel	rw	RUN	1 ≙ 0.1 %	0 - 1000	U16
314	P3-14	Reserved Parameter	-	-	–	–	
315	P3-15	Reserved Parameter	-	-	–	–	
316	P3-16	Reserved Parameter	-	-	–	–	
317	P3-17	Reserved Parameter	-	-	–	–	
318	P3-18	PID1 ResetControl	rw	RUN	1 ≙ 1	0, 1	U16
401	P4-01	Motor Control Mode	rw	STOP		0 - 6	U16
402	P4-02	Motor Identification	rw	STOP		0, 1	WORD
403	P4-03	MSC Kp	rw	RUN	1 ≙ 0.1 %	1 - 4000	U16
404	P4-04	MSC Ti	rw	RUN	1 ≙ 0.001 s	1 - 1000	U16
405	P4-05	Motor PF	rw	RUN	99 ≙ 0.99	• 0.00 (= disabled) • 0.50 - 0.99	U16
406	P4-06	M-Ref Source	rw	RUN	1 ≙ 1	0, 1, …, 5	U16
407	P4-07	M-Max Motoring	rw	RUN	2000 ≙ 200.0 %	0 - 2000	U16
408	P4-08	M-Min Motoring	rw	RUN	1 ≙ 0.1 %	0 - 150 %	U16
409	P4-09	M-Max Generative	rw	RUN	1 ≙ 1 %	0 - 200 %	U16
410	P4-10	f-MidV/f	rw	STOP	1 ≙ 0.1 %	0.0 - 100.0 %	U16
411	P4-11	V-MidV/f	rw	RUN	1 ≙ 0.1 %	0.0 - 100.0 %	U16
412	P4-12	T-Memory Enable	rw	RUN	1 ≙ 1	0, 1	U16
413	P4-13	Change Phasesequence Motor	rw	RUN	1 ≙ 1	0, 1	U16

Modbus register	Parameter	Parameter name	Access		Scaling	Value range	Data format
			rw/ro	RUN/ STOP			
501	P5-01	PDP-Address	rw	RUN	1 ≙ 1	1, 2, …, 63	U16
502	P5-02	CAN0 Baudrate	rw	RUN	0 ≙ 125 kbps 1 ≙ 250 kbps	0, 1, 2, 3	U16
503	P5-03	RS485-0 Baudrate	rw	RUN	0 ≙ 9.6 kbps 1 ≙ 19.2 kpbs	0, 1, 2, 3, 4	U16
504	P5-04	RS485-0 ParityType	rw	RUN	0 ≙ N-1 1 ≙ N-2	0, 1, 2, 3	U16
505	P5-05	Modbus RTU0 COM Timeout	rw	RUN	1 ≙ 0.1 s	0.0 - 5.0	U16
506	P5-06	Action@Modbus RTU error	rw	RUN	1 ≙ 1	0, 1, 2, 3	U16
507	P5-07	FieldbusRampControl	rw	RUN	1 ≙ 1	0, 1	U16
508	P5-08	NETSendPZD4	rw	RUN	1 ≙ 1	0, 1, …, 7	U16
509	P5-09	Reserved Parameter	-	-	–	–	U16
510	P5-10	Reserved Parameter	-	-	–	–	U16
511	P5-11	Reserved Parameter	-	-	–	–	U16
512	P5-12	NETSendPZD3	rw	RUN	–	0, 1, …, 7	U16
513	P5-13	NETReceivePZD4	rw	RUN	–	0, 1	U16
514	P5-14	NETReceivePZD3	rw	RUN	–	0, 1, 2	U16
515	P5-15	ParameterAccess	rw	RUN	1 ≙ 1	0, 1	U16
516	P5-16	Action@Communication Loss	rw	RUN	1 ≙ 1	0, 1, 2, 3, 4	U16
517	P5-17	Modbus RTU0 response delay	rw	STOP	1 ≙ 1	0, 1, …, 16	U16
601	P6-01	FirmwareUpgrade Enable	rw	STOP	1 ≙ 1	0, 1, 2, 3	U16
602	P6-02	Auto Thermal Management	rw	RUN	1 ≙ 1	0, 1, …, 5	WORD
603	P6-03	Auto Reset Delay	rw	RUN	1 ≙ 1	1 - 60	U16
604	P6-04	RO1 n-Hysteresis	rw	RUN	1 ≙ 0.1 %	0 - 250	U16
605	P6-05	Encoder Feedback Enable	rw	STOP	1 ≙ 1	0, 1	WORD
606	P6-06	Encoder PPR	rw	STOP	–	0 - 65535	U16
607	P6-07	Speed Error Limit	rw	RUN	1 ≙ 0.1 %	0 - 500	U16
608	P6-08	Freq RefMax	rw	RUN	–	0, 5 - 20	U16
609	P6-09	DroopMax	rw	RUN	1 ≙ 0.1 %	0 - 250	U16
610	P6-10	PLC Operation Enable	rw	RUN	1 ≙ 1	0, 1	WORD
611	P6-11	t-f-Fix before Start	rw	RUN	1 ≙ 0.1 s	0 - 2500	U16
612	P6-12	t-f-Fix after Stop	rw	RUN	1 ≙ 0.1 s	0 - 2500	U16
613	P6-13	Brake Release Delay	rw	RUN	1 ≙ 0.1 s	0 - 50	U16
614	P6-14	Brake Apply Delay	rw	RUN	1 ≙ 0.1 s	0 - 50	U16
615	P6-15	Brake M-Level Release	rw	RUN	1 ≙ 0.1 %	0 - 2000	U16
616	P6-16	Brake M-Level Timeout	rw	RUN	1 ≙ 0.1 s	0 - 250	U16
617	P6-17	Max Torque Timeout	rw	RUN	1 ≙ 0.1 s	0 - 250	U16

Modbus register	Parameter	Parameter name	Access		Scaling	Value range	Data format
			rw/ro	RUN/ STOP			
618	P6-18	DCBrakeCurrent	rw	STOP	0 ≙ Auto 1 ≙ 0.1 %	0 : Auto 0 - 300	U16
619	P6-19	Brake Resistor	rw	RUN	1 ≙ 1	0 R_{min} - 200	U16
620	P6-20	P-Brake Resistor	rw	RUN	1 ≙ 0.01 kW	0 - 20000	U16
621	P6-21	Brake Chopper ED Heat-Up	rw	RUN	1 ≙ 0.1 %	0 - 200	U16
622	P6-22	Reset Fan RunTime	rw	RUN	1 ≙ 1	0, 1	WORD
623	P6-23	Reset kWh Meter	rw	RUN	1 ≙ 1	0, 1	WORD
624	P6-24	Service Interval Time	rw	RUN	1 ≙ 1	0 - 60 000 h (0 = disabled)	U16
625	P6-25	Reset ServiceIndicator	rw	RUN	1 ≙ 1	0 -1	WORD
626	P6-26	AO1 Scale	rw	RUN	1 ≙ 0.1	0 - 5000	U16
627	P6-27	AO1 Offset	rw	RUN	1 ≙ 0.1 %	-5000 - 5000	S16
628	P6-28	PointerToParameter	rw	RUN	–	0 - 127	U16
629	P6-29	Save parameters	rw	STOP	1 ≙ 1	0, 1	WORD
630	P6-30	Password Level3	rw	RUN	–	0 - 9999	U16
701	P7-01	Motor Stator Resistance R1	rw	RUN	1 ≙ 0.001 Ω	0.000 Ω - f (I_e)	U16
702	P7-02	Motor Rotor Resistance R2	rw	RUN	1 ≙ 0.001 Ω	0.000 Ω - f (I_e)	U16
703	P7-03	Motor Stator Inductance d-Axis	rw	RUN	1 ≙ 0.0001 H	0.00 - 6.5535 H	U16
704	P7-04	Magnetizing Current @M=0	rw	RUN	1 ≙ 0.1 A	0.0 A - f (I_e)	U16
705	P7-05	Leak Inductance Rel	rw	RUN	1 ≙ 0.001	0.00 - 0.25	U16
706	P7-06	Motor Stator Inductance q-Axis	rw	RUN	1 ≙ 0.0001 H	0.000 - 6.5535 H	U16
707	P7-07	EnhancedGeneratorControl	rw	RUN	1 ≙ 1	0, 1	WORD
708	P7-08	ParameterAdaptation	rw	RUN	1 ≙ 1	0, 1	WORD
709	P7-09	Overvoltage Currentlimit	rw	RUN	1 ≙ 0.1 %	0.0 - 100 % rated motor current	U16
710	P7-10	LoadInertiaFactor	rw	RUN	1 ≙ 1	0 - 600	U16
711	P7-11	PWM lower Limit	rw	RUN	1 ≙ 1	0 - 500	U16
712	P7-12	t-Excitation-V/f	rw	RUN	–	0 - 2000	U16
713	P7-13	MSC Kd	rw	RUN	1 ≙ 0.1 %	0 - 4000	U16
714	P7-14	Torque Boost	rw	RUN	1 ≙ 0.1 %	0 - 1000	U16
715	P7-15	Torque Boost area	rw	RUN	1 ≙ 0.1 %	0 - 500	U16
716	P7-16	PM-MotorSignalIn	rw	RUN	–	0, 1, 2, 3	U16
717	P7-17	PM-MotorSignalInLevel	rw	RUN	–	0 - 100	U16

Modbus register	Parameter	Parameter name	Access		Scaling	Value range	Data format
			rw/ro	RUN/ STOP			
801	P8-01	t-acc2	rw	RUN	FS2, FS3: 1 ≙ 0.01 s FS4…: 1 ≙ 0.1 s	0 - 60000	U16
802	P8-02	n-accMulti1	rw	RUN	3000 ≙ 50.0 Hz	0 - 30000	U16
803	P8-03	t-acc3	rw	RUN	FS2, FS3: 1 ≙ 0.01 s FS4…: 1 ≙ 0.1 s	0 - 60000	U16
804	P8-04	n-accMulti2	rw	RUN	3000 ≙ 50.0 Hz	0 - 30000	U16
805	P8-05	t-acc4	rw	RUN	FS2, FS3: 1 ≙ 0.01 s FS4…: 1 ≙ 0.1 s	0 - 60000	U16
806	P8-06	n-accMulti3	rw	RUN	3000 ≙ 50.0 Hz	0 - 30000	U16
807	P8-07	t-dec4	rw	RUN	FS2, FS3: 1 ≙ 0.01 s FS4…: 1 ≙ 0.1 s	0 - 60000	U16
808	P8-08	n-decMulti3	rw	RUN	3000 ≙ 50.0 Hz	0 - 30000	U16
809	P8-09	t-dec3	rw	RUN	FS2, FS3: 1 ≙ 0.01 s FS4…: 1 ≙ 0.1 s	0 - 60000	U16
810	P8-10	n-decMulti2	rw	RUN	3000 ≙ 50.0 Hz	0 - 30000	U16
811	P8-11	t-dec2	rw	RUN	FS2, FS3: 1 ≙ 0.01 s FS4…: 1 ≙ 0.1 s	0 - 60000	U16
812	P8-12	n-decMulti1	rw	RUN	3000 ≙ 50.0 Hz	0 - 30000	U16
813	P8-13	Ramp Mode	rw	RUN	1 ≙ 1	0, 1	WORD
901	P9-01	Enable Operation Source	rw	STOP	1 ≙ 1	0 - 8	U16
902	P9-02	QuickStop Source	rw	STOP	1 ≙ 1	0 - 25	U16
903	P9-03	FWD Source	rw	STOP	1 ≙ 1	0 - 25	U16
904	P9-04	REV Source	rw	STOP	1 ≙ 1	0 - 25	U16
905	P9-05	Signal Format	rw	STOP	1 ≙ 1	0, 1	U16
906	P9-06	Force REV Source	rw	STOP	1 ≙ 1	0 - 25	U16
907	P9-07	FaultReset Source	rw	STOP	1 ≙ 1	0 - 25	U16
908	P9-08	External Fault1 Source	rw	STOP	1 ≙ 1	0 - 25	U16
909	P9-09	LocalRemote @Startup	rw	STOP	1 ≙ 1	0 - 25	U16
910	P9-10	Speed Source 1	rw	STOP	1 ≙ 1	0 - 16	U16
911	P9-11	Speed Source 2	rw	STOP	1 ≙ 1	0 - 16	U16
912	P9-12	Speed Source 3	rw	STOP	1 ≙ 1	0 - 16	U16
913	P9-13	Speed Source 4	rw	STOP	1 ≙ 1	0 - 16	U16
914	P9-14	Speed Source 5	rw	STOP	1 ≙ 1	0 - 16	U16
915	P9-15	Speed Source 6	rw	STOP	1 ≙ 1	0 - 16	U16
916	P9-16	Speed Source 7	rw	STOP	1 ≙ 1	0 - 16	U16
917	P9-17	Speed Source 8	rw	STOP	1 ≙ 1	0 - 16	U16
918	P9-18	Speed Select B0	rw	STOP	1 ≙ 1	0 - 25	U16
919	P9-19	Speed Select B1	rw	STOP	1 ≙ 1	0 - 25	U16
920	P9-20	Speed Select B2	rw	STOP	1 ≙ 1	0 - 25	U16

Modbus register	Para-meter	Parameter name	Access		Scaling	Value range	Data format
			rw/ro	RUN/ STOP			
921	P9-21	f-Fix Select B0	rw	STOP	1 ≙ 1	0 - 25	U16
922	P9-22	f-Fix Select B1	rw	STOP	1 ≙ 1	0 - 25	U16
923	P9-23	f-Fix Select B2	rw	STOP	1 ≙ 1	0 - 25	U16
924	P9-24	t-acc Select B0	rw	STOP	1 ≙ 1	0 - 25	U16
925	P9-25	t-acc Select B1	rw	STOP	1 ≙ 1	0 - 25	U16
926	P9-26	t-dec Select B0	rw	STOP	1 ≙ 1	0 - 25	U16
927	P9-27	t-dec Select B1	rw	STOP	1 ≙ 1	0 - 25	U16
928	P9-28	digRef UP Source	rw	STOP	1 ≙ 1	0 - 25	U16
929	P9-29	digRef DOWN Source	rw	STOP	1 ≙ 1	0 - 25	U16
930	P9-30	EnableDirFWD Source	rw	STOP	1 ≙ 1	0 - 25	U16
931	P9-31	EnableDirREV Source	rw	STOP	1 ≙ 1	0 - 25	U16
932	P9-32	Reserved Parameter	-	STOP	1 ≙ 1	–	U16
933	P9-33	ADO1 Function & Mode Extension	rw	STOP	1 ≙ 1	0, 1, 2	U16
934	P9-34	ADO2 Function & Mode Extension	rw	STOP	1 ≙ 1	0, 1, 2	U16
935	P9-35	RO1 Function Extension	rw	STOP	1 ≙ 1	0, 1	U16
936	P9-36	RO2 Function Extension	rw	STOP	1 ≙ 1	0, 1	U16
937	P9-37	Display Scale Source	rw	STOP	1 ≙ 1	0, 1	U16
938	P9-38	PID1 Set Point1 Source Ext	rw	STOP	1 ≙ 1	0, 1	U16
939	P9-39	PID1 Feedback1 Source Ext	rw	STOP	1 ≙ 1	0, 1	U16
940	P9-40	M-Ref Source Extension	rw	STOP	1 ≙ 1	0, 1	U16
941	P9-41	RO5 Function Extension	rw	STOP	1 ≙ 1	0, 1	U16

Modbus register	User defined register	Access		Scaling	Value range	Data format
		rw/ro	RUN/ STOP			
51	UserRegister1	rw	–	–	–	
52	UserRegister2	rw	–	–	–	
53	UserRegister3	rw	–	–	–	
54	UserRegister4	rw	–	–	–	
55	UserRegister5	rw	–	–	–	
56	UserRegister6	rw	–	–	–	
57	UserRegister7	rw	–	–	–	
58	UserRegister8	rw	–	–	–	
59	UserRegister9	rw	–	–	–	
60	UserRegister10	rw	–	–	–	
61	UserRegister11	rw	–	–	–	
62	UserRegister12	rw	–	–	–	
63	UserRegister13	rw	–	–	–	
64	UserRegister14	rw	–	–	–	
65	UserRegister15	rw	–	–	–	
66	User Analog Output 1	rw	–	–	–	
67	User Analog Output 2	rw	–	–	–	
70	User RO1 LogicStatus	rw	–	–	–	
71	User RO2 LogicStatus	rw	–	–	–	
72	User RO3 LogicStatus	rw	–	–	–	
73	User RO4 LogicStatus	rw	–	–	–	
74	User RO5 LogicStatus	rw	–	–	–	
75	User scaling value	rw	–	–	–	
76	User decimal scaling	rw	–	–	–	
77	User speed reference	rw	–	–	–	
78	User torque deference	rw	–	–	–	
75	Drive scaling value 1	ro	–	–	–	
76	Drive scaling value 2	ro	–	–	–	

3.2 Parameters for DC1 variable frequency drives

Table 19: Parameters for DC1 variable frequency drives

Modbus Register	Display	Parameter name	Access		Scaling	Value range	Data format
			rw/ro	RUN/ STOP			
20	P0-01	Analog Input 1	ro	RUN	4096 ≙ 100.0 %	0 - 1000	
21	P0-02	Analog Input 2	ro	RUN	4096 ≙ 100.0 %	0 - 1000	
23	P0-08	DC-Link Voltage	ro	RUN	230 ≙ 230 V	0 - 1000	
24	P0-09	Heatsink Temperature	ro	RUN	40 ≙ 40 °C	-10 - 150	
25	P0-10	t-Run (h)	ro	RUN	1 ≙ 1	–	
26	P0-10	t-Run (min/sec)	ro	RUN	300 ≙ 3.00 s	–	
129	P-01	f-max	rw	RUN	3000 ≙ 50.0 Hz	P-02 - (5 x P-09)	U16
130	P-02	f-min	rw	RUN	3000 ≙ 50.0 Hz	0 - P-01	U16
131	P-03	t-acc	rw	RUN	300 ≙ 3.00 s	0.1 - 600 s	U16
132	P-04	t-dec	rw	RUN	300 ≙ 3.00 s	0.1 - 600 s	U16
133	P-05	Stop Mode	rw	RUN	1 ≙ 1	0, 1, 2	U16
134	P-06	EnergyOptimizer	rw	RUN	1 ≙ 1	0, 1	U16
135	P-07	Motor Nom Voltage	rw	STOP	230 ≙ 230 V	0.20 - 230/500 V	U16
136	P-08	Motor Nom Current	rw	RUN	100 ≙ 10.0 A	Depending on device	U16
137	P-09	Motor Nom Frequency	rw	STOP	50 ≙ 50 Hz	20 - 500 Hz	U16
138	P-10	Motor Nom Speed	rw	RUN	1 ≙ 1	0 200 - 30000 rpm	U16
139	P-11	V-Boost	rw	RUN	100 ≙ 10.0 %	0.00 - 20.0 %	U16
140	P-12	Local ProcessData Source	rw	RUN	1 ≙ 1	0 - 13	U16
141	P-13	Last fault	ro	RUN	–	–	U16
142	P-14	Password	rw	RUN	1 ≙ 1	0 - 9999	U16
143	P-15	DI Config Select	rw	STOP	1 ≙ 1	0-13	U16
144	P-16	AI1 Signal Range	rw	RUN	1 ≙ 1	0 - 6	U16
145	P-17	Switching Frequency	rw	RUN	1 ≙ 1	0, 1, …, 5	U16
146	P-18	RO1 Function	rw	RUN	1 ≙ 1	0 - 9	U16
147	P-19	RO1 upper limit	rw	RUN	100 ≙ 10.0 %	0 -2000	U16
148	P-20	f-Fix1	rw	RUN	3000 ≙ 50.0 Hz	P-02 – P-01	U16
149	P-21	f-Fix2	rw	RUN	3000 ≙ 50.0 Hz	P-02 – P-01	U16
150	P-22	f-Fix3	rw	RUN	3000 ≙ 50.0 Hz	P-02 – P-01	U16
151	P-23	f-Fix4	rw	RUN	3000 ≙ 50.0 Hz	P-02 – P-01	U16
152	P-24	t-QuickDec	rw	RUN	250 ≙ 2.50 s	0 - 2500	U16
153	P-25	ADO1 Function & Mode	rw	RUN	1 ≙ 1	0 - 11	U16
154	P-26	f-SkipBand1	rw	RUN	3000 ≙ 50 Hz	0 - P-01	U16
155	P-27	f-Skip1	rw	RUN	3000 ≙ 50 Hz	0 - P-01	U16
156	P-28	V-MidV/f	rw	STOP	100 ≙ 100 V	0 - P-07	U16

Modbus Register	Display	Parameter name	Access		Scaling	Value range	Data format
			rw/ro	RUN/ STOP			
157	P-29	f-MidV/f	rw	STOP	50 ≙ 50 Hz	0 - P-09	U16
158	P-30	Start Mode	rw	RUN	1 ≙ 1	0 - 6	U16
159	P-31	Digital Reference Reset Mode	rw	RUN	1 ≙ 1	0, 1, 2, 3	U16
160	P-32	t-DCBrake@Stop	rw	RUN	250 ≙ 25 s	0, 0 - 250	U16
161	P-33	Spin Start Enable	rw	RUN	1 ≙ 1	0, 1	U16
162	P-34	Brake Chopper	rw	RUN	1 ≙ 1	0, 1	U16
163	P-35	AI1 Gain	rw	RUN	100 ≙ 10 %	0 - 5000	U16
164	P-36	RS485-0 Address	rw	RUN	1 ≙ 1	0 - 63	U16
164	P-36	RS485-0 Baudrate	rw	RUN	1 ≙ 1	1 - 6	U16
164	P-36	Modbus RTU0 COM Timeout	rw	RUN	1 ≙ 1	0 - 8	U16
165	P-37	Password Level2	rw	RUN	1 ≙ 1	0 - 9999	U16
166	P-38	Parameter Lock	rw	RUN	1 ≙ 1	0, 1	U16
167	P-39	AI1 Offset	rw	RUN	300 ≙ 30 %	-5000 - +5000	U16
168	P-40	Display Scale	rw	RUN	100 ≙ 0.10	0 - 6000	U16
169	P-41	PID1 Kp	rw	RUN	10 ≙ 1.0	1 - 300	U16
170	P-42	PID1 Ti	rw	RUN	10 ≙ 1.0 s	0 - 300	U16
171	P-43	PID1 Mode	rw	RUN	1 ≙ 1	0, 1	U16
172	P-44	PID1 Set Point 1 Source	rw	RUN	1 ≙ 1	0, 1	U16
173	P-45	PID1 Set Point Digital	rw	RUN	100 ≙ 10 %	0 - 1000	U16
174	P-46	PID 1 Feedback 1 Source	rw	RUN	1 ≙ 1	0, 1, 2, 3	U16
175	P-47	AI2 Signal Range	rw	RUN	1 ≙ 1	0, 1, …, 5	U16
176	P-48	t-Standby	rw	RUN	10 ≙ 1.0 s	0 - 250	U16
177	P-49	PID1 WakeUpLevel	rw	RUN	100 ≙ 10 %	0 - 1000	U16
178	P-50	CAN0 Baudrate	rw	RUN	1 ≙ 1	0, 1, 2, 3	U16
179	P-51	SwitchRemanentStorage	rw	RUN	1≙ 1	0, 1	U16
180	P-52	ParameterAccess	rw	RUN	1 ≙ 1	0, 1	U16
181	P-53	Action@Communication Loss	rw	RUN	1 ≙ 1	0, 1, 2, 3, 4	U16
182	P-54	RO1 Hysteresis	rw	RUN	100 ≙ 10 %	0 - 1000	U16
183	P-55	RO1 Switch-On Delay	rw	RUN	10 ≙ 1.0 s	0 - 250	U16

3.3 Parameters for DC1…E1 variable speed starters

Table 20: Parameters for DC1…E1 variable speed starters

Modbus-Register	Parameter	Parameter name	Access		Scaling	Value range	Data format
			rw/ro	RUN/ STOP			
20	P0-01	Analog Input1	ro	RUN	4096 ≙ 100.0 %	0 - 1000	–
21	P0-02	Analog Input2	ro	RUN	4096 ≙ 100.0 %	0 - 1000	–
40	P0-03	Frequency Reference	ro	RUN		-16384 - 16383	–
43	P0-07	Motor Voltage	ro	RUN	230 ≙ 230 V	0 - 500	–
23	P0-08	DC-Link Voltage	ro	RUN	230 ≙ 230 V	0 - 1000	–
24	P0-09	Heatsink Temperature	ro	RUN	40 ≙ 40 °C	-10 - 150	–
25	P0-10	t-Run (h)	ro	RUN	1 ≙ 1	–	–
26	P0-10	t-Run (min/sec)	ro	RUN	300 ≙ 3.00 s	–	–
39	P0-20	T-Controlboard	ro	RUN	40 ≙ 40 °C	0 - N/A	–
36	P0-26	kWh Meter	ro	RUN	100 ≙ 10.0 kWh	0 - N/A	–
37		MWh Meter	ro	RUN	100 ≙ 100 MWh	0 - N/A	–
29	P0-30	Serial Number 4	ro	RUN	1 ≙ 1	–	–
30	P0-30	Serial Number 3	ro	RUN	1 ≙ 1	–	–
31	P0-30	Serial Number 2	ro	RUN	1 ≙ 1	–	–
32	P0-30	Serial Number 1	ro	RUN	1 ≙ 1	–	–
129	P-01	f-max	rw	RUN	3000 ≙ 50.0 Hz	P-02 - 5 x P-09	U16
130	P-02	f-min	rw	RUN	3000 ≙ 50.0 Hz	0.0 Hz - P-01	U16
131	P-03	t-acc	rw	RUN	300 ≙ 3.00 s	0.00 s - 600 s	U16
132	P-04	t-dec	rw	RUN	300 ≙ 3.00 s	0.00 s - 601 s	U16
133	P-05	Stop Mode	rw	RUN	1 ≙ 1	0 - 3	U16
134	P-06	EnergyOptimizer	rw	RUN	1 ≙ 1	0 - 1	U16
135	P-07	Motor Nom Voltage	rw	STOP	230 ≙ 230 V	0 / 20 V - U_e	U16
136	P-08	Motor Nom Current	rw	RUN	100 ≙ 10.0 A	0.25 I_e - I_e	U16
137	P-09	Motor Nom Frequency	rw	STOP	50 ≙ 50.0 Hz	25 Hz - 500 Hz	U16
138	P-10	Motor Nom Speed	rw	RUN	1 ≙ 1	0 / 200 rpm - 30000 rpm	U16
139	P-11	V-Boost	rw	RUN	100 ≙ 10.0 %	0.0 % Ue - f (FS) FS1: 25 % U_e FS2: 20 % U_e FS3: 15 % U_e FS4: 10 % U_e	U16
140	P-12	Local ProcessData Source	rw	STOP	1 ≙ 1	0 - 13	U16
141	P-13	Application Mode Macro	rw	RUN	1 ≙ 1	–	U16
142	P-14	Password	rw	RUN	1 ≙ 1	0 - 65535	U16
143	P-15	DI Config Selec	rw	STOP	1 ≙ 1	0 - 17	U16
144	P-16	AI1 Signal Range	rw	RUN	1 ≙ 1	0 - 6	U16

Modbus-Register	Parameter	Parameter name	Access		Scaling	Value range	Data format
			rw/ro	RUN/ STOP			
145	P-17	Switching Frequency	rw	RUN	1 ≙ 1	0 - f (I_e)	U16
146	P-18	RO1 Function	rw	RUN	1 ≙ 1	0 - 7	U16
147	P-19	RO1 upper Limit	rw	RUN	100 ≙ 10.0 %	0 - 2	U16
148	P-20	f-Fix1	rw	RUN	3000 ≙ 50.0 Hz	f-min - f-max	U16
149	P-21	f-Fix2	rw	RUN	3000 ≙ 50.0 Hz	f-min - f-max	U16
150	P-22	f-Fix3	rw	RUN	3000 ≙ 50.0 Hz	f-min - f-max	U16
151	P-23	f-Fix4	rw	RUN	3000 ≙ 50.0 Hz	f-min - f-max	U16
152	P-24	t-QuickDec	rw	RUN	300 ≙ 3.00 s	0.00 s - 600.0 s	U16
153	P-25	AO1 Function	rw	RUN	1 ≙ 1	0 - 9	U16
154	P-26	f-SkipBand1	rw	RUN	3000 ≙ 50.0 Hz	0.0 Hz - f-max	U16
155	P-27	f-Skip1	rw	RUN	3000 ≙ 50.0 Hz	0.0 Hz - f-max	U16
156	P-28	V-MidV/f	rw	STOP	230 ≙ 230 V	0 V - P-07	U16
157	P-29	f-MidV/f	rw	STOP	3000 ≙ 50.0 Hz	0 Hz - P-09	U16
158	P-30	Start Mode	rw	RUN	1 ≙ 1	0 - 6	U16
159	P-31	Digital Reference Reset Mode	rw	RUN	1 ≙ 1	0 - 3	U16
160 (Low Byte)	P-32	t-DCBrake@Stop	rw	RUN	30 ≙ 3.0 s	0.0 s - 25.0 s	U16
160 (High Byte)	P-32	DCBrake	rw	RUN	1 ≙ 1	0-2	U16
161	P-33	Spin Start Enable	rw	RUN	1 ≙ 1	0 - 1	U16
162	P-34	Brake Chopper	rw	RUN	1 ≙ 1	0 - 2	U16
163	P-35	AI1 Gain	rw	RUN	100 ≙ 10.0 %	0 - 20	U16
164 (Low Byte)	P-36	RS485-0 Address	rw	RUN	1 ≙ 1	1 - 63	U16
164 (Bit 8 - Bit 11)	P-36	RS485-0 Baudrate	rw	RUN	1 ≙ 1	0 - 6	U16
164 (Bit 12 - Bit 15)	P-36	Modbus RTU0 COM Timeout	rw	RUN	1 ≙ 1	0 - 8	U16
165	P-37	Password Level2	rw	RUN	1 ≙ 1	0 - 9999	U16
166	P-38	Parameter Lock	rw	RUN	1 ≙ 1	0 - 1	U16
167	P-39	AI1 Offset	rw	RUN	10 ≙ 1.0 %	-5 - +5	U16
168 (Bit 0 - Bit 13)	P-40	Display Scale	rw	RUN	10000 ≙ 10.000	0 - 16.000	U16
168 (Bit 4, Bit 15)	P-40	Display Scale Source	rw	RUN	1 ≙ 1	0 - 2	U16

Modbus-Register	Parameter	Parameter name	Access		Scaling	Value range	Data format
			rw/ro	RUN/ STOP			
169	P-41	PID1 Kp	rw	RUN	10 ≙ 1.0	0,1 - 30	U16
170	P-42	PID1 Ti	rw	RUN	300 ≙ 3.00 s	0.0 s - 30.0 s	U16
171	P-43	PID1 Mode	rw	RUN	1 ≙ 1	0 - 1	U16
172	P-44	PID1 Set Point 1 Source	rw	RUN	1 ≙ 1	0 - 1	U16
173	P-45	PID1 Set Point Digital	rw	RUN	1 ≙ 1	0 - 1	U16
174	P-46	PID1 Feedback 1 Source	rw	RUN	1 ≙ 1	0 - 3	U16
175	P-47	AI2 Signal Range	rw	RUN	1 ≙ 1	0 - 6	U16
176	P-48	t-Standby	rw	RUN	300 ≙ 3.00 s	0.0 s - 25.0 s	U16
177	P-49	PID1 WakeUpLevel	rw	RUN	1 ≙ 1	0 - 1	U16
178	P-50	CAN0 Baudrate	rw	RUN	1 ≙ 1	0 - 3	U16
179	P-51	T-Memory Enable	rw	RUN	1 ≙ 1	0 - 1	U16
180	P-52	ParameterAccess	rw	RUN	1 ≙ 1	0 - 1	U16
181	P-53	Action@Communication Loss	rw	RUN	1 ≙ 1	0 - 4	U16
182	P-54	RO1 Hysteresis	rw	RUN	1 ≙ 1	0 - 1	U16
183	P-55	RO1 Switch-On Delay	rw	RUN	300 ≙ 3.00 s	0.0 s - 250.0 s	U16
188	P-60	Motor Control Mode	rw	RUN	1 ≙ 1	0 - 4	U16
189	P-61	Motor Identification	rw	RUN	300 ≙ 3.00 s	0.0 s - 250.0 s	U16
190	P-62	MSC Gain	rw	RUN	10 ≙ 1.0 %	0.0 % - 200.0 %	U16
191	P-63	I-CurrentLimit	rw	RUN	10 ≙ 1.0 %	0.1 % - 175 %	U16
192	P-64	Motor Stator Resistance R1	rw	RUN		0.00 Ω - 655.35 Ω	U16
193	P-65	Motor Stator Inductance d-Axis	rw	RUN		0.0 mH - 6553.5 mH	U16
194	P-66	Motor Stator Induktivität q-Achse	rw	RUN		0.0 mH - 6553.5 mH	U16
195	P-67	f-DCBremse@Stopp	rw	RUN	3000 ≙ 50.0 Hz	0.0 Hz - P-01	U16
196	P-68	DC-Brake Current	rw	RUN	10 ≙ 1.0 %	0,0 % - 100.0 %	U16

3.4 Parameters for DE1 variable speed starters

Table 21: Parameters for DE1 variable speed starters

Modbus Register	Display	Parameter name	Access		Scaling	Value range	Data format
			rw/ro	RUN/ STOP			
20	P0-01	Analog Input1	ro	RUN	4096 ≙ 100.0 %	0 - 1000	–
23	P0-08	DC-Link Voltage	ro	RUN	230 ≙ 230 V	0 - 1000	–
24	P0-09	Heatsink Temperature	ro	RUN	40 ≙ 40 °C	-10 - 150	–
25	P0-10	t-Run (h)	ro	RUN	1 ≙ 1	–	–
26	P0-10	t-Run (min/sec)	ro	RUN	300 ≙ 3.00 s	–	–
129	P-01	f-max	rw	STOP	3000 ≙ 50.0 Hz	P-02 - 300 Hz	U16
130	P-02	f-min	rw	STOP	3000 ≙ 50.0 Hz	0 - P-01	U16
131	P-03	t-acc	rw	RUN	300 ≙ 3.00 s	0.1 - 300 s	U16
132	P-04	t-dec	rw	RUN	300 ≙ 3.00 s	0.1 - 300 s	U16
133	P-05	Stop Mode	rw	RUN	1 ≙ 1	0, 1	U16
134	P-06	EnergyOptimizer	rw	STOP	1 ≙ 1	0, 1	U16
135	P-07	Motor Nom Voltage	rw	STOP	230 ≙ 230 V	50 - 500 V	U16
136	P-08	Motor Nom Current	rw	STOP	100 ≙ 10.0 A	(10 - 100 %) x I_e	U16
137	P-09	Motor Nom Frequency	rw	STOP	50 ≙ 50 Hz	20 - 300 Hz	U16
138	P-10	Motor Nom Speed	rw	STOP	1 ≙ 1	0 200 - 15000 rpm	U16
139	P-11	V-Boost	rw	RUN	100 ≙ 10.0 %	0.0 - 40.0 %	U16
140	P-12	Local ProcessData Source	rw	RUN	1 ≙ 1	0 - 13	U16
141	P-13	Last fault	ro	STOP	–	–	U16
142	P-14	Password	rw	RUN	1 ≙ 1	0 - 65535	U16
143	P-15	DI Config Select	rw	STOP	1 ≙ 1	0-9	U16
144	P-16	AI1 Signal Range	rw	STOP	1 ≙ 1	0- 3	U16
145	P-17	AI1 Gain	rw	RUN	10 ≙ 1	0.10 - 2.500	U16
146	P-18	AI1 Invert	rw	STOP	1 ≙ 1	0, 1	U16
147	P-19	DI3 Logic	rw	STOP	1 ≙ 1	0, 1	U16
148	P-20	f-Fix1	rw	STOP	3000 ≙ 50.0 Hz	P-02 – P-01	U16
149	P-21	f-Fix2	rw	STOP	3000 ≙ 50.0 Hz	P-02 – P-01	U16
150	P-22	f-Fix3	rw	STOP	3000 ≙ 50.0 Hz	P-02 – P-01	U16
151	P-23	f-Fix4	rw	STOP	3000 ≙ 50.0 Hz	P-02 – P-01	U16
152	P-24	Digital Reference Reset Mode	rw	RUN	1 ≙ 1	0, 1, 2, 3	U16
153	P-25	DCBrake	rw	STOP	1 ≙ 1	0, 1, 2, 3	U16
154	P-26	t-DCBrake@Stop	rw	RUN	100 ≙ 10.0 s	0 - 10 s	U16
155	P-27	DCBrakeVoltage	rw	RUN	100 ≙ 10 %	0 - P-07	U16
156	P-28	f-DCBrake@Stop	rw	RUN	3000 ≙ 50 Hz	0 - P-01	U16
157	P-29	Switching Frequency	rw	STOP	1 ≙ 1	0, 1, …, 5	U16

Modbus Register	Display	Parameter name	Access		Scaling	Value range	Data format
			rw/ro	RUN/ STOP			
158	P-30	Start Mode	rw	STOP	1 ≙ 1	0, 1, …, 10	U16
159	P-31	OverVoltage Control	rw	RUN	1 ≙ 1	0, 1	U16
160	P-32	Auto temperature management	rw	STOP	1 ≙ 1	0, 1	U16
161	P-33	SwitchRemanentStorage	rw	STOP	1 ≙ 1	0, 1	U16
162	P-34	PDP-Address	rw	RUN	1 ≙ 1	1 - 63	U16
163	P-35	RS485-0 Baudrate	rw	RUN	1 ≙ 1	0, 1, 2, 3, 4	U16
164	P-36	Modbus RTU0 COM Timeout	rw	RUN	1 ≙ 1	0, 1, …, 8	U16
165	P-37	Parameter Set	rw	STOP	1 ≙ 1	0, 1	U16
166	P-38	Password Level2	rw	RUN	1 ≙ 1	0 - 9999	U16
167	P-39	Parameter Lock	rw	RUN	1 ≙ 1	0, 1	U16
168	P-40	Action@Communication Loss	rw	RUN	1 ≙ 1	0, 1, 2, 3, 4	U16
169	P-41	ParameterAccess	rw	RUN	1 ≙ 1	0, 1	U16
Additionally on DE11 variable speed starters							
178	P-50	CANO Baud rate	rw	RUN		0, 1, 2, 3	U16
179	P-51	RO1 Function	rw	RUN		0, 1, …, 9	U16
180	P-52	RO1 upper limit	rw	RUN		0.0 - 200.0 %	U16
181	P-53	RO1 Hysteresis	rw	RUN		0.0 - 100.0 %	U16
182	P-54	RO1 Switch-On Delay	rw	RUN		0.0 - 250.0 s	U16

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