M-Max Series
Variable frequency drives

Pump Application Quick Start Guide

Effective June 2018
New Information

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Cover Photo: Eaton's M-Max™ Series variable frequency drive.

Step 1—Safety information

Definitions and Symbols

VOLTAGE

This symbol indicates high voltage. It calls your attention to items or operations that could be dangerous to you and other persons operating this equipment. Read the message and follow the instructions carefully.

This symbol is the "Safety Alert Symbol." It occurs with either of two signal words: CAUTION or WARNING, as described below.

WARNING

Indicates a potentially hazardous situation which, if not avoided, can result in serious injury or death.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, can result in minor to moderate injury, or serious damage to the product. The situation described in the CAUTION may, if not avoided, lead to serious results. Important safety measures are described in CAUTION (as well as WARNING).

Hazardous High Voltage

VOLTAGE

Motor control equipment and electronic controllers are connected to hazardous line voltages. When servicing drives and electronic controllers, there may be exposed components with housings or protrusions at or above line potential. Extreme care should be taken to protect against shock.

Stand on an insulating pad and make it a habit to use only one hand when checking components. Always work with another person in case an emergency occurs. Disconnect power before checking controllers or performing maintenance. Be sure equipment is properly grounded. Wear safety glasses whenever working on electronic controllers or rotating machinery.

Cautions and notices

CAUTION

Read this manual thoroughly and make sure you understand the procedures before you attempt to install, set up, or operate Eaton's M-Max Series variable frequency drive.

Cautions

CAUTION

Be ABSOLUTELY sure not to connect two functions to one and same output in order to avoid function overruns and to ensure flawless operation.

The calculated model does not protect the motor if the airflow to the motor is reduced by blocked air intake grill.

Notices

Notice

The *inputs*, unlike the *outputs*, cannot be changed in RUN state.

Danger and 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 IL04020001E 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 equalization. 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 24V supply. Only use power supply units complying with IEC 60364-4-41 (VDE 0100 Part 410) or HD384.4.41 52.

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.

Step 2—M-Max™ Series overview

About this manual

Figure 1. M-Max Series Variable Frequency Drive

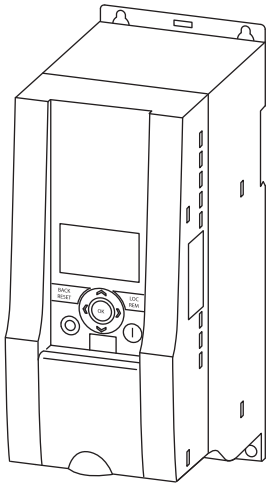
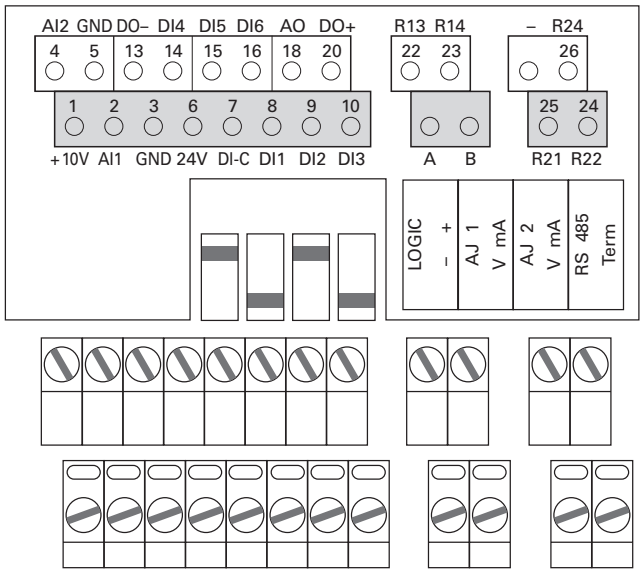


Figure 2. Control Signal Terminals



This quick reference guide contains selected information about the M-Max Series variable frequency drives.

This quick reference guide is a summary of manual MN04020001E and contains technical data, parameter lists and information about operating the variable frequency drives with a new pump application software variant. It is intended to support experienced, qualified users in the use of the M-Max Series variable frequency drive.

It is assumed that you have thoroughly read manual MN04020001E and that the variable frequency drive has been correctly installed and commissioned as described in manual MN04020001E and installation instructions IL04020001E.

Writing conversions

The symbols used in this manual have the following meanings:

► Indicates instructions to be followed.

Table 1. Symbols

Symbol	Description
	Indicates useful tips and additional information.
	**Caution!** warns of the risk of material damage.
	**Warning!** Warns about the possibility of serious property damage and minor injuries.
	**Danger!** Warns about the possibility of major property damage and serious injuries or death.
	In order to make it easier to follow the manual, the name of the current chapter is shown in the header of the left-hand page and the name of the current section is shown in the header of the right-hand page. This does not apply to pages at the start of a chapter or to empty pages at the end of a chapter.
	In order to make it easier to understand some of the figures included in this manual, the housing of the variable frequency drive, as well as other safety-relevant parts, have been left out. However, it is important to note that the variable frequency drive must only be operated with its housing placed properly, as well as with all required safety-relevant parts.
	All the specifications in this manual refer to the hardware and software versions documented in it.
	For more detailed indications and explanations on project planning, installation, and parameter configuration, please consult manual MN04020001E The complete documentation for the M-Max Series of frequency converters is stored electronically on a CD-ROM. This CD-ROM is part of the scope of supply. Additional information on the series described here can be found on the Internet under: www.eaton.com/M-Max

Rated operational data on the nameplate

The device-specific rated operational data for M-Max Series variable frequency drives is shown on the nameplate on the device's side and on the back of the control signal terminal cover.

The inscription of the nameplates has the following meaning (example) as shown in **Table 2**.

Table 2. Nameplate Inscriptions

Label	Meaning
MMX34AA3D3F0-0	Part no.: MMX = M-Max Series variable frequency drive 3 = Three-phase power connection 4 = 400V voltage category AA = Instance (Software version A and alphanumerical display) 3D3 = 3.3A rated current (3-decimal-3) F = Integrated radio interference suppression filter 0 = IP20 protection class 0 = No integrated optional assembly
Input	Power connection rating: Three-phase AC voltage (U_e 3~ AC), 380 – 480V voltage, 50/60 Hz frequency, input phase current (4.0A)
Output	Load side (motor) rating: Three-phase AC voltage (0 – U_e), output phase current (3.3A), output frequency (0 – 320 Hz)
Power	Assigned motor rating 1.1 kW at 400 V/1.5 hp at 460V for a four-pole internally cooled or surface-cooled three-phase asynchronous motor (1500 rpm at 50 Hz/ 1800 rpm at 60 Hz)
S/N	Serial number
	Variable frequency drive is an electrical apparatus. Read the manual (in this case MN04020001E) before making any electrical connections and commissioning.
IP20/Open Type	Degree of protection of the enclosure: IP20, UL® (cUL®) Open type
40W09	Manufacturing date Calendar week 40 of the year 2009

Mains voltages

The given rated operational voltages in **Table 3** are based on the standardized rated values in centrally earthed star networks.

In ring-type networks (e.g., Europe) the rated voltage corresponds the value of the consumer networks (e.g., 230V, 400V) at the utility company's transfer point.

In star-type mains (e.g., North America) the rated voltage at the utility company's transfer point is higher than in the consumer network. For example: 120V → 115V, 240V → 230V, 480V → 460V.

Table 3. General Rated Operational Data

Technical data	Unit	Value
General		
Standards and regulations		EMC: IEC/EN 61800-3, Safety: IEC/EN 61800-5, UL 508C
Certifications and manufacturer's declarations on conformity		EMC: CE, CB, c-Tick Safety: CE, CB, UL, cUL, phenum rated
Production quality		RoHS, ISO® 9001
Climatic proofing		< 95%, average relative humidity, noncondensing (EN 50178)
Air quality		
Chemical vapors		IEC 721-3-3: Device in operation, Class 3C2
Mechanical particles		IEC 721-3-3: Device in operation, Class 3S2
Ambient temperature		
Operation	°C	–10 to +50 ①
Storage	°C	–40 to +70
Installation altitude	H	0 – 1000m above sea level, over 1000m with 1% power reduction per 100m, maximum 2000m, at maximum +50°C ambient temperature. 2000m maximum for corner grounded device, 4500m for non-corner grounded device
Mounting position		Vertical (± 90 degrees lateral rotation)
Protection type		IP20
Busbar tag shroud		BGV A3 (VBG4, finger and back-of-hand safe)
Overvoltage category/degree of pollution		—
Mechanical shock resistance		IEC 68-2-27 Storage and transport: 15g, 11 ms (in the packaging) UPS drop test (for applicable UPS weights)
Vibration		EN 60068-2-6 3 – 150 Hz, oscillation amplitude 1 mm (Peak) at 3 – 15.8 Hz, maximum acceleration amplitude 1g at 15.8 – 150 Hz
Emitted interference with internal EMC filter (maximum motor cable length)		C2: Class A in 1st environment (residential area with commercial utilization) C3: Class A in 2nd environment (Industrial)
MMX11		C2 (5m), C3 (30m)
MMX12, MMX32		C2 (5m), C3 (30m)
MMX34		C2 (5m), C3 (30m)
Power Section		
Rated operational voltage		at 50/60 Hz ±10%
MMX11	U_e	1 AC 115V (110V – 15% …120V + 10%)
MMX12	U_e	1 AC 230V (208V – 15% …240V + 10%)
MMX32	U_e	3 AC 230V (208V – 15% …240V + 10%)
MMX34	U_e	3 AC 400V (380V – 15% …480V + 10%)

Table 3. General Rated Operational Data, continued

Technical data	Unit	Value
Power Section (continued)		
Mains network configuration (AC power supply network)		Center-point grounded star network (TN-S network) Phase grounded AC networks are not permitted.
Mains switch-on frequency		Maximum one time per minute
Mains current	THD	>120%
Short-circuit current		max. < 50 kA
Mains frequency	f_{LN}	50/60 Hz (45 – 66 Hz ±0%)
Pulse frequency (switching frequency of the inverter)	f_{PWM}	1 kHz – 16 kHz (WE: 6 kHz) ①
Operating mode		V/Hz-characteristic curve control (WE), sensorless vector control (open loop)
Output voltage	U_2	3 AC 230V (MMX11), 3 AC U_e (MMX12, MMX32, MMX34)
Output frequency	f_2	0 – 320 Hz (WE: 0 – 50 Hz)
Frequency resolution (set point value)	Hz	0.01
Rated operational current	I_e	100% continuous current at maximum +50°C ambient temperature
Overload current		150% for 60s every 600s
Starting current		200% for 2s every 20s
Braking torque		Maximum 30% M_N for all sizes up to maximum 100% M_N only as of size MMX34…4D3… with external braking resistance
Control Section		
Control voltage (output)	Vdc	24, max. 50 mA
Reference voltage (output)	Vdc	10, max. 10 mA
Input, digital, parameter definable		6 x, max. +30 Vdc, R_i > 12k ohm
Permitted residual ripple with external control voltage (+24V)		Max. 5% $\Delta U_a/U_a$
Input, analog, parameter definable		2 x 0 – +10 Vdc , R_i > 200k ohm /0 (4) – 20 mA, R_B ~ 200 ohm
Resolution	Bit	10
Output, analog, parameter definable		1 x 0 – 10 Vdc, max. 10 mA
Resolution	Bit	10
Output, digital, parameter definable		1 x Transistor, max. 48 Vdc, max. 50 mA
Output relay, parameter definable		1 x N/O 250 Vac maximum 2A/250 Vdc, maximum 0.4A
Output relay, parameter definable		1 x C/O 250 Vac maximum 2A/250 Vdc, maximum 0.4A
Serial interface		RS-485/Modbus® RTU

Note

① With MMX34AA014F0-0, the maximum permitted ambient temperature is limited to +40 °C and the maximum pulse frequency (fPWM) to 4 kHz.

Step 3—Technical data

Table 4. Technical data

Part Number	Rated Operational Current I_e [A]	Overload Current (150%) I_{e150} [A]	Assigned Motor Rating P (230V, 50 Hz) [kW]	[A] ①	P (230V, 60 Hz) [hp]	[A] ①	Installation Size
Power Connection Voltage: 1 AC 115V, 50/60 Hz (94 – 132V ± 0%, 45 – 66 Hz ± 0%)							
MMX11AA1D7…	1.7	2.6	0.25	1.4	1/3 ②	1.5 ②	FS2
MMX11AA2D4…	2.4	3.6	0.37	2.0	1/2	2.2	FS2
MMX11AA2D8…	2.8	4.2	0.55	2.7	3/4	2.2	FS2
MMX11AA3D7…	3.7	5.6	0.75	3.2	1	3.2	FS2
MMX11AA4D8…	4.8	7.2	1.10	4.6	1-1/2	4.2	FS3
Power Connection Voltage: 1 AC 230V, 50/60 Hz (177 – 264V ± 0%, 45 – 66 Hz ± 0%)							
MMX12AA1D7…	1.7	2.6	0.25	1.4	1/3 ②	1.5 ②	FS1
MMX12AA2D4…	2.4	3.6	0.37	2.0	1/2	2.2	FS1
MMX12AA2D8…	2.8	4.2	0.55	2.7	3/4	2.2	FS1
MMX12AA3D7…	3.7	5.6	0.75	3.2	1	3.2	FS2
MMX12AA4D8…	4.8	7.2	1.10	4.6	1-1/2	4.2	FS2
MMX12AA7D0…	7.0	10.5	1.50	6.3	2	6.8	FS2
MMX12AA9D6…	9.6	14.4	2.20	8.7	3	9.6	FS3
Power Connection Voltage: 3AC 230V, 50/60 Hz (177 – 264V ± 0%, 45 – 66 Hz ± 0%)							
MMX32AA1D7…	1.7	2.6	0.25	1.4	1/3 ②	1.5 ②	FS1
MMX32AA2D4…	2.4	3.6	0.37	2.0	1/2	2.2	FS1
MMX32AA2D8…	2.8	4.2	0.55	2.7	3/4	2.2	FS1
MMX32AA3D7…	3.7	5.6	0.75	3.2	1	3.2	FS2
MMX32AA4D8…	4.8	7.2	1.10	4.6	1-1/2	4.2	FS2
MMX32AA7D0…	7.0	10.5	1.50	6.3	2	6.8	FS2
MMX32AA011…	11.0	14.4	2.20	8.7	3	9.6	FS3
Power Connection Voltage: 3 AC 400V/460V, 50/60 Hz (323 – 528V ± 0%, 45 – 66 Hz ± 0%)							
MMX34AA1D3…	1.3	2.0	0.37	1.1	1/2	1.1	FS1
MMX34AA1D9…	1.9	2.9	0.55	1.5	3/4	1.6	FS1
MMX34AA2D4…	2.4	3.6	0.75	1.9	1	2.1	FS1
MMX34AA3D3…	3.3	5.0	1.10	2.6	1-1/2	3	FS2
MMX34AA4D3…	4.3	6.5	1.50	3.6	2	3.4	FS2
MMX34AA5D6…	5.6	8.4	2.20	5.0	3	4.8	FS2
MMX34AA7D6…	7.6	11.4	3.00	6.6	4	7.6	FS3
MMX34AA9D0…	9.0	13.5	4.00	8.5	5.5	7.6	FS3
MMX34AA012…	12.0	18.0	5.50	11.3	7-1/2	11	FS3
MMX34AA014…	14.0	21.0	7.50 ③	(15.2) ④	10 ③	14	FS3

Notes

① Rated motor currents for normal four-pole internally cooled and surface-cooled three-phase asynchronous motors (1500 rpm at 50 Hz, 1800 rpm at 60 Hz).

② Calculated motor rating (no normalized value). The mains voltage of 115V is raised to 230V (output voltage) through an internal voltage double connection.

③ Allocated motor output at a maximum ambient temperature of +40°C and a maximum pulse frequency of 4 kHz.

④ Operation with reduced load torque (about –10% MN).

Control signal terminals

The control section, with the corresponding control signal terminals, is shown below.

Figure 3. Schematic Arrangement and Designation of Control Signal Terminals

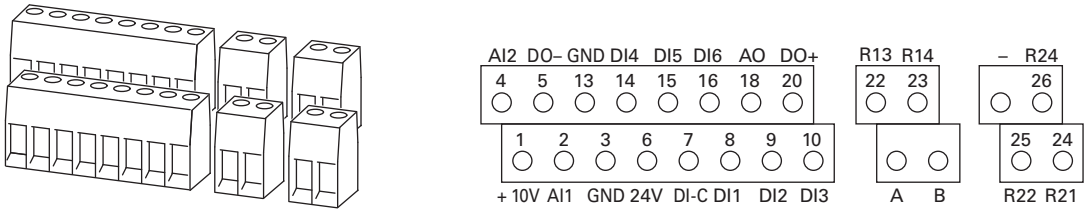


Table 5. Cable Cross Section (Cu): 0.5 – 1.5 mm²

Terminal Blocks		Signal	Factory Setting	Description
1	+10V	Output nominal voltage	—	Maximum load 10 mA, reference potential GND
2	AI1	Analog signal input 1	Frequency reference value ①	0 – +10V (R_i > 200k ohms) 0/4 – 20 mA (R_B = 200 ohms) Selectable with microswitch S2
3	GND	Reference potential	—	0V
6	24V	Control voltage for DI1 – DI6, output (+24V)	—	Maximum load 50 mA, reference potential GND
7	DI-C	Reference potential of digital inputs DI1 – DI6	LOGIC– (GND)	Selectable through microswitch LOGIC –/+
8	DI1	Digital input 1	FWD start enable, forward ①	0 – +30V (R_i > 12k ohms)
9	DI2	Digital input 2	REV start enable, reverse ①	0 – +30 (R_i > 12k ohms)
10	DI3	Digital input 3	Fixed frequency B0 ①	0 – +30V (R_i > 12k ohms)
4	AI2	Analog input 2	PI actual value ①	0 – +10V (R_i > 200k ohms) 0/4 – 20 mA (R_B = 200 ohms) Selectable through microswitch S3
5	GND	Reference potential	—	0V
13	DO–	Digital output	Active = READY ①	Transistor, max. 50 mA, terminal 20 supply voltage
14	DI4	Digital input 4	Fixed frequency B1 ①	0 – +30V (R_i = 12k ohms)
15	DI5	Digital input 5	Error acknowledgment ①	0 – +30V (R_i = 12k ohms)
16	DI6	Digital input 6	PI controller deactivated ①	0 – +30V (R_i = 12k ohms)
18	AO	Analog output	Output frequency ①	0 – +10V, max. 10 mA
20	DO+	Digital output	Supply voltage, see terminal 13	Supply voltage for digital output DO– max. 48 Vdc, max. 50 mA
A	A	RS-485 signal A	BUS-Communication	Modbus RTU
B	B	RS-485 signal B	BUS-Communication	Modbus RTU
22	R13	Relay 1, normally open contact	Active = RUN ①	Maximum switching load: 250 Vac/2A or 250 Vdc/0.4A
23	R14	Relay 1, normally open contact	Active = RUN ①	Maximum switching load: 250 Vac/2A or 250 Vdc/0.4A
24	R22	Relay 2, normally closed contact	Active = FAULT ①	Maximum switching load: 250 Vac/2A or 250 Vdc/0.4A
25	R21	Relay 2, common contact	Active = FAULT ①	Maximum switching load: 250 Vac/2A or 250 Vdc/0.4A
26	R24	Relay 2, normally open contact	Active = FAULT ①	Maximum switching load: 250 Vac/2A or 250 Vdc/0.4A

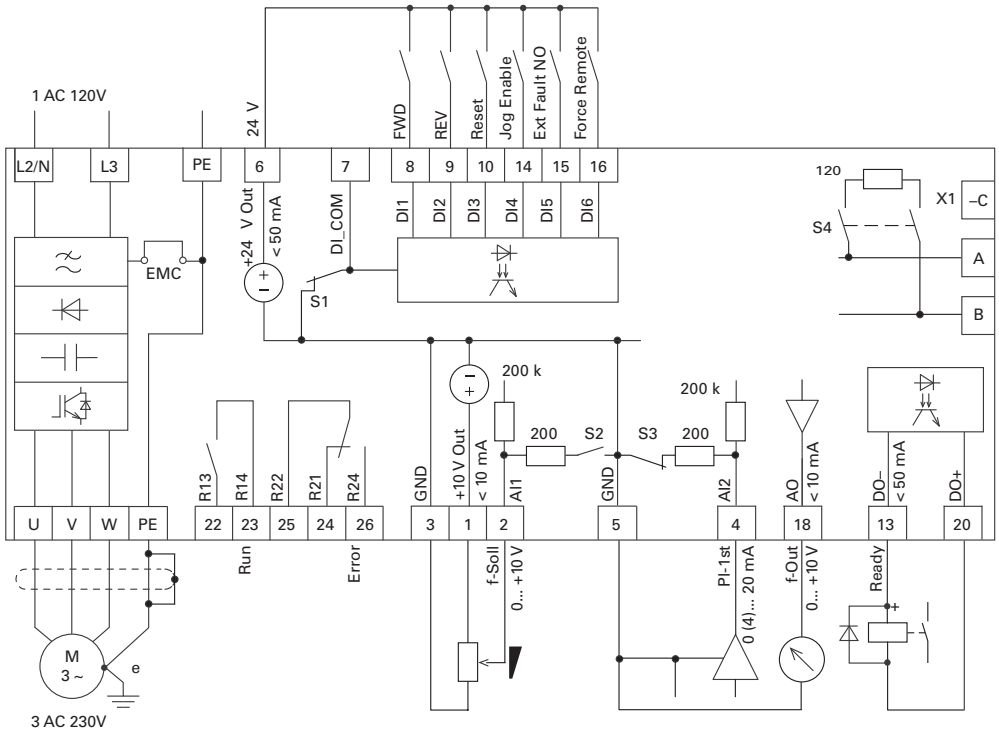
Note

① Programmable function (⟶ section "List of parameters," **Page 22**).

Block diagram

The following diagrams show all the terminals on an M-Max Series variable frequency drive and their functions at the default settings.

Figure 4. Block Diagram MMX11



➔ Block diagram MMX11 has a voltage doubler connection in the internal DC link. At a connection voltage of 1 AC 120V (115V), a motor voltage of 3 AC 230V is output.

Figure 5. MMX12 Block Diagram

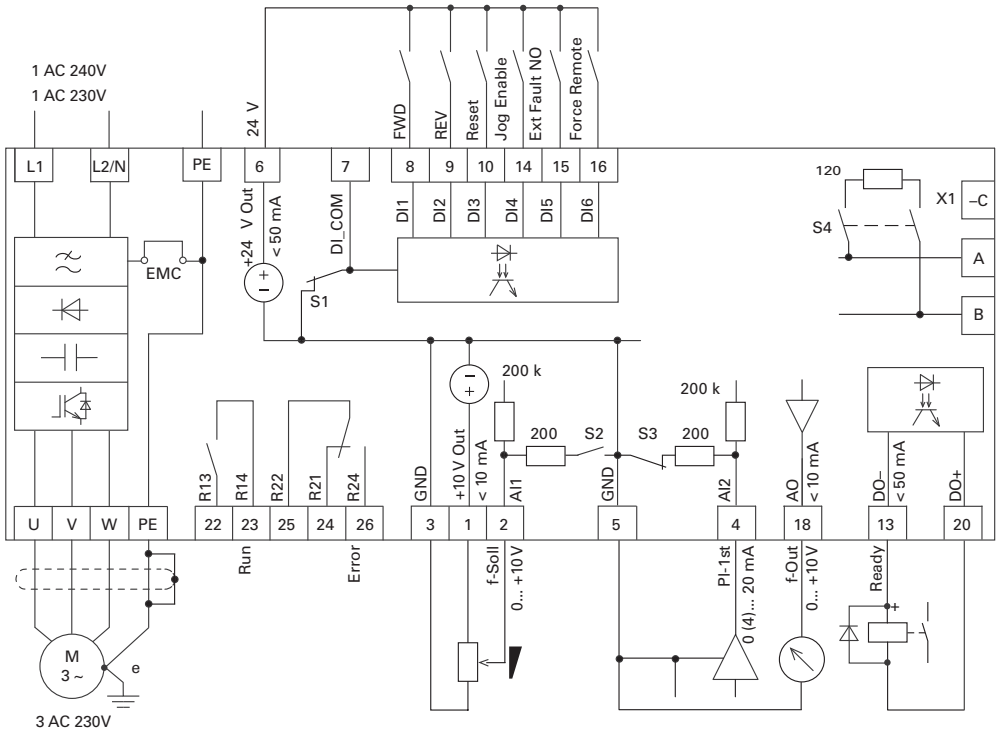
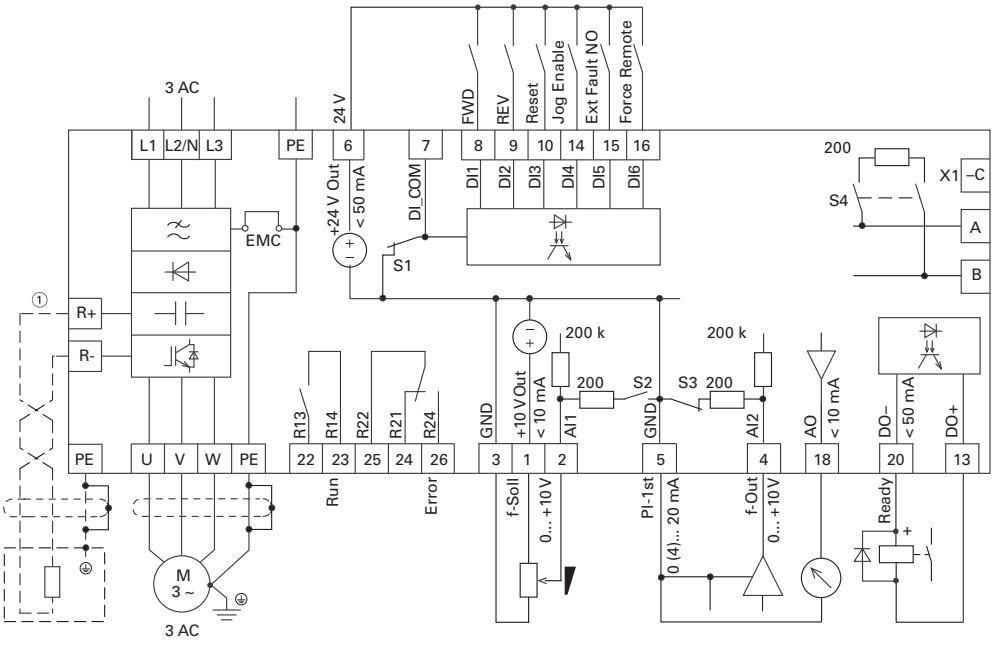


Figure 6. Block Diagram MMX32 and MMX34



Note

① Connection terminals R+ and R– for external braking resistance (optional), only with MMX34…4D3…, MMX34…5D6…, MMX34…7D6…, MMX34…9D0, MMX34…012… and MMX34…014…

Step 4—Operation

Checklist for commissioning

Before placing the variable frequency drive into operation, make sure to check the following (checklist):

No.		Activity	Note
1	☐	Installation and wiring have been carried out in accordance with the corresponding installation instructions (⟶ IL04020001E).	
2	☐	All wiring and line section leftovers, as well as all the tools used, have been removed from the variable frequency drive's proximity.	
3	☐	All terminals in the power section and in the control section were tightened with the specified torque.	
4	☐	The lines connected to the output terminals of the variable frequency drive (U/T1, V/T2, W/T3, R+, R–) are not short-circuited and are not connected to ground (PE).	
5	☐	The variable frequency drive has been earthed properly (PE).	
6	☐	All electrical terminals in the power section (L1, L2/N, L3, U/T1, V/T2, W/T3, R+, R–, PE) were implemented properly and were designed in line with the corresponding requirements.	
7	☐	Each single-phase of the supply voltage (L1, L2, L3) is protected with a fuse.	
8	☐	The variable frequency drive and the motor have been adjusted for the corresponding line voltage (⟶ section "Rated operational data on the nameplate," **Page 3**).	
9	☐	The quality and volume of cooling air are in line with the environmental conditions required for the variable frequency drive.	
10	☐	All connected control lines comply with the corresponding stop conditions (e.g., switch in OFF position and set point value = zero).	
11	☐	The parameters that were preset at the factory have been checked with the list of parameters (⟶ section "List of parameters," **Page 22**).	
12	☐	The effective direction of a coupled machine will allow the motor to start.	
13	☐	All emergency switching off functions and safety functions are in an appropriate condition.	

Hazard warnings

Please observe the following notes.

DANGER

Commissioning is only to be completed by qualified technicians.

DANGER

Hazardous voltage!

The safety instructions on pages iv and v must be followed.

DANGER

The components in the variable frequency drive's power section are energized if the supply voltage (line voltage) is connected. For instance: power terminals L1, L2/N, L3, R+, R–, U/T1, V/T2, W/T3.

The control signal terminals are isolated from the line power potential.

There can be a dangerous voltage on the relay terminals (22 to 26) even if the frequency converter is not being supplied with line voltage (e.g., integration of relay contacts in control systems with 230 Vac)

DANGER

The components in the frequency converter's power section remain energized up to five (5) minutes after the supply voltage has been switched off (intermediate circuit capacitor discharging time).

Pay attention to hazard warnings!

DANGER

Following a shutdown (fault, line voltage off), the motor can start automatically (when the supply voltage is switched back on) if the automatic restart function has been enabled.

CAUTION

Any contactors and switching devices on the power side are not to be opened during motor operation. Inching operation using the power switch is not permitted.

Contactors and switching devices (repair and maintenance switches) on the motor side are never to be opened while the motor is in operation.

Inching operation of the motor with contactors and switching devices in the output of the variable frequency drive is not permitted.

CAUTION

Make sure that there is no danger in starting the motor. Disconnect the driven machine if there is a danger in an incorrect operational status.

The START button is only functional if the KEYPAD operating mode is activated. The STOP button is active in all operating modes.

If motors are to be operated with frequencies higher than the standard 50 or 60 Hz, then these operating ranges must be approved by the motor manufacturer. The motors could be damaged otherwise.

Step 5—Error and warning messages

Introduction

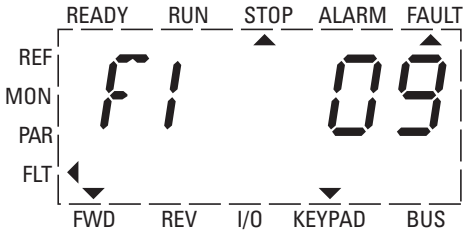
The M-Max Series variable frequency drive have several internal monitoring functions. When deviations from the optimal operating status are detected, faults (FAULT) and warning messages (ALARM) are differentiated between.

Error messages

Faults can cause faulty functionality and technical defects. The inverter (variable frequency drive output) is automatically disabled if a fault is detected. The connected motor then runs down freely to a stop.

Error messages are shown on the display with an arrowhead ▲ under FAULT and with the error code F… (F1 = last fault, F2 = last but one fault, etc.).

Figure 7. Error Message Example



Acknowledge fault message (Reset)

The current fault message flashes (for example, F1 09). It can be acknowledged with the BACK/RESET key or by actuating DI3 (by default control signal terminal 10). The display automatically changes from the flashing indication through four horizontal lines (Reset) to the continuous display of the fault message. The arrow tip ▲ under FAULT goes out.

DANGER

When a start signal is applied, the drive restarts automatically if P3.1 = 0 is set (REAF = restart after fault) and when the fault message has been acknowledged (Reset).

The current fault message indication (F1…) is cleared when the power supply is interrupted or when you press the BACK/RESET key and then the OK key (indication d…) and then the BACK/RESET key again. The indication goes out and the arrow tip ◀ flashes at menu level MON.

Fault log (FLT)

The last nine faults can be called up and shown in succession in the fault log (FLT).

To do this, select menu level FLT (▲). With arrow keys ∧ and ∨ you can separately call up faults F1 to F9. Each fault is saved together with the time at which it occurred: d (day), H (hour) and m (minute). To select a fault message, use arrow keys ∧ and ∨ and OK.

The content of the fault memory is cleared when the default settings are reloaded. When you press the BACK/RESET key, the menu level indication (◀) flashes and you then hold the STOP key for about 5 seconds.

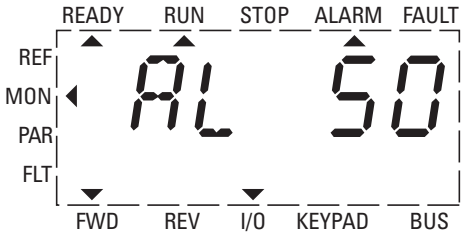
→ When the default settings are loaded, all parameters are reset!

Alarm messages

A warning message warns of possible damages and indicates threatening faults, which can still be avoided, for example in the event of excess temperature.

Warning messages appear on the display with an arrow ▲ under ALARM and AL with the respective code number. The code numbers for faults and warning messages are identical.

Figure 8. Example of an Alarm Message



→ If a warning message occurs, the variable frequency drive remains active (READY, RUN).

In the given example (AL 50 = current set point signal 4–20 mA interrupted), the drive stops following the absence of a reference value. If no more measures are introduced because of the warning message (e.g., a shutdown), the drive can start again automatically in the example AL 50 when the current signal returns (e.g., a contact fault in the signal line).

The alarm message (AL) is displayed alternating with the active operational display value.

Table 6 shows the error code, the possible causes, and indicates corrective measures.

Table 6. List of Fault Messages (F) and Warning Messages (AL)

Display	Designation	Possible Cause	Instructions
01	Overcurrent	The variable frequency drive has detected an excessive current (> 4 x I_N) in the motor cable Sudden load increase Short circuit in motor cable Inadequate motor	Check the load Check the motor size Check the cable
02	Overvoltage	The DC bus voltage has exceeded the internal safety limit The delay time is too short High overvoltage peaks in line power	Increase braking time
03	Ground fault	An additional leakage current was detected when starting by means of a current measurement Insulation fault in the cables or in the motor	Check the motor cable and the motor
08	System fault	Component fault Malfunction	Reset the fault and restart. If the fault occurs again, please contact your Eaton representative or call 877-ETN-CARE (386-2273).
09	Undervoltage	The DC bus voltage is operating below voltage level. Probable cause: The supply voltage is too low Internal device fault Power failure	If a brief power failure takes place, reset the fault and restart the variable frequency drive Check the supply voltage. If it is OK, there is an internal fault. If this is the case, please contact your Eaton representative or call 877-ETN-CARE (386-2273).
13	Under-temperature	The IGBT switch temperature is below –10ºC.	Check the ambient temperature
14	Over-temperature	The IGBT switch temperature is above 120ºC. An excessive temperature warning is issued if the IGBT switch temperature goes above 110ºC.	Make sure that there is an unobstructed flow of cooling air Check the ambient temperature Make sure that the switching frequency is not too high in relation to the ambient temperature and to the motor load
15	Stall protection	The motor blocking protection mechanism has been triggered.	Check the motor
16	Motor over-temperature	The variable frequency drive's motor temperature model has detected motor overheating. The motor is overloaded.	Decrease the motor load. If the motor is not overloaded, check the temperature model parameter.
22	EEPROM checksum error	Error when storing parameters Malfunction Component fault Error in microprocessor monitoring	Please contact your Eaton representative or call 877-ETN-CARE (386-2273).
25	Watchdog	Error in microprocessor monitoring Malfunction Component fault	Reset the fault and restart. If the fault occurs again, please contact your Eaton representative or call 877-ETN-CARE (386-2273).

Table 6. List of Fault Messages (F) and Warning Messages (AL), continued

Display	Designation	Possible Cause	Instructions
34	Internal communication error	Environment interferences or faulty hardware	If the fault occurs again, please contact your Eaton representative or call 877-ETN-CARE (386-2273).
35	Application error	The application is not working.	Please contact your Eaton representative or call 877-ETN-CARE (386-2273).
50	4 mA fault (Analog input)	Selected signal range: 4 – 20 mA ⟶ parameter P2.1 Current less than 4 mA or voltage below 2V Signal line interrupted The signal source is faulty	Check the analog input's current source and circuit.
51	External fault	Error message on digital input. The digital input was programmed as an input for external error messages. The input is active.	Check the programming and check the device indicated by the error message Check the cabling for the respective device as well
53	Field bus error	The communication link between the master device and the drive's field bus has been interrupted.	Check the installation. If the installation is OK, please contact your Eaton representative or call 877-ETN-CARE (386-2273).
54	Slot fault	Connection not good	Check connection between API board and fieldbus board
55	Thermistor Fault	Error message due to external thermistor triggered.	Check the programming and check the device indicated by the error message. Check the cabling for the respective device as well
70	Softfill Fault	System feedback did not meet the required flow in set period of time on startup.	Check the programming and check the device indicated by the error message. Check the system to validate no issue as well. Check the respective cabling and feedback sensor.
71	Broken Pipe Fault	System feedback did not meet the required flow in set period of time.	Check the programming and check the device indicated by the error message. Check the system to validate no issue as well. Check the respective cabling and feedback sensor.
72	Low PID Feedback Fault	System feedback fell below the minimum PID Feedback level.	Check the programming and check the device indicated by the error message. Check the system to validate no issue as well. Check the respective cabling and feedback sensor.
73	High PID Feedback Fault	System feedback went below the minimum PID Feedback level.	Check the programming and check the device indicated by the error message. Check the system to validate no issue as well. Check the respective cabling and feedback sensor.
74	Prime Loss Fault	System feedback did not meet the required flow in set period of time and is below set power rating.	Check the programming and check the device indicated by the error message. Check the system to validate no issue as well. Check the respective cabling and feedback sensor.
80	Contactor Interlock Fault	Error message on digital input. The digital input was programmed as an input for Contactor Interlock Open messages. The input did not active in set delay time.	Check the programming and check the device indicated by the error message. Check the cabling for the respective device as well.
82	CPX Temp Open Fault	Error message on digital input. The digital input was programmed as an input for CPX Temp Open messages. The input did not active in set delay time.	Check the programming and check the device indicated by the error message. Check the cabling for the respective device as well.

Step 6—Parameters

Control unit

The following figure shows and indicates the elements of the M-Max's Series integrated control unit.

Figure 9. View: Control Unit With LCD Display, Function Keys, and Interface

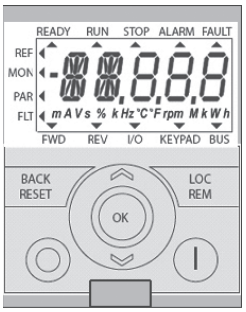
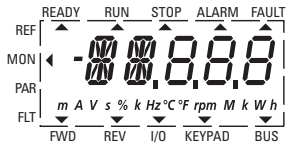
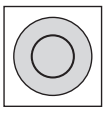
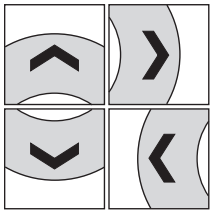


Table 7. Control Unit Elements

Operating Unit Element	Explanation	Operating Unit Element	Explanation
	Backlit liquid crystal display (LCD) Plain text with alphanumeric characters		Select function and parameter Reduce numerical value
	Acknowledge fault message (Reset) Activates the selection for the menu levels (◀ flashes)		Switch to individual parameter groups Select individual digits in multi-digit display
	Switch between the different control levels (I/O – KEYPAD – BUS)		
	Select function and parameter Increase numerical value		Stops the running motor (P6.16) With the menu level active (◀ flashing) you can load the default settings (press and hold the key for five seconds). This clears the fault memory (FLT).
	Confirm and activate selection (store) Lock display		Motor start with selected direction of rotation (only active in KEYPAD control level)
			Interface for communication (Option: MMX-COM-PC)

→ Actuating the arrow keys causes the active value to increase or decrease the parameter number or the function by one unit.

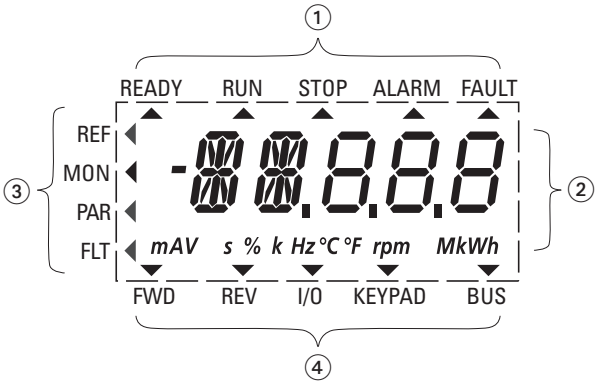


If you hold one of the two arrow keys pressed, the respective units increase or decrease automatically.

Display unit

The following shows the display unit (LCD display with all display elements).

Figure 10. LCD Display (Areas)



The display unit consists of a backlit liquid crystal display (LCD). It is divided into four areas:

Table 8. Areas of the LCD Display

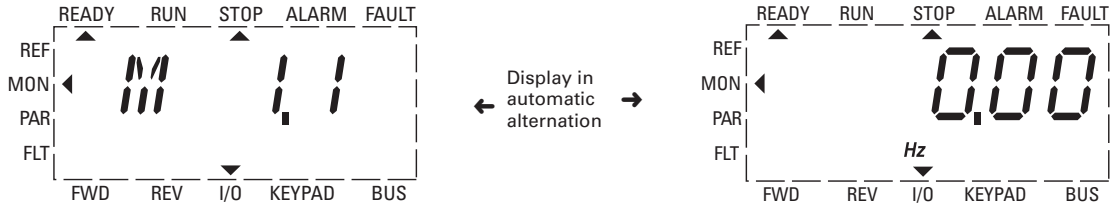
Area		Description
1	Status display	The arrowheads (▲) on the top border show information regarding the drive: READY = Ready to start RUN = Operating notification STOP = Stop, stop command activated ALARM = Alarm message activated FAULT = The drive has been stopped due to an error message.
2	Plain text display	Two 14- and three 7-segment blocks for displaying: AL = Alarm message F = Error messages M = Measurement value (operating data) P = Parameter numbers S = System parameter **-** = Counterclockwise field of rotation (REV) The respective units of measurement are displayed in the bottom line.
3	Menu level	The arrowhead (◀) shows the selected main menu: REF = Set point input (Reference) MON = Operational data indicator (Monitor) PAR = Parameter levels FLT = Fault log (Fault)
4	Control commands	The arrowhead (▼) points to the selected rotating field direction and the active control level: FWD = Clockwise rotating field (Forward Run) REV = Counterclockwise rotating field (Reverse Run) I/O = Via control terminals (Input/Output) KEYPAD = Via control unit BUS = Via field bus (interface)

General information on menu navigation

By applying the specified supply voltage to the connection terminal L2/N and L3 (MMX11), L1 and L2/N (MMX12) or L1, L2/N and L3 (MMX32, MMX34), the variable frequency drive automatically runs the following functions:

- The lighting of the LCD display is switched on and all segments are actuated briefly.
- After the self-test, the top status line of the LCD display indicates that the device is ready to start and proper operation by an arrow ▲ under READY. The arrow under STOP indicates that there is no start command (FWD or REV).
- The arrow ▼ in the bottom status line shows the actuation via control signal terminals with the factory setting on I/O Control (Control Input/Output). The arrow over FWD (Forward) indicates the basic rotational direction (phase sequence for a clockwise rotating field) on the output terminals U/T1, V/T2 and W/T3).
- Display for the operating data M1.1 and 0.00 Hz (output frequency) in automatic alternating sequence. The arrow ◀ in the left-hand status line indicates menu level MON (Monitor = Operating data display).

Figure 11. Operational Data Indicator (Operational)



By actuating the OK button, you can set the alternating display mode to stay on the output frequency (0.00 Hz).

Setting parameters

The following table shows an example of how you can select and set parameters.

Table 9. LCD Display in Operation

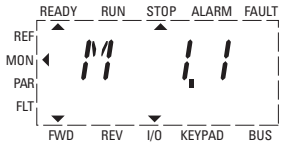
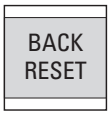
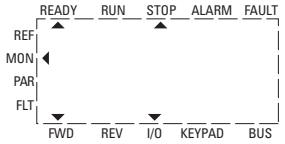
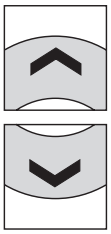
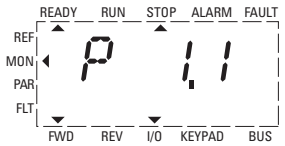
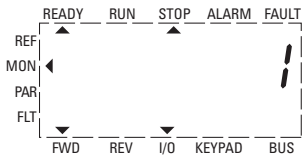
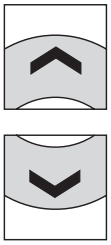
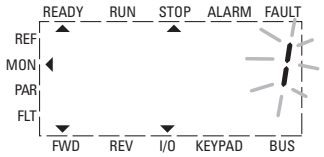
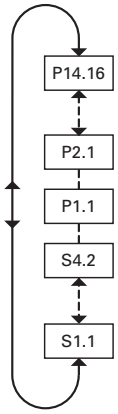
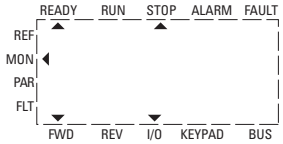
Sequence	Commands	Display	Description
0			Measured value 1.1 The display changes automatically with the value of the output frequency 0.00 Hz (at STOP).
1			By actuating the BACK/RESET button, you activate the menu level (arrow flashes).
			You can select the individual main menus with the two arrow keys (closed circuit): REF = Set point input (Reference) MON = Operational data indicator (Monitor) PAR = Parameter levels FLT = Fault log (FAULT)
			Use the OK button to open the selected main menu.
2		 ↓ Display in automatic alternation ↑	The numerical first value is always shown from the selected main menu. Example: Main menu PAR, Parameter P1.1 The display automatically switches between the parameter number and the defined value.
			Use the OK button to activate the selected parameter. The value (1) flashes.
3			If the parameter value is flashing, you can use the two arrow keys to change the value within the permitted range.

Table 9. LCD Display in Operation, continued

Sequence	Commands	Display	Description
	OK		The selected value is confirmed with the OK button. The display now changes automatically between the new value and the respective parameter number.
4			The other parameters in the main menu PAR can be selected with the two arrow keys (closed circuit, Example: Factory setting).
			
			
5	BACK RESET		By actuating the BACK/RESET button, you exit main menu PAR (arrow flashes, see sequence 1)

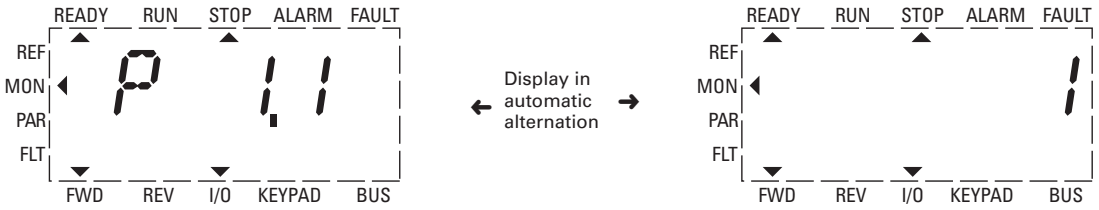
→ All settings are stored automatically by actuating the OK button.

→ Parameters marked in column "Access right RUN" with ✔ can be changed during operation (RUN mode).

Parameter menu (PAR)

You have access to all M-Max Series parameters in the parameter menu (PAR) (see "List of parameters" on **Page 22**).

Figure 12. Parameter Menu (P1.1 = 1, Quick-Configuration)



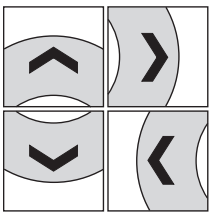
➔ The parameter menu always starts with parameter P1.1.

Quick start wizard

The quick-start wizard guides you in the quick configuration through all important settings that have to be made or that you should check for your application. The parameters that are called during the process are listed in **Table 11** on **Page 22** in column Basic (Standard Drive).

➔ The process is run from parameter to parameter. Returning is not possible here.

In the quick-configuration, the OK button activates the individual parameter values and then moves on to the next parameter. Every parameter always shows the value that is set in alternating sequence. By actuating the OK button again, you activate the value (value flashes).



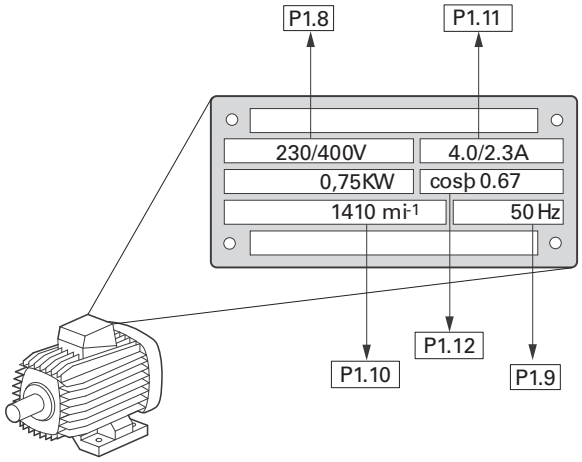
In the quick-configuration, the arrow keys have a limited functionality (changing parameter values).

The quick configuration is completed when the frequency display M1.1 is activated automatically. Selecting the PAR main menu again enables you to call up the parameters of the quick configuration.

Example: Motor parameters (P1)

For optimal operation, you should enter the ratings plate information for the motor here. This information makes up the base values for the motor controller (electrical reproduction).

Figure 13. Motor Parameters From Ratings Plate

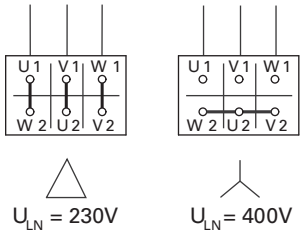


The motor data is set to the rated operation data for the variable frequency drive and depends on the performance variables in factory settings (see 1).

When selecting the rating data, take the dependency of the type of switching on the strength of the feeding mains voltage into account:

230V (P1.9) → delta circuit A → P1.11 = 4A
400V (P1.9) → star connection → P1.11 = 2.3A

Figure 14. Circuits (Delta, Star)



Example: Single-phase connection of the MMX12AA4D8… variable frequency drive to a 230V mains voltage. The stator winding of the motor is connected in a delta circuit (motor rated current 4A as per rating plate Figure 13). See 1) in the factory settings.

Required changes for the electrical reproduction for the motor: P1.11 = 4.0, P1.10 = 1410, P1.12 = 0.67

P1.8 = 230V and P1.9 = 50 Hz are the default settings of the MMX12.

List of parameters

Quick configuration (basis)

➔ When first switching on or after activating the default settings (S4.2 = 1), you are guided step by step through the provided parameters by the quick-start assistant. The defined values are confirmed with the OK button or they can be changed to suit your application and the motor data.

In parameter P1.1, you can switch to the specified macro application setting with the quick-start assistant (see **Table 11**).

The quick-start assistant ends this first cycle by automatically switching to frequency display (M1.1 = 0.00 Hz).

By selecting the parameter level (PAR) again, besides the selected parameters for the quick-configuration, the system parameters (S) are also shown in other cycles.

Table 10. Quick Configuration

PNU	ID	Access Right RUN	Designation	Value Range	Factory Setting	User Setting
P1.1	1909	✔	Application	0 = None 1 = Constant Pressure	0	
P1.11	113		Motor Rated Current	0.2 x Ie … 2 x Ie (Motor rating plate)	Ie	
P4.5	359		PID Min Limit	-10000 - P4.6	0	
P4.6	360		PID Max Limit	P4.5 - 10000	100	

Table 11. Predefined Differences in Application Parameters From Parameter P1.1

Parameters	Designation	None	Constant Pressure
P1.1	Application	0 = None	1 = Constant Pressure
P1.2	Min Frequency	0.00 Hz	42.00 Hz
P1.3	Max Frequency	50.00 Hz	60.00 Hz
P1.4	Min Frequency Ramp Time	0.0 s	0.1 s
P1.5	Acceleration Time 1	3.0 s	1.0 s
P1.6	Deceleration Time 1	3.0 s	1.0 s
P1.9	Nominal Frequency of Motor	1440	1750
P1.16	Remote Reference	3 = AI1	6 = PID
P4.4	PID Decimal	1	0
P4.27	Low Feedback Level	varies	30
P4.29	High Feedback Level	varies	100
P4.30	Sleep Frequency	20.0 Hz	42.0 Hz
P4.31	Sleep Delay	30 s	50 s
P4.32	Wake Up Limit	varies	5
P4.33	Wake Up Action	0 = Below level	2 = Below Setpoint level
P5.6	Prime Loss Fault Response	0 = No Action	2 = Fault, Coast
P5.8	Prime Loss Low Level	0	50
P5.9	Prime Loss High Level	0	70
P6.2	Acceleration Time 2	10 s	1 s
P6.3	Deceleration Time 2	10 s	1 s
P6.7	DC Braking Current	0 A	1.7 A
P7.4	Field Weakening Point	50.0 Hz	60.0 Hz
P7.6	v/hz Curve Midpoint Frequency	50.0 Hz	60.0 Hz
P8.17	Motor Memory Mode	0	2

All Parameters

➔ When first switching on or after activating the default settings (S4.2 = 1) parameter P1.1 must be set to 0 for access to all parameters.

Table 12. G1 Basic Parameters

Code	Parameter	Min.	Max.	Unit	Default	Macro 1	ID	Notes
P1.1	Application	0	1		0	1	1909	0 = None 1 = Constant Pressure
P1.2	Min frequency	0	P1.3	Hz	0	42	101	
P1.3	Max frequency	P1.2	320	Hz	50	60	102	**Note**: If f_{max} > than the motor synchronous speed, check suitability for motor and drive system.
P1.4	Min Freq Ramp Time	0	3000	s	0	0.1	115	When set to 0 follow normal accel time.
P1.5	Acceleration time 1	0.1	3000	s	3	1	103	
P1.6	Deceleration time 1	0.1	3000	s	3	1	104	
P1.7	Current limit	0.1 x I_h	2 x I_h	A	I_L	I_L	107	I_h is the nominal current rating of the inverter.
P1.8	Nominal voltage of the motor	180	500	V	MMX-2: 230V MMX-4: 460V MMX-5: 575V	MMX-2: 230V MMX-4: 460V MMX-5: 575V	110	Motor nameplate value.
P1.9	Nominal frequency of the motor	30	320	Hz	60	60	111	Motor nameplate value.
P1.10	Nominal speed of the motor	300	20000	rpm	1440	1776	112	Motor nameplate value.
P1.11	Nominal current of the motor	0.1 x I_h	2 x I_h	A	I_h	I_h	113	Check the rating plate of the motor.
P1.12	Power Factor	0.3	1		0.85	0.85	120	Check the rating plate of the motor.
P1.13	Local control Source	1	3		2	2	172	1 = I/O Terminal 2 = Keypad 3 = Fieldbus
P1.14	Remote control Source	1	3		1	1	173	1 = I/O Terminal 2 = Keypad 3 = Fieldbus
P1.15	Local reference	0	6		1	1	174	0 = Preset Speed 0 1 = Keypad 2 = Fieldbus 3 = AI1 4 = AI2 5 = AI1/AI2 Sel 6 = PID
P1.16	Remote Reference	0	6		3	6	175	See P1.12

Table 13. G2 Input Signals

Code	Parameter	Min.	Max.	Unit	Default	Macro 1	ID	Notes
P2.1	Start/Stop logic selection	0	3		0	0	300	0 = Forw-Rev (Auto- Restart) 1 = Start-Rev 2 = StartP-StopP 3 = Forw-Rev
P2.2	DIN 1 Function	0	22		1	1	200	0 = Not used 1 = Start Signal 1 2 = Start Signal 2 3 = Run Enable 4 = Reverse 5 = Preset Speed 1 6 = Preset Speed 2 7 = Preset Speed 3 8 = Fault Reset 9 = External Fault Normally Open 10 = External Fault Normally Closed 11 = Accel/Decel Time Select 12 = Accel/Decel Prohibit 13 = DC Brake 14 = Jog Speed 15 = AI1/AI2 Select 16 = Force Local 17 = Force Remote 18 = Parameter Set Select 19 = CPX Temp Open 20 = Output Contactor Interlock 21 = PID Setpoint Select 22 = Derag
P2.3	DIN 2 Function	0	22		2	2	201	See P2.2
P2.4	DIN 3 Function	0	22		8	8	202	See P2.2
P2.5	DIN 4 Function	0	22		14	14	203	See P2.2
P2.6	DIN 5 Function	0	22		9	9	204	See P2.2
P2.7	DIN 6 Function	0	22		17	17	205	See P2.2
P2.8	AI1 signal range	0	1		0	0	320	0 = 0–100% 1 = 4 mA/20%–100%
P2.9	AI1 custom minimum setting	-100	100	%	0	0	321	
P2.10	AI1 custom maximum setting	-100	100	%	100	100	322	
P2.11	AI1 filter time	0	10	s	0.1	0.1	324	0 = No filtering
P2.12	AI2 signal range	0	1		1	1	325	0 = 0–100% 1 = 4mA/20%–100%
P2.13	AI2 custom minimum setting	-100	100	%	0	0	326	
P2.14	AI2 custom maximum setting	-100	100	%	100	100	327	
P2.15	AI2 filter time	0	10	s	0.1	0.1	329	0 = No filtering
P2.16	Preset Speed 0	P1.2	P1.3	Hz	5	6	104	
P2.17	Preset Speed 1	P1.2	P1.3	Hz	10	12	105	
P2.18	Preset Speed 2	P1.2	P1.3	Hz	15	18	106	
P2.19	Preset Speed 3	P1.2	P1.3	Hz	20	24	126	
P2.20	Preset Speed 4	P1.2	P1.3	Hz	25	30	127	

Table 13. G2 Input Signals, continued

Code	Parameter	Min.	Max.	Unit	Default	Macro 1	ID	Notes
P2.21	Preset Speed 5	P1.2	P1.3	Hz	30	36	128	
P2.22	Preset Speed 6	P1.2	P1.3	Hz	40	48	129	
P2.23	Preset Speed 7	P1.2	P1.3	Hz	50	60	130	
P2.24	Jog Speed Ref	P1.2	P1.3	Hz	20	20	124	

Table 14. G3 Output Signals

Code	Parameter	Min.	Max.	Unit	Default	Macro 1	ID	Notes
P3.1	Digital output 1 function	0	28		1	1	250	0 = Not used 1 = Ready 2 = Run 3 = Fault 4 = Fault inverted 5 = Warning 6 = Ext. fault or warning 7 = Ref. fault or warning 8 = Unit Over Temp Warning 9 = Reverse 10 = Unrequested Direction 11 = At speed 12 = Jog Speed 13 = Remote Active 14 = Freq. limit 1 superv. 15 = Freq. limit 2 superv. 20 = Motor Regulator 21 = Fieldbus input data 1 22 = Fieldbus input data 2 23 = Fieldbus input data 3 24 = Fieldbus input data 4 25 = Fieldbus input data 5 28 = SoftFill Active
P3.2	DO1 Invert	0	1		0	0	1458	0 = No Inversion 1 = Inverted
P3.3	On delay	0	320	s	0	0	260	0.00 = delay not in use
P3.4	Off delay	0	320	s	0	0	261	0.00 = delay not in use
P3.5	Relay Output 1 function	0	28		2	2	251	See P3.1
P3.6	RO1 Invert	0	1		0	0	1331	0 = No Inversion 1 = Inverted
P3.7	On delay	0	320	s	0	0	262	0.00 = delay not in use
P3.8	Off delay	0	320	s	0	0	263	0.00 = delay not in use
P3.9	Relay Output 2 function	0	28		3	3	252	See P3.1
P3.10	RO2 Invert	0	1		0	0	1332	0 = No Inversion 1 = Inverted
P3.11	On delay	0	320	s	0	0	264	0.00 = delay not in use
P3.12	Off delay	0	320	s	0	0	265	0.00 = delay not in use
P3.13	Output frequency limit 1 supervision	0	2		0	0	315	0 = No limit 1 = Low limit supervision 2 = High limit supervision
P3.14	Output frequency limit 1; Supervised value	0	P1.3	Hz	0	0	316	

Table 14. G3 Output Signals, continued

Code	Parameter	Min.	Max.	Unit	Default	Macro 1	ID	Notes
P3.15	Output frequency limit 2 supervision	0	2		0	0	346	0 = No limit 1 = Low limit supervision 2 = High limit supervision
P3.16	Output frequency limit 2; Supervised value	0	P1.3	Hz	0	0	347	
P3.17	Current Supv Val	0	3000	A	0	0	1907	
P3.18	Analog output 1 function	0	4		1	1	307	0 = Not used 1 = Output freq. (0 – f_{max}) 2 = Motor current (0 – InMotor) 3 = Motor torque (0 – TnMotor) 4 = PID Controller
P3.19	Analog output 1 filter time	0.01	10	s	0.1	0.1	308	0 = No filtering
P3.20	Analog output 1 minimum	0	1		0	0	310	0 = 0 mA 1 = 4 mA
P3.21	Analog output 1 gain	0	200	%	100	100	375	

Table 15. G4 PID

Code	Parameter	Min.	Max.	Unit	Default	Macro 1	ID	Notes
P4.1	PID Controller Gain	0	1000	%	100	100	118	
P4.2	PID Controller I Time	0	320	s	1	1	119	
P4.3	PID Controller D Time	0	10	s	0	0	132	
P4.4	Decimals	0	2		1	0	132	
P4.5	PID Min Limit	-10000	P4.6		0	0	359	
P4.6	PID Max Limit	P4.5	10000		100	100	360	
P4.7	Error Inversion	0	1		0	0	342	0 = Normal 1= Inverted
P4.8	PID Output Filter Time	0	10	s	0	0	1431	
P4.9	Maximum Deviation	0	100	%	100	100	1478	
P4.10	SetPoint Source	0	1		0	0	332	0 = Setpoint source 1 1 = Setpoint source 2
P4.11	Source 1 Sel	0	4		2	2	334	0 = AI1 1 = AI2 2 = Keypad Setpoint 1 3 = Keypad Setpoint 2 4 = Fieldbus Process Data In 1
P4.12	Source 2 Sel	0	4		3	3	335	See P4.11
P4.13	PID Keypad Setpoint 1	P4.14	P4.15		50	50	167	
P4.14	PID SP Source 1 Min	P4.5	P4.15		0	0	361	
P4.15	PID SP Source 1 Max	P4.14	P4.6		100	100	136	
P4.16	PID Keypad Setpoint 2	P4.17	P4.18		50	50	167	
P4.17	PID SP Source 2 Min	P4.5	P4.6		0	0	363	
P4.18	PID SP Source 2 Max	P4.5	P4.6		100	100	364	

Table 15. G4 PID, continued

Code	Parameter	Min.	Max.	Unit	Default	Macro 1	ID	Notes
P4.19	Actual Value Select	0	6		0	0	333	0 = Feedback Source 1 1 = Feedback Source 2 2 = Source 1 + Source 2 3 = Source 1 –Source 2 4 = Source 1 * Source 2 5 = Min (Source 1, Source 2) 6 = Max (Source1, Source 2)
P4.20	Feedback Source 1	0	3		2	2	336	0 = Not Used 1 = AI1 2 = AI2 3 = Fieldbus Process Data In 2
P4.21	Feedback 1 Min Scale	0	100	%	0	0	337	
P4.22	Feedback 1 Max Scale	0	100	%	100	100	338	
P4.23	Feedback Source 2	0	3		0	0	339	See P4.20
P4.24	Feedback 2 Min Scale	0	100	%	0	0	340	
P4.25	Feedback 2 Max Scale	0	100	%	100	100	341	
P4.26	Low Feedback Fault Resp	0	2		0	0	752	0 = No Action 1 = Warning 2 = Fault
P4.27	Low Feedback Level	P4.5	P4.6		varies	30	1007	
P4.28	High Feedback Fault Resp.	0	2		0	0	753	0 = No Action 1 = Warning 2 = Fault
P4.29	High Feedback Level	P4.5	P4.6		vareis	100	1008	
P4.30	Sleep Frequency	0	60	Hz	20	42	1016	
P4.31	Sleep Delay	0	3600	s	30	50	1017	
P4.32	Wake Up Limit	P4.5	P4.6		varies	5	1018	
P4.33	Wake Up Action	0	3		0	2	1019	0 = Below Level 1 = Above Level 2 = Below Setpoint –Level 3 = Above Setpoint + Level
P4.34	Sleep Boost	P4.5	P4.6		varies	varies	1020	

Table 16. G5 Pump Control

Code	Parameter	Min.	Max.	Unit	Default	Macro 1	ID	Notes
P5.1	Pump Prime Enable	0	2		0	0	1001	0 = Disabled 1 = Level 2 = Run for time specified in Delay
P5.2	Pump Prime Freq	P1.2	P1.3	Hz	20	20	1002	
P5.3	Pump Prime Limit	P4.5	P4.6		varies	varies	1003	
P5.4	Pump Prime Timeout	0	3600	s	0	0	1004	
P5.5	Pump Prime Fault Response	0	2		2	2	750	0 = No Action 1 = Warning 2 = Fault, Coast
P5.6	Prime Loss Fault Response	0	2		0	2	761	0 = No Action 1 = Warning 2 = Fault, Coast

Table 16. G5 Pump Control, continued

Code	Parameter	Min.	Max.	Unit	Default	Macro 1	ID	Notes
P5.7	Prime Loss Detection	1	3		2	2	762	1 = Motor Current 2 = Motor Power 3 = Motor Torque
P5.8	Prime Loss Low Level	0	1000	P5.7	0	50	763	
P5.9	Prime Loss High Level	0	1000	P5.7	0	70	764	
P5.10	Prime Loss Delay	0	3600	s	10	10	765	
P5.11	Broken Pipe Fault Response	0	2		0	0	751	0 = No Action 1 = Warning 2 = Fault, Coast
P5.12	Broken Pipe Level	P4.5	P4.6		varies	varies	1006	
P5.13	Broken Pipe Frequency	0	P1.3	Hz	55	55	1005	
P5.14	Broken Pipe Delay	0	320	s	10	10	1496	
P5.15	De-Rag Function	0	4		0	0	766	0 = Not Used 1 = On Start 2 = On Start And Stop 3 = Digital Input 4 = Current Level
P5.16	De-Rag Cycles	0	10		3	3	774	1 = Motor Current 2 = Motor Power 3 = Motor Torque
P5.17	De-Rag Speed FWD	0	P1.3	Hz	20	20	767	1 = Motor Current 2 = Motor Power 3 = Motor Torque
P5.18	De-Rag Speed REV	0	P1.3	Hz	20	20	768	
P5.19	De-Rag On Time	0	3600	s	5	5	769	
P5.20	De-Rag Off Time	0	3600	s	5	5	770	
P5.21	Current Level	0	3.4	A	0	0	773	
P5.22	Back Spin Delay	0	3600	s	0	0	1497	
P5.23	Minumim Run Time	0	3600	s	0	0	1494	

Table 17. G6 Drive Control

Code	Parameter	Min.	Max.	Unit	Default	Macro 1	ID	Notes
P6.1	Ramp shape	0	10	s	0	0	500	0 = Linear >0 = S-curve ramp time
P6.2	Acceleration time 2	0.1	3000	s	10	1	502	
P6.3	Deceleration time 2	0.1	3000	s	10	1	503	
P6.4	Brake chopper	0	4		0	0	504	0 = Disabled 1 = Used when running 2 = Used when stopped and Running
P6.5	Start function	0	1		0	0	505	0 = Ramp 1 = Flying start
P6.6	Stop function	0	1		0	0	506	0 = Coasting 1 = Ramp
P6.7	DC braking current	0.34	3.4	A	0	1.7	507	
P6.8	DC braking time at stop	0	600	s	0	0	508	0 = DC brake is off at stop

Table 17. G6 Drive Control, continued

Code	Parameter	Min.	Max.	Unit	Default	Macro 1	ID	Notes
P6.9	Frequency to start DC braking during ramp stop	0.1	10	Hz	1.5	1.5	515	
P6.10	DC braking time at start	0	600	s	0	0	516	0 = DC brake is off at start
P6.11	Brake Chopper Threshold	0	911	V	797	797	1447	
P6.12	Skip frequency range 1 low limit	0	P6.13	Hz	0	0	509	
P6.13	Skip frequency range 1 high limit	P6.12	P1.3	Hz	0	0	510	0 = Skip frequency range 1 not used
P6.14	Skip frequency range 2 low limit	0	P6.15	Hz	0	0	511	
P6.15	Skip frequency range 2 high limit	P6.14	P1.3	Hz	0	0	512	0 = Skip frequency range 1 not used
P6.16	Skip frequency range 3 low limit	0	P6.17	Hz	0	0	513	
P6.17	Skip frequency range 3 high limit	P6.16	P1.3	Hz	0	0	514	0 = Skip frequency range 1 not used

Table 18. G7 Motor Control

Code	Parameter	Min.	Max.	Unit	Default	Macro 1	ID	Notes
P7.1	Motor control mode	0	1		0	0	600	0 = Freq Control 1 = OL SpeedCont
P7.2	V/Hz Boost	0	1		0	0	109	0 = Not used 1 = Automatic torque boost
P7.3	V/Hz Ratio Select	0	2		0	0	108	0 = Linear 1 = Squared 2 = Programmable
P7.4	Field weakening point	30	320	Hz	50	60	602	
P7.5	Voltage at field weakening point	10	200	%	100	100	603	n% x U_{nmot}
P7.6	V/Hz curve midpoint frequency	0	60	Hz	50	60	604	
P7.7	V/Hz curve midpoint voltage	0	100	%	100	100	605	n% x U_{nmot} Parameter max. value = par. 1.6.5
P7.8	Output voltage at zero frequency	0	40	%	0	0	606	n% x U_{nmot}
P7.9	Switching frequency	1.5	16	kHz	6	6	601	
P7.10	Stop On Direction Change from Keypad	0	1		1	1	1600	
P7.11	StopButton Active	0	1		1	1	1474	
P7.12	Reverse Inhibit	0	1		0	0	1429	
P7.13	Keypad Lock	0	1		0	0	1483	
P7.14	Keypad Reference	P1.2	P1.3	Hz	0	0	184	
P7.15	Sine Filter Activated	0	1		0	0	522	

Table 19. G8 Protections

Code	Parameter	Min.	Max.	Unit	Default	Macro 1	ID	Notes
P8.1	Ref Fault Resp	0	3		1	1	700	0 = No Action 1 = Warning 2 = Fault 3 = Warn:Feedback Source 2
P8.2	Ref Fault Delay	0	10	s	0.5	0.5	1430	
P8.3	Input phase supervision	0	2		2	2	730	0 = No response 1 = Warning 2 = Fault
P8.4	UnderVolt Response	0	2		2	2	748	
P8.5	Earth fault Protection	0	2		2	2	703	
P8.6	Stall protection	0	2		1	1	709	
P8.7	UnderLoad Protection	0	2		0	0	713	
P8.8	Motor Overload	0	2		2	2	704	
P8.9	Motor ambient temperature factor	-20	100	?C	40	40	705	
P8.10	Motor cooling factor at zero speed	0	150	%	40	40	706	
P8.11	Motor thermal time constant	1	200	M	45	45	707	
P8.12	Thermistor	0	0		0	0	1473	
P8.13	UnderLoad Torque	10	150	%	50	50	714	
P8.14	Under Load Zero	5	150	%	10	10	715	
P8.15	Response to fieldbus fault	0	2		2	2	733	
P8.16	Response to slot fault	0	2		2	2	734	
P8.17	Motor Memory Mode	0	2		0	2	1484	0 = off 1 = Constant Mode 2 = Last Value Mode

Table 20. G9 Auto Restart

Code	Parameter	Min.	Max.	Unit	Default	Macro 1	ID	Notes
P9.1	Wait time	0.1	10	s	0.5	0.5	717	
P9.2	Trial time	0	60	s	30	30	718	
P9.3	Start mode	0	2		0	0	719	0 = Ramp 1 = Flying start 2 = According to P6.5
P9.4	Auto Restart Enable	0	1		0	0	731	
P9.5	Tries	1	10		3	3	759	

Table 21. Monitor Menu

Code	Parameter	Unit	ID	Description
V1	Output Frequency	Hz	1	Output frequency to motor
V2	FreqRreference	Hz	25	Frequency reference to motor control
V3	Motor Speed Rpm	rpm	2	Motor speed in rpm
V4	Motor Current	A	3	
V5	Motor Torque	%	4	In % of nominal torque
V6	Motor Power	%	5	Motor shaft power in %
V7	Motor Voltage	V	6	
V8	DC-Bus Voltage	V	7	
V9	Unit Temperature	∞C	8	Heatsink temperature
V10	Motor Temperature	%	9	Calculated motor temperature
V11	Analog Input 1	V	13	AI1
V12	Analog Input 2	mA	14	AI2
V13	Analog Iout	mA	26	AO1
V14	DIN1, DIN2, DIN3		15	Digital input status
V15	DIN4, DIN5, DIN6		16	Digital input status
V16	DO1,RO1,RO2		17	Relay Output Status
V18	PID Setpoint	Varies	20	
V19	PID Error	Varies	22	
V17	PID Feedback	Varies	21	
V20	PID output	%	23	

Parameters marked with "M" (Monitor) are values currently being measured, variables calculated from these measured values, or status values from control signals. They cannot be edited.

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