>pDRIVE<

Operating instructions Modbus

- **>pDRIVE<** *MX* ***eco*** 4V
- >pDRIVE< *MX* ***pro*** 4V
- >pDRIVE< *MX* ***pro*** 6V
- **>pDRIVE<** *MX* ***multi-eco***
- >pDRIVE< *MX* ***multi-pro***

Modbus

General remarks

The following symbols should assist you in handling the instructions:

Advice, tip !

General information, note exactly !

The requirements for successful commissioning are correct selection of the device, proper planning and installation. If you have any further questions, please contact the supplier of the device.

Capacitor discharge !

Before performing any work on or in the device, disconnect it from the mains and wait at least 15 minutes until the capacitors have been fully discharged to ensure that there is no voltage on the device.

Automatic restart !

With certain parameter settings it may happen that the frequency inverter restarts automatically when the mains supply returns after a power failure. Make sure that in this case neither persons nor equipment is in danger.

Commissioning and service !

Work on or in the device must be done only by duly qualified staff and in full compliance with the appropriate instructions and pertinent regulations. In case of a fault contacts which are normally potential-free and/or PCBs may carry dangerous voltages. To avoid any risk to humans, obey the regulations concerning "Work on Live Equipment" explicitly.

Terms of delivery

The latest edition "General Terms of Delivery of the Austrian Electrical and Electronics Industry Association" form the basis of our deliveries and services.

Specifications in this instructions

We are always anxious to improve our products and adapt them to the latest state of the art. Therefore, we reserve the right to modify the specifications given in this instructions at any time, particular those referring to measures and dimensions. All planning recommendations and connection examples are non-binding suggestions for which we cannot assume liability, particularly because the regulations to be complied depend on the type and place of installation and on the use of the devices.

Regulations

The user is responsible to ensure that the device and its components are used in compliance with the applicable regulations. It is not permitted to use these devices in residential environments without special measures to suppress radio frequency interferences.

Trademark rights

Please note that we do not guarantee that the connections, devices and processes described herein are free from patent or trademark rights of third parties.

Option Modbus for the frequency inverters
>pDRIVE< MX eco

This instructions describe the functions software version APSeco_A04_16 and higher

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The instructions in hand cover the topics operation, parameterization and diagnostics of the *>pDRIVE< MX eco* Modbus interface. Moreover, the principles of the Modbus architecture and their main components are explained in detail.

Use this instructions additionally to the device documentation "Description of functions" and "Mounting instructions".

In order to address an inverter via fieldbus also during mains cut-off (line contactor control, disconnecting switch, ...) the *>pDRIVE< MX eco* has to be supplied with an external 24 V buffer voltage.

When using the Modbus interface only connect pins 4, 5 and 8 in order to avoid malfunction or damage of the *>pDRIVE< MX eco* !

Modbus

Function Modbus

All frequency inverters of the *>pDRIVE< MX eco* range support the fieldbus system Modbus as standard. It is coupled at the RJ45 socket next to the terminals (see chapter "Modbus connection", page 10).

In the Modbus network the frequency inverter is operated as slave. The used profile is designed on the basis of the Profidrive profile VDI/VDE 3689.

Principle function

The data transfer in a Modbus network takes place via the serial device interface (RS485 2-wire) with a master/slave method.

Only the Modbus master can send commands (request) to the other bus subscribers. Depending on the command, the reaction (response) of the individual slave devices is either to send the desired data or to confirm the execution of the desired operation function. During transfer of the data, request and response constantly alternate.

The master sends commands to the slave device. This slave sends data only when prompted to do so by the master device. The data exchange thus follows a fixed scheme. The sequence is always seen from the viewpoint of the Modbus master.

The commands are embedded in the transferred data frame in the form of function codes. The request of the master contains a function code that represents a command to be executed for the slave device. In the process, the transferred data bytes contain all information required for the execution of the command. The error check bytes enable the slave unit to check the integrity of the data received. The response of the slave device contains the function code of the request as an "echo."

The data bytes of the response (slave to master) depend on the function code used and are provided by the slave device. The error check bytes enable the master to check the validity of the received data.

The structure of the sent data is defined in various Modbus protocols.

In addition to the Modbus RTU (master/slave communication in binary code) there are also the formats Modbus-ASCII and Modbus-PLUS.

The *>pDRIVE< MX eco* devices support the Modbus RTU protocol.

Structure of the telegram

The telegram structure of a Modbus frame always consists of the address of the slave being addressed, the desired request code, a data field of variable length and a 16-bit CRC to guarantee data consistency.

The end of the telegram is recognized by a pause ≥ 3.5 bytes. The structure of a byte can be set using parameter D6.12 "Modbus format".

The transfer of the telegrams takes place according to the master/slave system through the entry of the desired slave address in confirmed form. If a value of zero is used as the slave address, the telegram applies for all slaves (broadcast service).

The permissible address range of the individual slaves is 1...247. There may not be two or more devices with the same address at the bus.

To set up a single-point connection (network consists of only one master and one slave), the master can use the address 248. When using this address, the slave responds independent of its address which is set by D6.10.

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Slave address	Request code	Data	CRC 16
1 byte	1 byte	1...126 byte	2 byte

Creating CRC 16

CRC 16 is calculated according to the following method for checking the data security:

- Initialize CRC (16-bit register) to hex FFFF
- Execution from the first to the last byte of the message:

  CRC XOR <byte> → CRC

  Execute (8 times)

  Move CRC by 1 bit to the right

  If output bit = 1, execute CRC XOR A001 hex → CRC.

  End of execution

  End of execution
- The CRC value which is calculated that way is initially transferred with the low-order byte and then with the high-order byte.

Modbus functions / request code

Request code hex	Modbus function	Broadcast	Description	Use
03 hex	Read Holding Registers	No	Reading of a single parameter (16 bit) or a maximum of 63 parameters with consecutive logical address	Parameterization, Process data ZTW + IW
06 hex	Write Single Register	Yes	Writing of a single parameter (16 bit)	Parameterization
08 hex	Diagnostics	No	Service for fieldbus diagnostics (requests with subcodes)	Diagnostics
17 hex	Read/write multiple reg.	No	Request for writing and reading several words with consecutive logical addresses	Process data STW+SW, ZTW + IW

Structure of the Modbus user data

The available request codes of the Modbus provide services for various tasks.

Diagnostic functions (request code hex 08)

Using the request code 08 hex and its subcodes, bus-specific information can be read in order to evaluate the quality of transmission statistically.

Request telegram Master → *>pDRIVE< MX eco*

Slave address	Request	Subcode		Request data		CRC 16	
	08 hex	Hi	Lo	Hi	Lo	Lo	Hi
1 byte	1 byte	2 bytes		2 bytes		2 bytes	

Response telegram *>pDRIVE< MX eco* → Master

Slave address	Response	Subcode		Response data		CRC 16	
	08 hex	Hi	Lo	Hi	Lo	Lo	Hi
1 byte	1 byte	2 bytes		2 bytes		2 bytes	

Subcode	Request data	Response data	Description
00	XX YY	XX YY	The request causes an echo at the respective slave. The response telegram of the slave is a copy of the request telegram.
0A	00 00	00 00	Reset counter
0C	00 00	= actual value of the counter	Reading out the CRC Error Message counter (number of the faulty received telegrams)
0E	00 00	= actual value of the counter	Reading out the telegram counter (number of the telegrams received from the slave, independent of the type of telegram)

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Parameterization of the *>pDRIVE< MX eco* (request code hex 03, 06)

By means of the services Read (03 hex) and Write (06 hex) of parameters all inverter-internal parameters can be accessed via their logical address.

For details, see chapter "Parameterization", page 31.

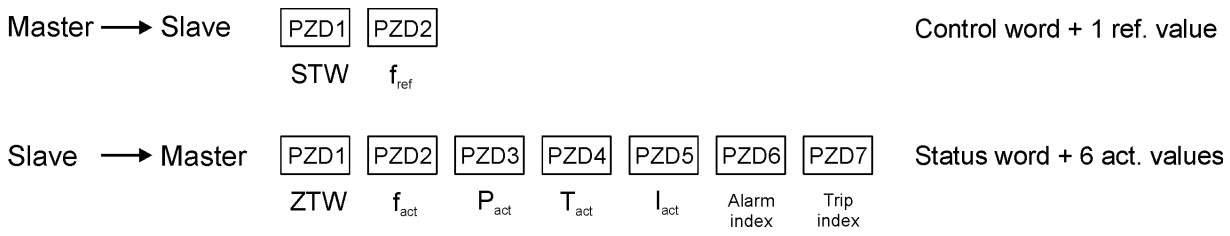
Monitoring and control of the *>pDRIVE< MX eco* (request codes hex 03, 17)

By means of the services Read (03 hex) and Write/Read (17 hex) of multiple registers access to device-internal addresses of the control word and status word as well as to the available reference values and actual values is possible.

Therewith pure monitoring as well as complete control of the *>pDRIVE< MX eco* is possible. The device-internal drive profile is designed on the basis of the Profidrive profile (VDI/VDE 3689).

Unlike the telegram structure predefined by the Profidrive profile (PPO types 1...5), the lengths of the telegrams can be freely defined for both directions (master → slave / slave → master) in Modbus. As a result the telegram length can be optimized according to the existing requirements of the process.

Example of a Modbus user data telegram



Master → *>pDRIVE< MX eco*

For control of the *>pDRIVE< MX eco* the addresses 51D...526 hex are used. The number of the inverter-internal and actually used reference values can be preset by means of parameter D6.100 "No. of Bus-ref. values". The reference values are configured by means of parameters D6.101...D6.133.

Word	PZD1	PZD2	PZD3	PZD4	PZD5	PZD6	PZD7	PZD8	PZD9	PZD10
User data	STW	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8	SW 9
Log. address (hex)	51D	51E	51F	520	521	522	523	524	525	526
Configuration	---	D6.101	D6.105	D6.109	D6.113	D6.117	D6.121	D6.125	D6.129	D6.133

PZD … Process data word

STW … Control word, 16 bit chain of commands. (11 bits corresponding to Profidrive profile, 5 bits freely usable)

SW … Reference value, 16 bit display, -200...+200 %, resolution 2^{-14}

***>pDRIVE< MX eco* → Master**

The addresses FA...103 hex are used to read out information provided by the *>pDRIVE< MX eco* like status word and actual values. The number of the inverter-internal and actually handled actual values can be preset by means of parameter D6.137 "Number actual values". The actual values are configured by means of parameters D6.138...D6.170.

Word	PZD1	PZD2	PZD3	PZD4	PZD5	PZD6	PZD7	PZD8	PZD9	PZD10
User data	ZTW	IW 1	IW 2	IW 3	IW 4	IW 5	IW 6	IW 7	IW 8	IW 9
Log. address (hex)	FA	FB	FC	FD	FE	FF	100	101	102	103
Configuration		D6.138	D6.142	D6.146	D6.150	D6.154	D6.158	D6.162	D6.166	D6.170

PZD … Process data word

ZTW … Status word, 16 bit chain of commands. (11 bits corresponding to Profidrive profile, 5 bits freely usable)

IW … Actual value, 16 bit display, -200...+200 %, resolution 2-14

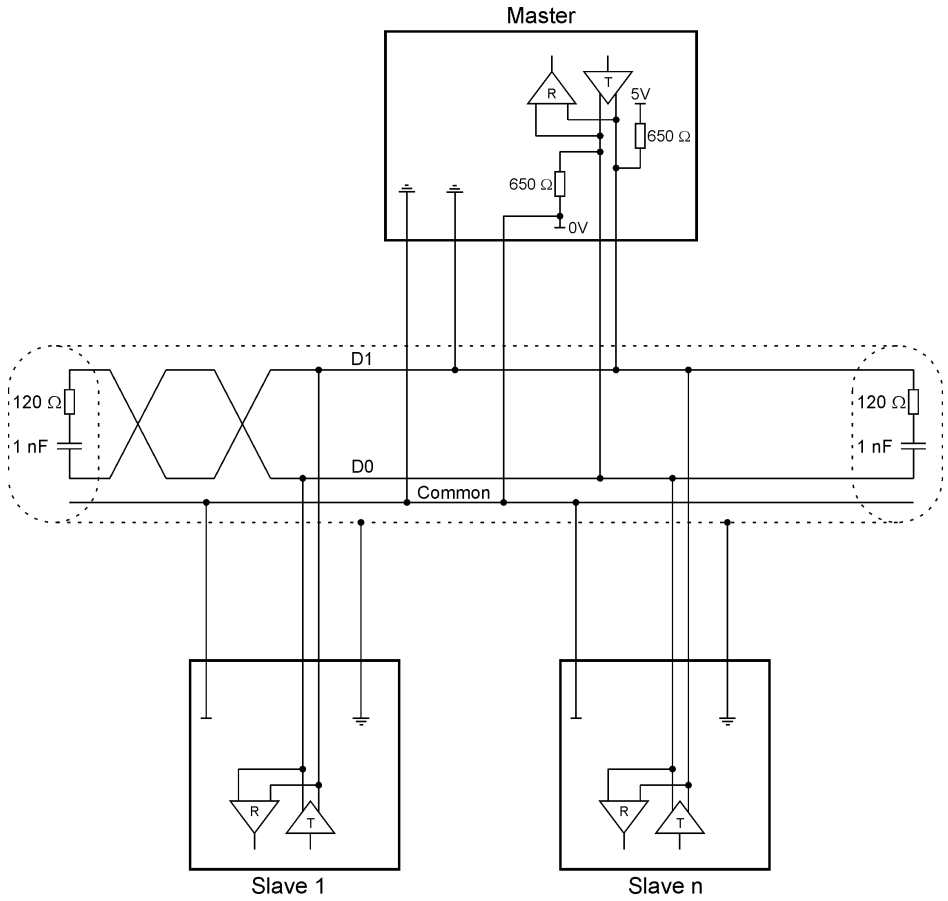
A detailed description of the control word and status word can be found in chapter "Process data area", page 16.

Structure of the network

The typical Modbus topology corresponds to an RS485 2-wire serial bus network with drop lines. The individual subscribers are connected using a 2-wire, screened twisted cable (typ. Cat 5), whereby only the signals D1, D2 and Common are connected.

According to the Modbus recommendations, both bus lines are to be connected with one 650 Ω resistor against 5 V and ground when installing the master. At both ends of the bus segment, the bus cable is to be terminated with a 120 Ω resistor and a serially connected 1 nF capacitor.

At every bus segment, a maximum of 32 subscribers (including repeater) can be operated. The maximum line extension amounts to 1000 m at 19.2 kBaud. Principally, the drop lines must be kept as short as possible (max.. 20 m for a single line, 40 m in total in case of centralized distribution).



Technical key data of a Modbus network	
Maximum number of subscribers:	247 in all segments
Maximum number of subscribers per segment:	32 including the repeater
Bus cable:	Screened, 2 x twisted, two-wire line Characteristic impedance: 100...120 Ω Distributed capacitance: < 60 nF/km Loop resistance: < 160 Ω/km Wire cross-section: > 0.22 mm²
Bus connection:	RJ45 - screened, pin assignment 4, 5, 8
Bus termination:	Every bus segment has to be terminated using a serial connection of R = 120 Ω and C = 1 nF.
Galvanic isolation:	No

Detailed information regarding the Modbus specification can also be found under www.modbus.org (Modbus_over_serial_line_V1.pdf Edition 2002).

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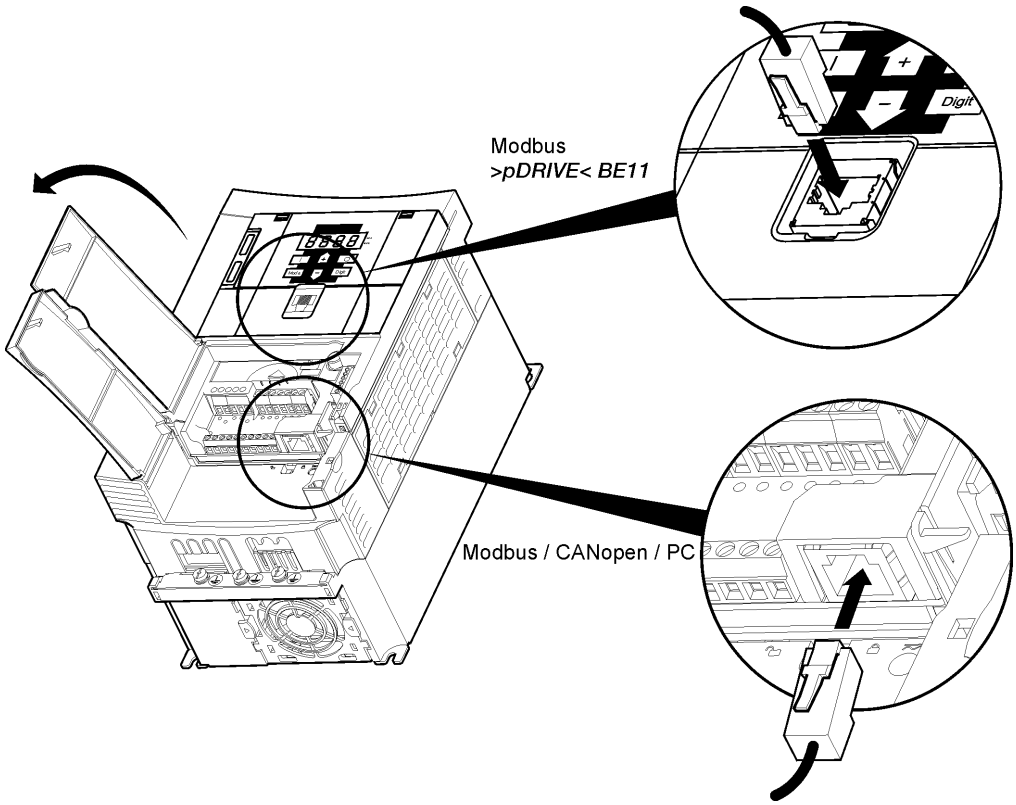
Modbus connection



Plug assignment

Pin assignment of the RJ45 device interface

Socket

8.....1

Pin	Signal
1	CAN_H *)
2	CAN_L *)
3	CAN_GND *)
4	D1
5	D0
6	Not used
7	VP **)
8	Common *)

*) CANopen signals

**) Supply voltage for the Matrix 3 interface converter RS232/485 (8 P01 124)

The RJ45 socket (in the duct next to the control terminals) can be used as serial interface for the fieldbus systems Modbus and CANopen as well as to couple the PC software Matrix 3. When building up a Modbus network, only the signals of pins 4, 5 and 8 may be used.

Consequently, connection is possible in two different ways:

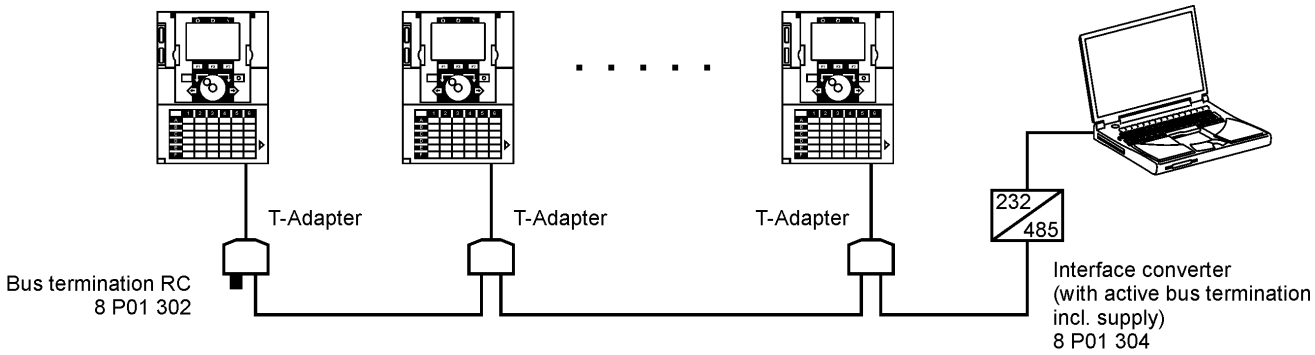
1. Using the optional Modbus T-adapter

The Modbus T-adapter provides two RJ45 sockets for further bus wiring. On both sockets, which are connected in parallel, only pins 4, 5 and 8 are connected so that also pre-assembled cables (1:1 connection) can be used.

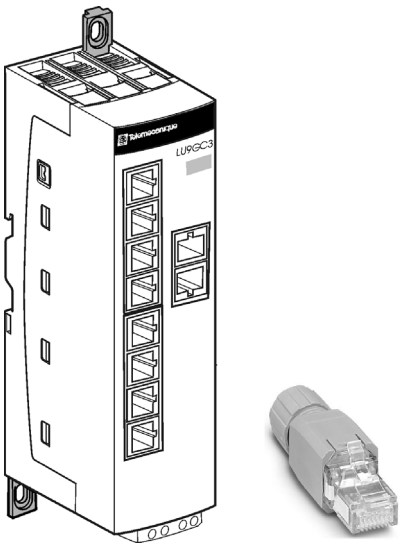
The Modbus T-adapter is available in two different lengths.

8 P01 300 Modbus T-adapter with 0.3 m connecting cable
8 P01 301 Modbus T-adapter with 1 m connecting cable

Example of a bus structure with T-adapter:



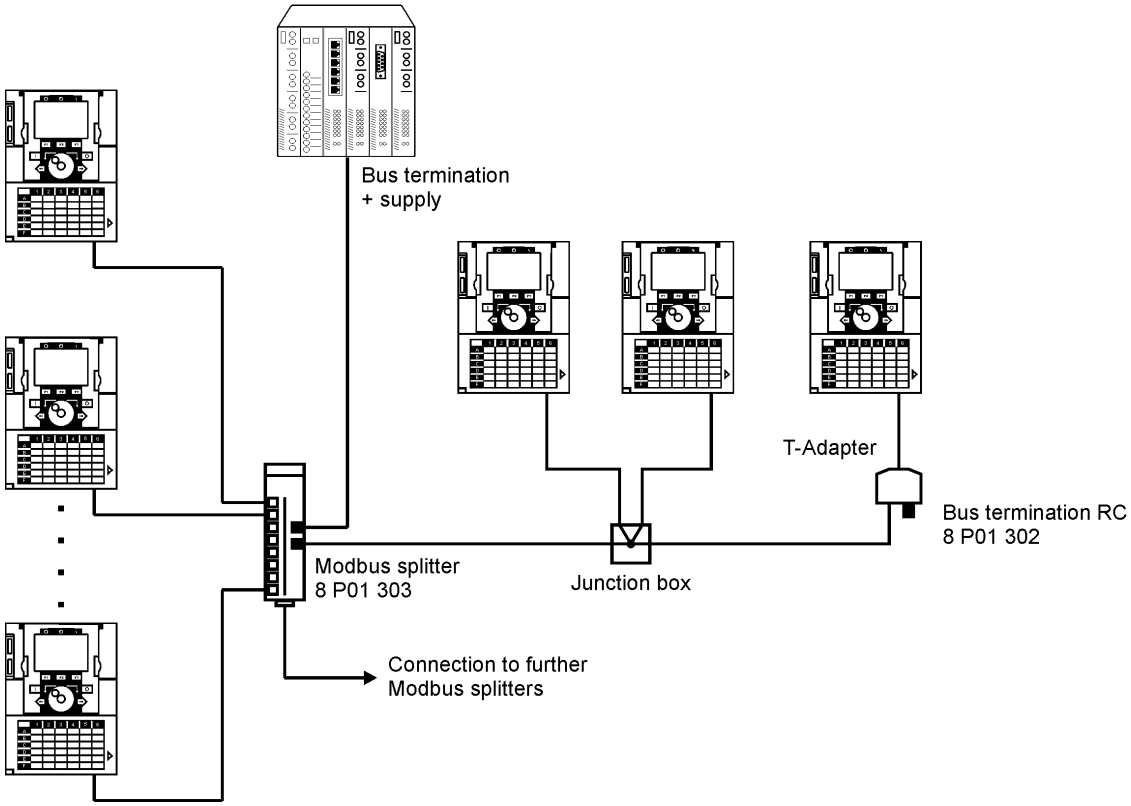
2. Using the optional Modbus splitter or an external junction box



When no Modbus T-adapter is used, please ensure that only the three pins 4, 5 and 8 at the RJ45 connector of the bus connection are connected. Using the PHOENIX CONTACT VARIOSUB RJ45 QUICKON connector is a simple and capable solution to establish a connection between the bus subscriber and the Modbus splitter.

8 P01 303 Passive Modbus splitter
8 P01 306 RJ45 Connector VARIOSUB RJ45 QUICKON

Example of a bus structure with Modbus splitter:



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>pDRIVE< MX Modbus options

Option *>pDRIVE< MODBUS T-ADAP 03*	8 P01 300
Option *>pDRIVE< MODBUS T-ADAP 10*	8 P01 301
Option *>pDRIVE< MODBUS R+C*	8 P01 302
Option *>pDRIVE< MODBUS SPLITTER*	8 P01 303
Option *>pDRIVE< RS232/485*	8 P01 304
Option *>pDRIVE< MODBUS PLUG*	8 P01 305
Option *>pDRIVE< CABLE 3-BE*	8 P01 122
Option *>pDRIVE< CABLE 10-BE*	8 P01 123

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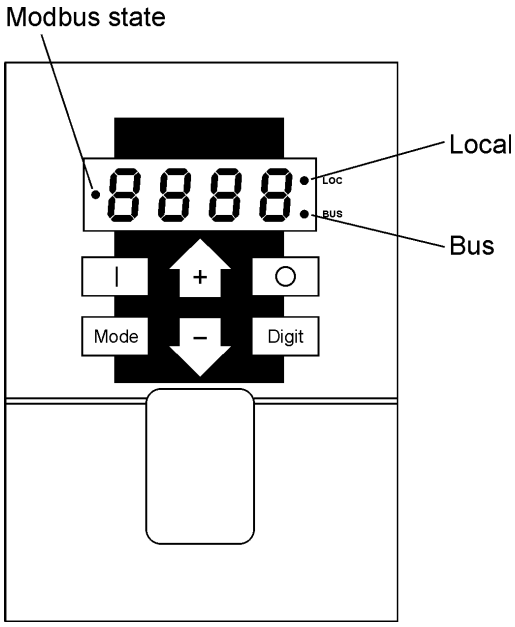
Further recommended Modbus components

Cable LAPPKABEL, UNITRONIC® BUS FD P LD, 2x2 x0.22

When using the Modbus interface only connect pins 4, 5 and 8 in order to avoid malfunction or damage of the *>pDRIVE< MX eco* !

LED - Indicator lamps

Typically the diagnostics of the Modbus connection is executed by means of the matrix operating panel BE11. If no operating panel is available, the actual bus state can be read out also using the built-in LED keypad.



LED		Active control source
Local	Bus	(matrix field E4)
0	0	Terminal operation
1	0	Panel mode
0	1	Fieldbus

LED Modbus state		Bus state
dark		Modbus is not connected or inactive
flashing	100ms	LED flashes proportional to the number of the incoming and outgoing telegrams

Process data area

Process data area

The exchange of process data takes place using the Modbus request telegram code 17 hex. Therefor the status word with 1...9 actual values is sent as a response telegram to the master when the inverter receives a data telegram (consisting of the control word and 1...9 reference values). Typically, these telegrams are sent by the master cyclically to the individual slaves. The achievable cycle time depends on the bus structure, the number of bus subscribers and the transmission rate. Inside the inverter, the data are processed in a background task (typically 10...50 ms).

Example of a process data telegram to the slave with address 10

Read process data: Status word + 6 actual values, log. address of ZTW 250 dec = 00FA hex

Write process data: Control word + 1 reference value, log. address of STW 1309 dec = 051D hex

STW= 047F, SW=4000 hex (100 %)

Master ⟶ Slave	PZD1	PZD2	Control word + 1 ref. value
	STW	f_{ref}	

Slave ⟶ Master	PZD1	PZD2	PZD3	PZD4	PZD5	PZD6	PZD7	Status word + 6 act. values
	ZTW	f_{act}	P_{act}	T_{act}	I_{act}	Alarm index	Trip index	

Request telegram Master → *>pDRIVE< MX eco*

Slave address	Request	Start address "read" (ZTW)		Number of words to be read (ZTW +IW)		Start address "write" (STW)		Number of words to be written (STW + SW)		- - -
	17 hex	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	- - -
1 byte	1 byte	2 bytes		2 bytes		2 bytes		2 bytes		

- - -	Number of "write" bytes	Word 1		- - -	Word X		CRC 16	
- - -		Hi	Lo	- - -	Hi	Lo	Lo	Hi
	1 byte	2 bytes			2 bytes		2 bytes	

Summary of the request telegram

Slave	Code	ZTW address		Number of parameters		STW address		Number of parameters		Number of bytes	Word 1		Word 2		CRC *)	
0A	17	00	FA	00	07	05	1D	00	02	04	04	7F	40	00	39	A3

*) Calculation of the CRC algorithm, see chapter "**Structure of the telegram**", page 4.

Response telegram >*pDRIVE*< *MX eco* → Master

Slave address	Respon se	Number of read bytes	Word 1		- - -	Word X		CRC 16	
	17 hex		Hi	Lo	- - -	Hi	Lo	Lo	Hi
1 byte	1 byte	1 byte	2 bytes			2 bytes		2 bytes	

Summary of the response telegram

Slave	Code	Number of bytes	Word 1		Word 2		Word 3		Word 4		Word 5		- - -
0A	17	0E	01	B7	40	00	20	00	20	00	20	00	- - -

- - -	Word 6		Word 7		CRC	
- - -	00	00	00	00	Lo	Hi

ZTW = 01B7
ITW 1 = 4000hex (f act 100%)
ITW 2 = 4000hex (P act 50%)
ITW 3 = 4000hex (T act 50%)
ITW 4 = 4000hex (I act 50%)
ITW 5 = 0000hex (no alarm)
ITW 6 = 0000hex (no fault)

If the Modbus should be used only for monitoring purposes, the "Read Holding Registers" (Multiple Read) code 03 hex telegram should be used.

In special cases, the individual access to the respective elements of the process data is possible using commands 03 hex, 06 hex, and 10 hex.

The design of the device-internal drive profile is based on the Profidrive profile (VDI/VDE 3689). The standardized information of the control and status word (bits 0...10) require no further inverter-internal settings. The reference use, the assignment of actual values and the use of the free bits (11...15) must be adjusted accordingly in matrix field "D6 Fieldbus".

Also see chapter "Structure of the Modbus user data", page 5.

Control word

Assignment

Bit 15		
Bit 14	5 freely configurable	
Bit 13	control bits for internal or external	
Bit 12	frequency inverter commands	
Bit 11		
Bit 10	Control O.K.	No control
Bit 9	–	–
Bit 8	–	–
Bit 7	Reset	–
Bit 6	Release reference value	Lock reference value
Bit 5	Release ramp integrator	Lock ramp integrator
Bit 4	Release ramp output	Lock ramp output
Bit 3	Release operation	Lock operation
Bit 2	Operating condition	OFF 3 (Fast stop)
Bit 1	Operating condition	OFF 2 (Impulse inhibit)
Bit 0	On	OFF 1
	High = 1	Low = 0

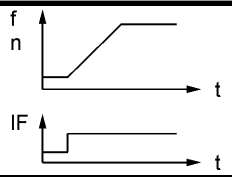
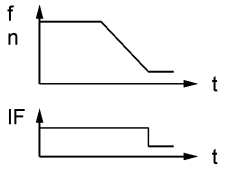
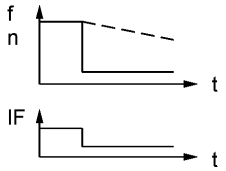
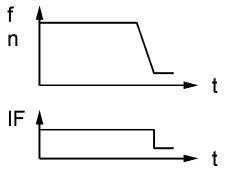
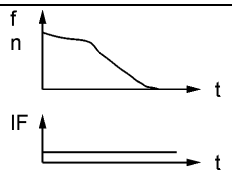
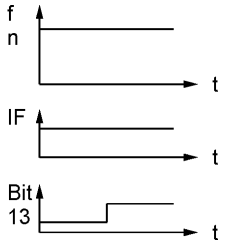
Description of control word bits

Bit	Value	Meaning	Note
0	1	ON	– Is accepted when the drive state is "*1 .. Ready to switch on*" and changes to drive state "*3 Ready to run*" if the DC link is charged. – At active line contactor control: Change to drive state "*2 .. Charge DC link*", after successful charging the drive state changes to "*3 .. Ready to run*".
	0	OFF 1	– When the command has been accepted, the drive state changes to "*13 .. OFF 1 active*" and thus the drive is shut down along the deceleration ramp. – When the output frequency reaches zero Hz: the drive state changes from "*0 .. Not ready to switch on*" to "*1 .. Ready to switch on*" if the basic state (bit 1 = 0, bit 2 = 1, bit 3 = 1 and bit 10 = 1) is present. – If a renewed OFF 1 (On) command occurs during deceleration, the inverter tries to reach the given reference value along the acceleration ramp. Thereby the drive state changes to "*7 .. Run*". – At active line contactor control, the line contactor is switched off if the drive state changes to "*1 .. Ready to switch on*".
1	1	Operating condition	"*OFF 2*" command canceled
	0	OFF 2 (Impulse inhibit)	– When the command has been accepted, the inverter will be locked and the drive state changes to "*19 .. Lock switching-on*". – At active line contactor control the main contactor is switched off. – If the basic state (bit 1 = 0, bit 2 = 1, bit 3 = 1 and bit 10 = 1) is given, the drive state changes to "*1 .. Ready to switch on*". The OFF 2 command can also be triggered by means of the terminal function Impulse enable !
2	1	Operating condition	"*OFF 3*" command canceled
	0	OFF 3	– When the command has been accepted, the drive state changes to "*14 .. OFF 3 active*" and the drive is shut down as quickly as possible with maximum current and maximum DC link voltage. – When the output frequency reaches zero Hz, the drive state changes to "*19 .. Lock switching-on*". – Thereby, at active line contactor control the main contactor is switched off. If the OFF 3 command (bit 2 = 1) is canceled during deceleration, fast stop is executed all the same.

Bit	Value	Meaning	Note
3	1	Operation released	When the command has been accepted, the inverter is released (Impulse enable) in drive state "*3 .. Ready to run*" and afterwards the drive state changes to "*4 .. Operation released*".
	0	Lock operation	– When the command has been accepted, the inverter will be locked and the drive state changes to "*3 .. Ready to run*". – If the drive state is "*13 .. OFF 1 active*", the inverter will be locked and the drive state changes to "*0 .. Not ready to switch on*". – Thereby, at active line contactor control the main contactor is switched off. – If the basic state (bit 1 = 0, bit 2 = 1, bit 3 = 1 and bit 10 = 1) is given, the drive state changes to "*1 .. Ready to switch on*". – If the drive state is "*14 .. OFF 3 active*", the procedure is executed all the same !
4	1	Release ramp output	Drive state "*5 .. Ramp output released*"
	0	Lock ramp output	When the command has been accepted, the output of the ramp function generator is set to zero. The drive stops with maximum current and maximum DC link voltage. The drive state changes to "*4 .. Operation released*".
5	1	Release ramp integrator	Drive state "*6 .. Ramp output released*"
	0	Stop ramp integrator	When the command has been accepted, the output of the ramp function generator is set to zero. The drive stops with maximum current and maximum DC link voltage. The drive state changes to "*4 .. Operation released*".
6	1	Release reference value	When the command has been accepted, the given reference value at the input of the ramp function generator is released. The drive state changes to "*7 .. Run*".
	0	Lock reference value	When the command has been accepted, the input of the ramp function generator is set to zero. As a result the drive decelerates along the set ramp. The drive state changes to "*6 .. Ramp released*".
7	1	Reset	– The reset command is accepted at the positive edge when the drive state is "*20 .. Fault*". – If there is no fault anymore, the drive state changes to "*19 .. Lock switching-on*". – If a fault is still remaining the drive state is furthermore "*20 .. Fault*". The reset command can also be triggered by means of the terminal function "Ext. reset" as well as by means of the Stop/Reset key on the keypad.
	0	no meaning	

Bit	Value	Meaning	Note
8	1	Jog 1 start	Command not provided
	0	Jog 1 off	Command not provided
9	1	Jog 2 start	Command not provided
	0	Jog 2 off	Command not provided
10	1	Control O.K.	When the command has been accepted, the DP slave is controlled via the bus interface. The process data become valid. This bit must be set in order to accept control commands and/or the free bits as well as analog signals !
	0	No control	– When the command has been accepted, all data are processed depending in status bit 9 "*Control requested*". Control requested == 1 → Behaviour according to bus fault – If the DP slave requests control furthermore, the frequency inverter switches over to fault state with the fault message BUS_COMM2 (depending on the setting of parameter D6.03 "Bus error behaviour"). In this case an alarm message is always set ! Control requested == 0 → Data to 0 ! → only I/O or panel operation

Summary of the most important control commands

Function		Control word	
		Binary	Hexadecimal
ON Start with controlled acceleration		0000010001111111	47F
OFF 1 Stop according to the set deceleration ramp		0000010001111110 corresponds with the "basic state"	47E
OFF 2 Impulse inhibit (free-wheeling)		0000010001111101 results in drive state Lock switching-on !	47D
OFF 3 Emergency stop (deceleration at current or DC link voltage limit)		0000010001111011 results in drive state Lock switching-on !	47B
Reset		xxxxx1xx1xxxxxxx	e.g. 480
Use of a free bit (e.g. 13) during operation		0000010001111111 +0010000000000000 0010010001111111	47F +2000 247F
Canceling "Lock switching-on"	Basic state start command	"*15 Lock switching-on*" 0000010001111110 0000010001111111	e.g.: 47E 47F

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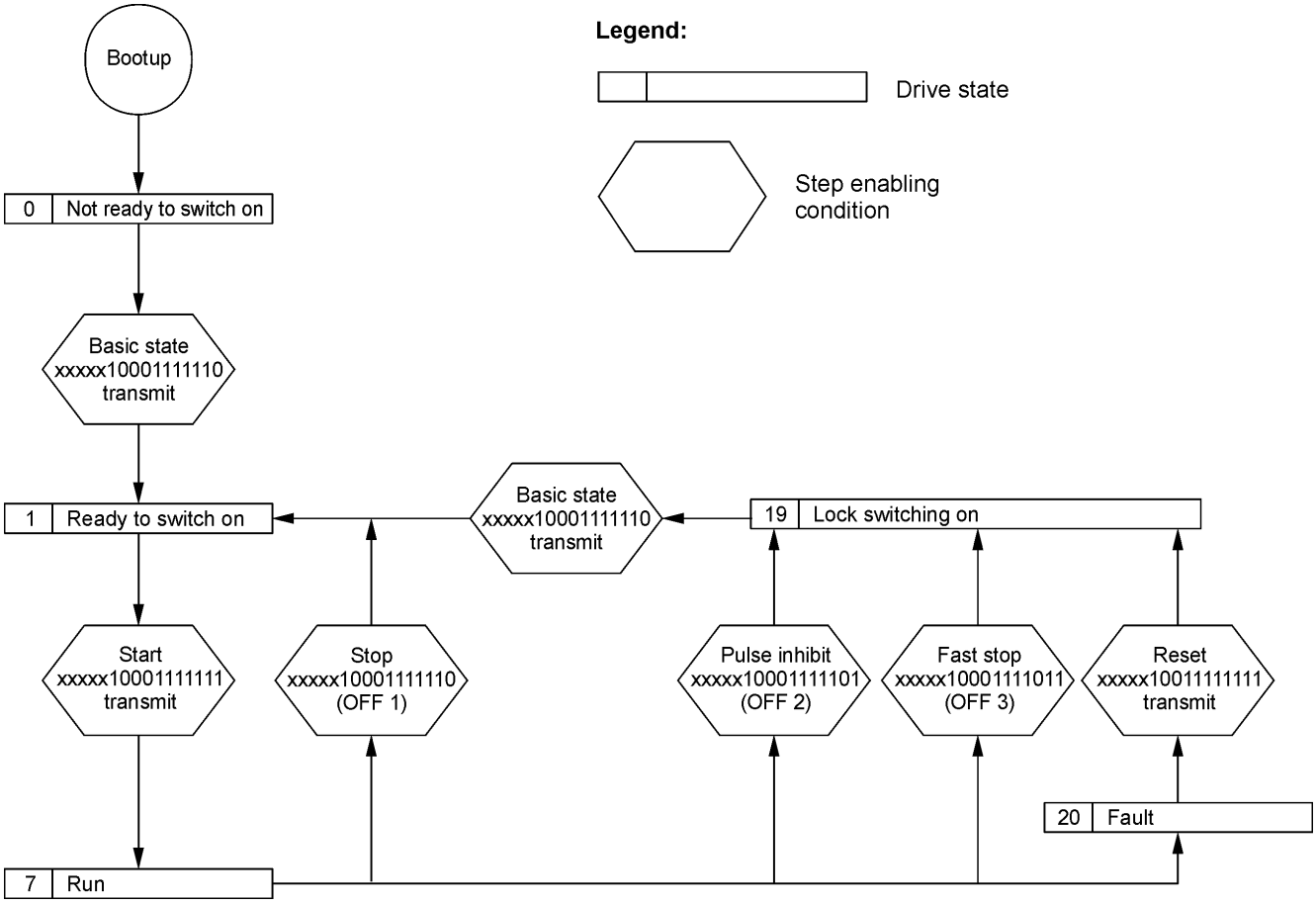
Simplified state machine

For standard control with the commands:

- Start / Stop along the inverter-internal acceleration / deceleration ramps
- Impulse inhibit
- Emergency stop
- Reset of a fault



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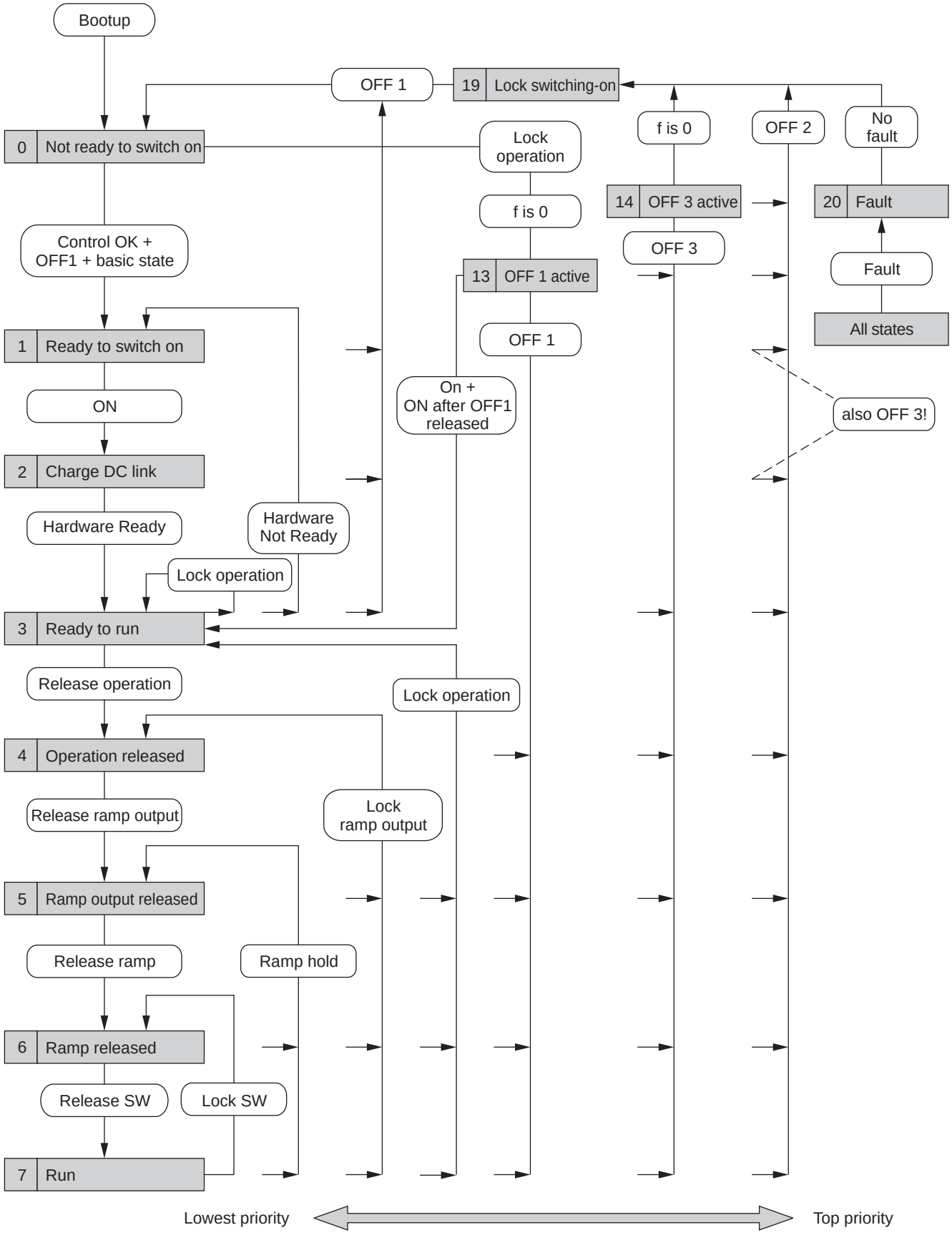
The commands Impulse inhibit (OFF 2), Fast stop (OFF 3) as well as a fault which has been reset always result in drive state "*Lock switching-on*" !

In order to reach drive state "Run" it is necessary to send the basic state (bit 0 = 0, bit 1, 2 = 1) before transmitting the start command (bit 0 = 1).

After connecting the mains (bootup of the drive) the basic state (bit 0 = 0, bit 1, 2 =1) must be provided in order to reach drive state "Ready to switch on".

State machine Profidrive



Main reference value (Auxiliary reference values)

Depending on the setting of parameter D6.100 "No. of Bus-ref. values", 1...9 reference values are available in the Modbus user data protocol. The meaning of the individual reference value words (16 bits each) is defined by parameterization of the *>pDRIVE< MX eco* using the Matrix surface.

The reference values can be divided into two groups:

- inverter-internal reference values like e.g. f-reference, PID actual/reference value and suchlike (according to the reference use)
- forwarding to the analog outputs for external use, without influencing the inverter control (bit 10 STW must be 1 !).

The reference values are linear scaled values with 16 bit display.
That is: 0 % = 0 (0 hex), 100 % = 214 (4000 hex)
Therefrom a presentable data range of -200...+200 % with a resolution of 2^{-14} (0.0061 %) results.

%	Binary	Hexadecimal	Decimal
199.9939	01111111 11111111	7FFF	32767
100.0000	01000000 00000000	4000	16384
0.0061	00000000 00000001	0001	1
0.0000	00000000 00000000	0000	0
-0.0061	11111111 11111111	FFFF	-1
-100.0000	11000000 00000000	C000	-16384
-200.0000	10000000 00000000	8000	-32768

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The reference values are scaled by means of parameterization in matrix field D6. All reference values are scaled in Hz or %.

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Using bits 11...15 of the control word

According to the Profibus profile bits 11...15 are not defined and therefore they can be freely used by the user.

When the frequency inverter is parameterized appropriate, this digital information can be used

- for inverter-internal control signals (corresponding to the use of the digital inputs) or
- totally separated from the inverter functions in order to transmit information using the digital outputs of the frequency inverter (bit 10 STW must be 1 !).

This additional information (bit 11...15) are added to the control word in the corresponding numerical format.

Use	Free control bits	Possible reference values
Inverter – "internal"	f-reference 2 2nd ramp External fault PID active Mains ON(OFF) ... (for the complete list see matrix filed D6)	f-reference 1 f-reference 2 f-correction PID ref. value PID actual value
Inverter – "external"	Relay and digital outputs of the basic card or the option card IO11 or IO12	Analog output of the basic card or the option card *>pDRIVE<* IO12

Status word

Assignment

Bit 15		
Bit 14	5 freely configurable	
Bit 13	status bits for internal or external	
Bit 12	frequency inverter messages	
Bit 11		
Bit 10	f (n) ≥ f level	f (n) ≤ f level
Bit 9	Control requested	No control rights requested
Bit 8	f (n) = f (n) ref	f (n) ≠ f (n) ref
Bit 7	Alarm	No alarm
Bit 6	Lock switching-on	No Lock switching-on
Bit 5	No OFF 3	OFF 3 (Emergency stop)
Bit 4	No OFF 2	OFF 2 (Impulse inhibit)
Bit 3	Fault	No fault
Bit 2	Operation released	Operation locked
Bit 1	Ready to run	Not ready to run
Bit 0	Ready to switch on	Not ready to switch on
	High = 1	Low = 0

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Listing of the most important drive states	Status word bits										
	10	9	8	7	6	5	4	3	2	1	0
0 .. Not ready to switch on	x	1	x	x	0	x	x	0	0	0	0
1 .. Ready to switch on	x	1	x	x	0	x	x	0	0	0	1
3 .. Ready to run	x	1	x	x	0	x	x	0	0	1	1
7 .. Run	x	1	x	x	0	1	1	0	1	1	1
19 .. Lock switching on	x	1	x	x	1	x	x	0	0	0	0
20 .. Fault	x	1	x	x	0	x	x	1	0	0	0

0 .. Bit state zero

1 .. Bit state one

x .. Bit state is undefined

Description of status word bits

Bit	Value	Meaning	Note
0	1	Ready to switch on	The drive state is "*1 .. Ready to switch on*". The inverter is locked. At active line contactor control the main contactor is switched off.
	0	Not ready to switch on	The drive state is "*0 .. Not ready to switch on*" or "*19 .. Lock switching-on*".
1	1	Ready to run	The drive state is "*3 .. Ready to run*". That means that there is voltage on the power part and there are no faults. But the inverter is still locked. At active line contactor control the Run message already occurs during charging → drive state "*2 .. Charge DC link*"
	0	Not ready to run	
2	1	Operation released	The drive state is "*4 .. Operation released*", "*5 .. Ramp output released*", "*6 .. Ramp released*", "*7 .. Run*", "*13 .. OFF 1 active*" or "*14 .. OFF 3 active*". The inverter is operating with impulse enable and there is voltage on the output terminals.
	0	Operation locked	
3	1	Fault	The drive is not in operation due to a fault. The drive state is "*20 .. Fault*". After successful trouble shooting and reset of the fault the drive state changes to "*19 .. Lock switching-on*".
	0	Failure-free	
4	1	no OFF 2	
	0	OFF 2 (Impulse inhibit)	An OFF 2 (impulse inhibit) command is given.
5	1	no OFF 3	
	0	OFF 3 (emergency stop)	An OFF 3 (emergency stop) command is given.
6	1	Lock switching-on	The inverter has drive state "*19 .. Lock switching-on*". This state occurs in consequence of the commands OFF 2, OFF 3 and "Lock operation" as well as after successful resetting of a fault. This drive state is canceled by means of bit 0 STW = 0. The drive state "Lock switching-on" is canceled by means of bit 1 of the control word (OFF1/ON).
	0	No lock switching-on	
7	1	Alarm	There is an alarm message, resetting is not required.
	0	No alarm	
8	1	f, (n) = f, (n) ref	Comparison of reference and actual value for frequency or speed. A tolerance of 0.5 Hz is accepted.
	0	f, (n) ≠ f, (n) ref	

Bit	Value	Meaning	Note
9	1	Control requested	If the frequency inverter is parameterized for bus operation by means of parameter D6.01 (control via bus), the inverter asks the DP master for assumption of control after mains connection or connecting an external 24 V buffer voltage. As long as the master does not assume control, an alarm message (ZTW bit 7) is given.
	0	No bus operation	If the inverter is disconnected from the bus communication because of switching to panel mode (key on the keypad), bit 9 is reset to zero. – If the master does not send "Control OK" (STW bit10 = 0), an alarm message is set. – If the drive is switched to remote mode = bus operation again, the automation system has to answer with "Control OK" within 2 seconds. Otherwise the drive is switched back to panel mode automatically.
10	1	f ≥ f level	Function not provided
	0	f ≤ f level	Function not provided

Main actual value (Auxiliary actual values)

Depending on the setting of parameter D6.137 "Number actual values", 1...9 actual values are available in the Modbus user data protocol. The meaning of the individual actual values is defined by parameterization of the >*pDRIVE*< *MX eco* using the Matrix surface.

The actual values can be divided into two groups:

- inverter-internal actual values like e.g. actual value of speed, torque a.s.o. (according to the analog outputs of the frequency inverter)
- assumption of the analog inputs for external use by means of the DP master (without influencing the inverter control). Bit 10 STW must be 1 !

The actual values are linear scaled values with 16 bit display.
That is 0 % = 0 (0 hex), 100 % = 214 (4000 hex)

Therefrom a presentable data range of -200...+200 % with a resolution of 2^{-14} (0.0061 %) results.

%	Binary	Hexadecimal	Decimal
199.9939	01111111 11111111	7FFF	32767
100.0000	01000000 00000000	4000	16384
0.0061	00000000 00000001	0001	1
0.0000	00000000 00000000	0000	0
-0.0061	11111111 11111111	FFFF	-1
-100.0000	11000000 00000000	C000	-16384
-200.0000	10000000 00000000	8000	-32768

The actual values are scaled by means of parameterization in matrix field D6. The scaling of the individual actual values is fixed for each output value. See matrix field D6.

Using bits 11...15

According to the Profibus profile bits 11...15 of the status word are not defined and therefore they can be freely used by the user. When the frequency inverter is parameterized appropriate, this digital information can be derived from inverter-internal operating states (corresponding to the digital outputs) as well as totally separated from the inverter functions by means of the digital inputs of the frequency inverter.

This additional information (bit 11...15) are added to the status word automatically.

Use	Free status word bits	Actual values
Inverter – "internal"	Ready	Output frequency
	Run	|Output frequency|
	Ready / run	Output current
	Fault	Torque
	...	...
	(for the complete list see matrix filed D6)	(for the complete list see matrix filed D6)
Inverter – "external"	DI1...DI6 DI7...DI10 or DI11...DI14	Analog inputs of the basic card or the option card >*pDRIVE*< IO12

Parameterization

General

Using the 03hex Read Holding Register and 06 Write Single Register Modbus services, each parameter in the inverter can be read or written via the bus.

The request initiated by the master (read / write) is transferred to the inverter via the Modbus. The inverter processes the request and sends a corresponding response.

Inside the inverter, the parameterization is processed as a background task. There, the parameter requests are processed in a time-optimized manner, i.e. a request is accepted and, at the same time, a response is provided for retrieval (typ. 10...50 ms).

Request and response telegram are of following data type:

Read parameter value

Request telegram Master → *>pDRIVE< MX eco*

Slave address	Request	Parameter address		Number of parameters to be read		CRC 16	
	3 hex	Hi	Lo	Hi	Lo	Lo	Hi
1 byte	1 byte	2 bytes		2 bytes		2 bytes	

Response telegram *>pDRIVE< MX eco* → Master

Slave address	Response	Number of read bytes	Parameter value 1		- - -	Parameter value X		CRC 16	
	03 hex		Hi	Lo	- - -	Hi	Lo	Lo	Hi
1 byte	1 byte	1 byte	2 bytes			2 bytes		2 bytes	

Write parameter value

Request telegram Master → *>pDRIVE< MX eco*

Slave address	Request	Parameter address		Parameter value		CRC 16	
	06 hex	Hi	Lo	Hi	Lo	Lo	Hi
1 byte	1 byte	2 bytes		2 bytes		2 bytes	

Response telegram *>pDRIVE< MX eco* → Master

Slave address	Response	Parameter address		Parameter value		CRC 16	
	06 hex	Hi	Lo	Hi	Lo	Hi	Lo
1 byte	1 byte	2 bytes		2 bytes		2 bytes	

The individual parameters are accessed via their internal logical addresses. Addresses are valid in the range of 0...2047 (11 bits) and they are mentioned in the parameter list which is provided in the appendix. The address is used in the request telegram as well as in the response telegram.

If a write request could be performed successfully, the transferred parameter value and the original request code appear in the response telegram as an echo.

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In case of requests that can not be executed, an error telegram is sent to the master. It contains the original request code, but bit 7 is set to "high" as an error flag (request + 80 hex). In the "error code" byte, details regarding the existing fault can be found.

Structure of the error telegram

Slave Address	Response code	Error code	CRC 16	
	80 + request code		Lo	Hi
1 byte	1 byte	1 byte	2 bytes	

Error code	Description
00	No error
01	Unknown request code
02	Inadmissible logical or physical address
03	Faulty data size (byte, word) or faulty number of data
04	Request cannot be executed due to: – Parameter is of type "actual value" – Parameter cannot be changed during operation – Parameter cannot be changed due to double assignment – The parameterizing station (F6.03) is not set to "Modbus"
05	Request length faulty
06	Access not permitted

Rules for processing of requests / responses

- The master makes a request and has to wait for the response telegram of the respective slave before it can formulate a new request.
- The master has to check the response to a request made dependent on the response code.

  In case of a positive response code (request = response)
  - Evaluation of the parameter number
  - Evaluation of the parameter value

  In case of a negative response code (request +80hex)
  - Evaluation of the error code
- Requests or responses must be completely transferred in one telegram. Combined requests are not possible.
- In case of responses which include actual values, the inverter always replies the actual value when repeating the response telegrams.
- For write requests, the value which is transmitted in the response must be evaluated (the request is canceled if the value remains the same or if a fault occurs).
- After changing a parameter a storage command must be sent in order to protect the data against voltage loss. The storage command takes place when writing value 1 to the logical address 0028 hex / 40 dec.

Examples

Reading of the shaft power (parameter A2.07, address 006B hex / 107 dec)

Request telegram Master → *>pDRIVE< MX eco*

Slave	Code	Parameter address		Number of parameters		CRC	
0A	03	00	6B	00	01	Lo	Hi

Response telegram *>pDRIVE< MX eco* → Master

Slave	Code	Number of bytes	Parameter value		CRC	
0A	03	02	00	7B	Lo	Hi

Parameter value 007B hex = 123 dec

Scaling: Real value = transferred value / factor
(for factor, see chapter "Parameter list of the ***>pDRIVE< MX eco***", from page 60)

P = 123 / 10 = 12.3 kW

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Programming of the parameterizing station on Modbus (F6.03 = setting 2, address 047A hex, 1146 dec)

Request telegram Master → *>pDRIVE< MX eco*

Slave	Code	Parameter address		Parameter value		CRC	
0A	06	04	7A	00	02	Lo	Hi

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Response telegram *>pDRIVE< MX eco* → Master

Slave	Code	Parameter address		Parameter value		CRC	
0A	06	04	7A	00	02	Lo	Hi

It is necessary to set parameter F6.03 "Parametrising station" to setting "2 .. Modbus" in order to be qualified for adjusting other parameters via Modbus.

Programming of the digital input DI1 on Motorpot + (D2.01 = setting 14, address 02FF hex, 767 dec)

Request telegram Master → >*pDRIVE*< *MX eco*

Slave	Code	Parameter address		Parameter value		CRC	
0A	06	02	FF	00	0E	Lo	Hi

Response telegram >*pDRIVE*< *MX eco* → Master (in case of accepted request)

Slave	Code	Parameter address		Parameter value		CRC	
0A	06	02	FF	00	0E	Lo	Hi

Response telegram >*pDRIVE*< *MX eco* → Master (in case of non-executable request)

Slave	Response code	Error code	CRC 16	
0A	86	04	Lo	Hi

Response code 86 = parameterizing error (request 06+80 = 86)

Error code = 04 parameter value cannot be written (Adjusting parameters is only permitted during impulse inhibit. You try to assign the digital function "Motorpot +" twice or the parameterization station is not set to "Modbus".)

Adjustment of an analog value (D3.04 "AO1 max. value" = 150 %, address 0311 hex, 785 dec)

Request telegram Master → >*pDRIVE*< *MX eco*

Slave	Code	Parameter address		Parameter value		CRC	
0A	06	03	11	3A	98	Lo	Hi

Parameter value: for transferred value = real value * factor
(for factor, see chapter "Parameter list of the ***>pDRIVE< MX eco***", from page 60)

150.00% * 100 =15000 (15000 dec / 3A98 hex)

Response telegram >*pDRIVE*< *MX eco* → Master

Slave	Code	Parameter address		Parameter value		CRC	
0A	06	03	11	3A	98	Lo	Hi

Reading of drive reference F1.01, address 000B hex, 11 dec

The drive reference is a parameter of type text. It is to be read in ASCII-coded form.

Corresponding to the expected length of text the start address and a certain number of ensuing parameters has to be read. See the parameter list in the appendix.

Request telegram Master → *>pDRIVE< MX eco*

Slave	Code	Parameter address		Number of parameters		CRC	
0A	03	00	0B	00	08	Lo	Hi

Response telegram *>pDRIVE< MX eco* → Master

Slave	Code	Number of bytes	Parameter value 1		Parameter value 2		Parameter value 3		Parameter value 4		- - -
0A	03	10	4D	58	65	63	6F	34	56	31	- - -

- - -	Parameter value 5		Parameter value 6		Parameter value 7		Parameter value 8		CRC		- - -
- - -	2E	35	20	00	00	00	00	00	Lo	Hi	- - -

Evaluation of the parameter values:

If you string the characters decoded with ASCII together, you get the drive reference.

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(in the case of this type, only ten characters are used)

ASCII code table

ISO / IEC 10 367
Basic G0 Set
Latin Alphabet No. 1 supplementary set

hex	Char	hex	Char	hex	Char	hex	Char	hex	Char	hex	Char
20	Space	40	@	60	`	A1	¡	C1	Á	E1	á
21	!	41	A	61	a	A2	¢	C2	Â	E2	â
22	"	42	B	62	b	A3	£	C3	Ã	E3	ã
23	§	43	C	63	c	A4	¤	C4	Ä	E4	ä
24	$	44	D	64	d	A5	¥	C5	Å	E5	å
25	%	45	E	65	e	A6	¦	C6	Æ	E6	æ
26	&	46	F	66	f	A7	§	C7	Ç	E7	ç
27	´	47	G	67	g	A8	¨	C8	È	E8	è
28	(	48	H	68	h	A9	©	C9	É	E9	é
29	)	49	I	69	i	AA	ª	CA	Ê	EA	ê
2A	*	4A	J	6A	j	AB	«	CB	Ë	EB	ë
2B	+	4B	K	6B	k	AC	¬	CC	Ì	EC	ì
2C	,	4C	L	6C	l	AD		CD	Í	ED	í
2D	-	4D	M	6D	m	AE	®	CE	Î	EE	î
2E	.	4E	N	6E	n	AF	¯	CF	Ï	EF	ï
2F	/	4F	O	6F	o	B0	°	D0	Đ	F0	ð
30	0	50	P	70	p	B1	±	D1	Ñ	F1	ñ
31	1	51	Q	71	q	B2	²	D2	Ò	F2	ò
32	2	52	R	72	r	B3	³	D3	Ó	F3	ó
33	3	53	S	73	s	B4	´	D4	Ô	F4	ô
34	4	54	T	74	t	B5	µ	D5	Õ	F5	õ
35	5	55	U	75	u	B6	¶	D6	Ö	F6	ö
36	6	56	V	76	v	B7	·	D7	×	F7	÷
37	7	57	W	77	w	B8	¸	D8	Ø	F8	ø
38	8	58	X	78	x	B9	¹	D9	Ù	F9	ù
39	9	59	Y	79	y	BA	º	DA	Ú	FA	ú
3A	:	5A	Z	7A	z	BB	»	DB	Û	FB	û
3B	;	5B	[	7B	{	BC	¼	DC	Ü	FC	ü
3C	<	5C	\	7C	|	BD	½	DD	Ý	FD	ý
3D	=	5D	]	7D	}	BE	¾	DE	Þ	FE	þ
3E	>	5E	^	7E	~	BF	¿	DF	ß	FF	ÿ
3F	?	5F	_	7F	DEL	C0	À	E0	à	0	\n

Inverter settings

General fieldbus settings

Parameter group D6 Fieldbus is used for configuration of all fieldbus connections which are possible with the >*pDRIVE*< *MX eco*. The two fieldbus connections CANopen and Modus are available as standard. Further fieldbuses like e.g. Profibus DP can be realized by means of optional PCBs which can be built-in.

According to the used bus which is selected with parameter D6.01 only parameters for this bus are displayed in matrix field D6.

D6.01	Bus selection				0 .. No bus

0 ...No bus
1 ...Modbus
2 ...CanOpen
3 ...Profibus

The desired fieldbus system is activated by means of parameter D6.01 "Bus selection". The activation influences the principle data exchange between the bus subscribers in respect of the transmitted process data (reference / actual values) and the parameterization service.

In order to use the bus control word of the respective bus profile for the control of the >*pDRIVE*< *MX eco,* Control source 1 or 2 (E4.01, E4.02) must be set to "Bus".

See also parameter group E4 of the >*pDRIVE*< *MX eco* Description of functions.

D6.02	Control requested				1 .. Active

0 ...Not active
1 ...Active

In order to recognize a communication problem at the serial fieldbus interface, two different monitoring routines are available.

Watch dog timing

The watch dog timing checks the fieldbus interface for a cyclical signal of the active bus master or scanner and therefrom it is a check of the bus hardware (cable break, malfunction of the master component, ...). The monitoring time depends on the existing network configuration like the number of subscribers, set baud rate a.s.o.. It is automatically transmitted from the master to the slave by means of the parameterization telegram or it has to be set at the inverter.

Loss of control

In contrast to the watch dog timing the control monitoring checks the data content of the serial data traffic. If a malfunction occurs at the fieldbus master or its respective PLC, all outgoing data are set to zero (Fail Save Mode). Therefore, the slave receives a telegram (with data content zero) periodically whereby the triggering of the watch dog timing is prevented.

In order to recognize this state and to take suitable measures, a monitoring of control can be activated with parameter D6.02 (typical for Profibus DP).

If parameter D6.02 Control requested is set to "1 .. Active" the inverter monitors bit 10 of the control word. If this bit equals state "Low", loss of control is detected.

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D6.03	Bus error behaviour				1 .. Trip

1 ...Trip
2 ...Last ref. val & alarm
3 ...Emerg. ref.val. & alarm

D6.04	Bus error delay time				0.5 s

0...3200 s

Parameter D6.03 defines the behaviour of the inverter if a bus error occurs. Depending on the process demands one of the following reactions can be selected:

Setting	Behaviour in case of a bus fault
1 .. Trip	Fault shut-down with the message "Bus fault".
2 .. Last ref. val & alarm	The alarm message "Bus fault" is set. The drive still remains in operation and uses the last valid reference value of this source instead of the missing bus reference value. If the bus connection is available again, the bus reference value is used and the alarm message is reset.
3 .. Emerg. ref.val. & alarm	The alarm message "Bus fault" is set. The drive still remains in operation and uses the value according setting SW1-9 emergency value (see matrix field D6) instead of the missing bus reference value. If the bus connection is available again, the bus reference value is used and the alarm message is reset.

Modbus settings

D6.10	Modbus address				0

0...247

Address of the Modbus subscriber. When the address is set to 0, the Modbus server is deactivated internally. The address 0 is used by the Modbus master for broadcast telegrams.

D6.11	Modbus baud rate				32 .. 19200 baud

24...4800 baud
28...9600 baud
32...19200 baud
36...38400 baud

D6.12	Modbus format				3 .. 8E1

2 ...8O1
3 ...8E1
4 ...8N1
5 ...8N2

Setting	Data bits	Parity bit	Stop bit	Bit / byte
8O1	8	Odd	1	10
8E1	8	Even	1	10
8N1	8	No	1	9
8N2	8	No	2	10

D6.15	Modbus time-out				5 s
	0...300 s				

The watchdog for the Modbus connection is set depending on the existing network configuration, such as the number of subscribers, the selected baud rate, and so on. If the time between two telegrams from the master exceeds the set value, there is a communication problem with the master.

The behaviour of the ***>pDRIVE< MX eco*** in case of a timeout can be set by means of parameter D6.03 "Bus error behaviour".

If 0.0 seconds are set, the watchdog function is inactive.

Configuration of the fieldbus reference values

Corresponding to the configured telegram length one to nine reference values are available in addition to the digital control word.

D6.100	No. of Bus-ref. values				5 .. 1 STW + 5 SW
	1 ...1 STW + 1 SW	6... 1 STW + 6 SW			
	2 ...1 STW + 2 SW	7... 1 STW + 7 SW			
	3 ...1 STW + 3 SW	8... 1 STW + 8 SW			
	4 ...1 STW + 4 SW	9... 1 STW + 9 SW			
	5 ...1 STW + 5 SW				

According to the set number of reference values D6.100 only relevant parameters are displayed in matrix field D6 in order to guarantee clear parameterization.

The references for the different functions of the *>pDRIVE< MX eco* can be provided in different ways (see chapters reference sources /reference value distributor in the Description of functions).

One way is the usage of fieldbus reference values. Thereby, the reference values are provided by means of automation devices (PLC) which transmit the required reference values serial to the activated fieldbus interface.

D6.101	Ref. value1 selection				0 .. Not used
	0 ...Not used	6... PID-reference val. [%]			
	1 ...f-reference 1 [Hz]	7... PID-actual value [%]			
	2 ...f-reference 2 [Hz]	15 .. Request [%]			
	3 ...f-correction [Hz]				

The output of the reference source Bus SW1 can be set as source for different uses according to the reference value distributor. Parameter D6.101 "Ref. value1 selection" assigns the reference value to the desired use (see also chapter reference sources, reference value distributor in the Description of functions).

D6.102	Ref. value1 min. value				0 % or Hz
	-300...300 % or Hz				

D6.103	Ref. value1 max. value				50 % or Hz
	-300...300 % or Hz				

The two parameters D6.102 "Ref. value1 min. value" and D6.103 "Ref. value1 max. value" are used for linear scaling of the transmitted reference value. D6.102 assigns an output value to the reference point at 0 % (0 dec = 0000 hex), D6.103 assigns it to the reference point at 100 % (16384 dec = 4000 hex).

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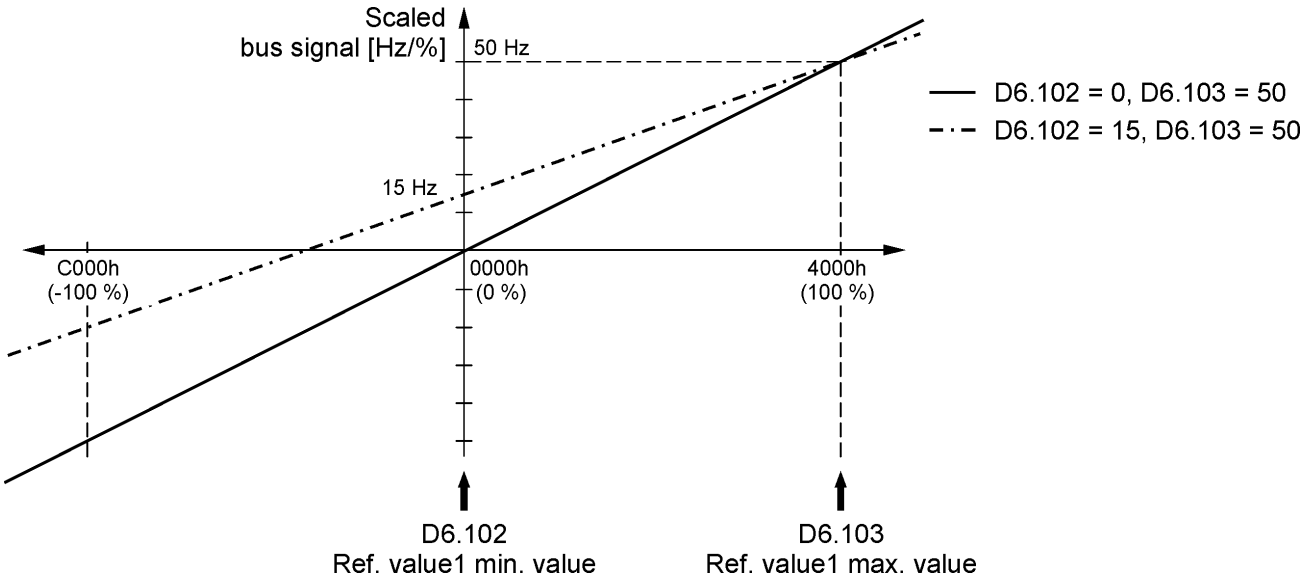
The unit of the reference value is scaled according to the reference use "D6.101 "Ref. value1 selection" for all frequency values in Hz, while the remaining signals are scaled in %.

Bus SW-1 scaling



D6.104	Ref. value1 emergency				0 hex
	0...65535 hex				

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In case of setting D6.03 Bus error behaviour to "3 .. Emerg. ref.val. & alarm" the set emergency reference value is used during a bus fault. The unit of the emergency reference value corresponds to that of the min/max scaling.

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It is not possible to assign reference paths twice. If you try to assign a second reference source to a use which is already allocated in the reference value distributor, the parameterization will prevent this and a corresponding alarm message will be shown in the display.

D6.105	Ref. value2 selection				0 .. Not used
D6.106	Ref. value2 min. value				0
D6.107	Ref. value2 max. value				50
D6.108	Ref. value2 emergency				0 hex

D6.109	Ref. value3 selection				0 .. Not used
D6.110	Ref. value3 min. value				0
D6.111	Ref. value3 max. value				50
D6.112	Ref. value3 emergency				0 hex

D6.113	Ref. value4 selection				0 .. Not used
D6.114	Ref. value4 min. value				0
D6.115	Ref. value4 max. value				50
D6.116	Ref. value4 emergency				0 hex

D6.117	Ref. value5 selection				0 .. Not used
D6.118	Ref. value5 min. value				0
D6.119	Ref. value5 max. value				50
D6.120	Ref. value5 emergency				0 hex

D6.121	Ref. value6 selection				0 .. Not used
D6.122	Ref. value6 min. value				0
D6.123	Ref. value6 max. value				50
D6.124	Ref. value6 emergency				0 hex

D6.125	Ref. value7 selection				0 .. Not used
D6.126	Ref. value7 min. value				0
D6.127	Ref. value7 max. value				50
D6.128	Ref. value7 emergency				0 hex

D6.129	Ref. value8 selection				0 .. Not used
D6.130	Ref. value8 min. value				0
D6.131	Ref. value8 max. value				50
D6.132	Ref. value8 emergency				0 hex

D6.133	Ref. value9 selection				0 .. Not used
D6.134	Ref. value9 min. value				0
D6.135	Ref. value9 max. value				50
D6.136	Ref. value9 emergency				0 hex

The settings of the bus reference values 2...9 are logical identical with those of bus reference value 1 (see parameters D6.101...D6.104).

Configuration of the fieldbus actual values

Corresponding to the configured telegram length one to nine actual values are available in addition to the digital status word.

D6.137	Number actual values				5 .. 1 ZTW + 5 IW

1 ...1 ZTW + 1 IW	6...1 ZTW + 6 IW
2 ...1 ZTW + 2 IW	7...1 ZTW + 7 IW
3 ...1 ZTW + 3 IW	8...1 ZTW + 8 IW
4 ...1 ZTW + 4 IW	9...1 ZTW + 9 IW
5 ...1 ZTW + 5 IW	

According to the set number of actual values D6.137 only relevant parameters are displayed in matrix field D6 in order to guarantee clear parameterization.

The >*pDRIVE*< *MX eco* provides analog outputs and serial fieldbus actual values to forward analog information of the actual values. The size to be issued as well as their scaling can be freely configured.

Following process sizes can be transmitted as actual values:

Process size	Value	Unit	Scaling
1 .. Output frequency	100.0	Hz	100.0
2 .. |Output frequency|	100.0	Hz	100.0
3 .. Motor current	100.0	%	Nominal current >*pDRIVE*< *MX eco*
4 .. Torque	100.0	%	Nominal motor torque
5 .. |Torque|	100.0	%	Nominal motor torque
6 .. Process torque	100.0	%	Reference to parameter A2.19
7 .. |Facility torque|	100.0	%	Reference to parameter A2.19
8 .. Power	100.0	%	Nominal inverter power
9 .. |Power|	100.0	%	Nominal inverter power
10 .. Motor voltage	100.0	%	Nominal voltage motor
11 .. Speed	100.0	%	Nominal speed at f_{MAX} (C2.02)
12 .. |Speed|	100.0	%	Nominal speed at f_{MAX} (C2.02)
15 .. int. f-ref. before ramp	100.0	Hz	100.0
16 .. int. f-ref. after ramp	100.0	Hz	100.0
17 .. PID-reference val. [%]	100.0	%	100.0
18 .. PID-actual value [%]	100.0	%	100.0
19 .. PID-deviation [%]	100.0	%	100.0
20 .. PID-output	100.0	%	100.0
23 .. int. ref. switch-over	100.0	Hz	100.0
24 .. Calculator	100.0	%	100.0
25 .. Curve generator	100.0	%	100.0
26 .. Counter (average)	100.0	%	100.0
27 .. Total counter	100.0	%	100.0
28 .. Speed machine	100.0	%	100.0
33 .. ---	100.0	%	1000 V DC
36 .. Thermal load BR	100.0	%	100.0
37 .. Thermal load VSD	100.0	%	100.0
39 .. Reserve	100.0	%	100.0
41 .. Position value HIGH	100.0	%	10 V = 4000 hex
42 .. Reserve	100.0	%	10 V or 20 mA = 4000 hex
43 .. Reserve	100.0	%	20 mA = 4000 hex
44 .. Bus SW 1	100.0	%	10V or 20 mA = 4000 hex
45 .. Bus SW 2	100.0	%	D1.33 = 4000 hex
47 .. Bus SW 4	100.0	%	100.0
48 .. Bus SW 5	100.0	%	100.0
49 .. Bus SW 6	100.0	%	100.0
50 .. Bus SW 7	100.0	%	100.0
51 .. Bus SW 8	100.0	%	100.0
52 .. Bus SW 9	100.0	%	100.0
55 .. AI 1	100.0	%	100.0
56 .. AI 2	100.0	%	100.0
57 .. AI 3	100.0	%	100.0
58 .. AI 4	100.0	Integer	See table alarm index given in the appendix
59 .. Frequency input	100.0	Integer	See table alarm index given in the appendix

D6.138	Act. value1 selection				1 .. Output frequency

0 ...Not used	18 .. PID-actual value [%]	44...Bus SW 1	
1 ...Output frequency	19 .. PID-deviation [%]	45...Bus SW 2	
2 ...|Output frequency|	20 .. PID-output	47...Bus SW 4	
3 ...Motor current	23 .. int. ref. switch-over	48...Bus SW 5	
4 ...Torque	24 .. Calculator	49...Bus SW 6	
5 ...|Torque|	25 .. Curve generator	50...Bus SW 7	
6 ...Process torque	26 .. Counter (average)	51...Bus SW 8	
7 ...|Facility torque|	27 .. Total counter	52...Bus SW 9	
8 ...Power	28 .. Speed machine	53...Reserve	
9 ...|Power|	33 .. ---	54...Reserve	
10...Motor voltage	36 .. Thermal load BR	55...AI 1	
11...Speed	37 .. Thermal load VSD	58...AI 4	
12...|Speed|	39 .. Reserve	59...Frequency input	
15...int. f-ref. before ramp	41 .. Position value HIGH		
16...int. f-ref. after ramp	42 .. Reserve		
17...PID-reference val. [%]	43 .. Reserve		

Selection of the size which should be transmitted at bus actual value 1.

D6.139	Act. value1 min. value				0 % or Hz
	-300...300 % or Hz				

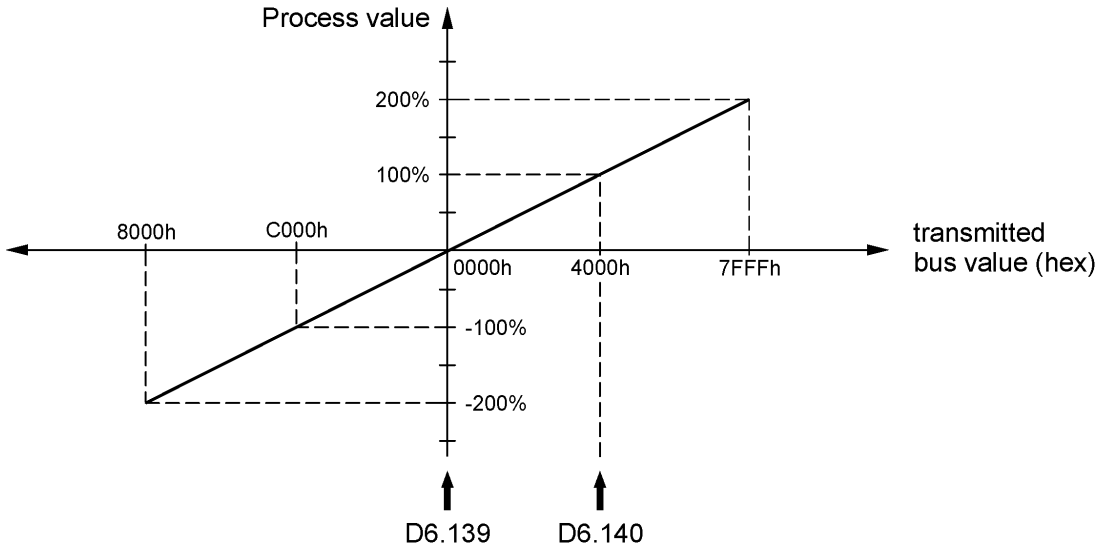
D6.140	Act. value1 max. value				50 % or Hz
	-300...300 % or Hz				

The two parameters D6.139 "Act. value1 min. value" and D6.140 "Act. value1 max. value" are used for linear scaling of the transmitted bus actual value. D6.139 assigns the minimum value to the actual value point 0 % (0 dec = 0000 hex), D6.140 assigns the maximum value of a process size to the actual value point 100 % (16384 dec = 4000 hex).

The scaling of the process size and their unit can be seen from the table above.

Settings example for bus actual value 1

Process size	Scaling	D6.139 "Act. value1 min. value"	D6.140 "Act. value1 max. value"	Scaling of the output signal
8 .. Power	100 % = Nom. motor power (e.g. 90 kW)	0 %	100 %	4000 hex (16384 dec) at 100 % $P_{N\ Motor}$ (max. presentable range = 200 %)



D6.141	Act. value1 filter-time				0.1 s

0...30 s

During the measurement of dynamically changing values, such as current or torque, it may be a good idea to filter the actual value which should be transmitted already in the inverter. The measurement value can be stabilized before transmission by setting an appropriate filter time at the output filter.

At setting 0.0 seconds the filter is deactivated.

D6.142	Act. value2 selection				3 .. Motor current
D6.143	Act. value2 min. value				0
D6.144	Act. value2 max. value				100
D6.145	Act. value2 filter-time				0.1 s

D6.146	Act. value3 selection				4 .. Torque
D6.147	Act. value3 min. value				0
D6.148	Act. value3 max. value				100
D6.149	Act. value3 filter-time				0.1 s

D6.150	Act. value4 selection				8 .. Power
D6.151	Act. value4 min. value				0
D6.152	Act. value4 max. value				100
D6.153	Act. value4 filter-time				0.1 s

D6.154	Act. value5 selection				0 .. Not used
D6.155	Act. value5 min. value				0
D6.156	Act. value5 max. value				100
D6.157	Act. value5 filter-time				0.0 s

D6.158	Act. value6 selection				0 .. Not used
D6.159	Act. value6 min. value				0
D6.160	Act. value6 max. value				100
D6.161	Act. value6 filter-time				0.1 s

D6.162	Act. value7 selection				0 .. Not used
D6.163	Act. value7 min. value				0
D6.164	Act. value7 max. value				100
D6.165	Act. value7 filter-time				0.1 s

D6.166	Act. value8 selection				0 .. Not used
D6.167	Act. value8 min. value				0
D6.168	Act. value8 max. value				100
D6.169	Act. value8 filter-time				0.1 s

D6.170	Act. value9 selection				0 .. Not used
D6.171	Act. value9 min. value				0
D6.172	Act. value9 max. value				100
D6.173	Act. value9 filter-time				0.1 s

The settings of the bus reference values 2...9 are logical identical with those of bus reference value 1 (see parameters D6.138...D6.141).

Configuration of control word bits 11...15

D6.174	Bit 11 STW1 selection				0 .. Not used

0 ...Not used	29 .. Ext. fault 1	56 .. Mains cut-out
11 ...f-ref reverse	30 .. Ext. fault 2	57 .. ON-lock
14 ...Motor pot. +	32 .. Emergency oper.	58 .. Locking
15 ...Motor pot. -	35 .. PID-active	59 .. Feedb. motor contactor
16 ...Pre-set A	36 .. PID-lock	60 .. Motor heating
17 ...Pre-set B	37 .. PID-wind up	61 .. Operation with IR
18 ...Pre-set C	40 .. Feed in pressure OK	64 .. Pulse counter input
19 ...Pre-set D	41 .. Level OK	65 .. Pulse counter reset
22 ...f-reference 2 [Hz]	42 .. Level <	66 .. n-monitoring
23 ...Control source 2	50 .. C. motor 1 ready	67 .. Parameter locked
24 ...2nd ramp	51 .. C. motor 2 ready	
25 ...Reference value B	52 .. C. motor 3 ready	
26 ...Panel operation	53 .. C. motor 4 ready	

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Parameter D6.174 assigns a digital input function to bit 11 of the control word. A description of this function can be found in the *>pDRIVE< MX eco* Description of functions (matrix field D2).

D6.175	Bit 12 STW1 selection				0 .. Not used
D6.176	Bit 13 STW1 selection				0 .. Not used
D6.177	Bit 14 STW1 selection				0 .. Not used
D6.178	Bit 15 STW1 selection				0 .. Not used

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Setting possibilities see D6.174.

D6.179	Bit at term.-mode act.	0110			

0 .. STW1 Bit 11	☐ / ☑
1 .. STW1 Bit 12	☐ / ☑
2 .. STW1 Bit 13	☐ / ☑
3 .. STW1 Bit 14	☐ / ☑
4 .. STW1 Bit 15	☐ / ☑

When the control source selection (see Matrix field E4) is used to switch between terminal and fieldbus operation it might be necessary to have individual bits (11...15) of the bus control word active despite the fact that the control source has been switched to the terminals.

This exception from switch-over can be configured by the appropriate selection with parameter D6.179 "Bit at term.-mode act.".

Example: External fault

In case of a process fault the inverter is shut-down systematically using bit 11 of the control word. This behaviour should be also guaranteed in case of controlling the drive via local operation (by means of terminal commands). Digital input DI4 can be used to switch between terminal strip operation and bus operation.

D6.174 "Bit 11 STW1 selection" = "29 .. Ext. fault 1"

If a switch-over from bus operation to terminal strip operation takes place, the commands of the control word become ineffective ! The parameterized function "Ext. fault 1" is not effective any longer.

For this reason, for control word bits that shall be effective both in the bus operation as well as the terminal operation bit 11 must be marked in parameter D6.179 "Bit at term.-mode act.".

Adjust parameter D2.15 "DI at bus mode active" on the other hand, if a digital input should be effective in terminal operation as well as in bus operation,

If a control signal is configured both on a free bit at the bus as well as on the terminals which are active during bus operation, the bus command will be preferred.

Configuration of status word bits 11...15

D6.197	Bit 11 ZTW1 selection				0 .. Not used

0 ...Not used	20 .. Limitation active	44...Output T4
1 ...Ready	24 .. Motor heating active	45...Output T5
2 ...Operation	25 .. Motorfluxing active	46...Output T6
3 ...Ready / run	27 .. DC link charged	54...Bus STW bit 11
4 ...Trip	28 .. Line Contactor ON	55...Bus STW bit 12
5 ...Sum alarm	29 .. Motor contactor ON	56...Bus STW bit 13
6 ...Motor turns	30 .. C. motor 1 ON	57...Bus STW bit 14
7 ...f = f ref	31 .. C. motor 2 ON	58...Bus STW bit 15
8 ...Generator operation	32 .. C. motor 3 ON	61...Digital input DI1
11...Shut down	33 .. C. motor 4 ON	62...Digital input DI2
12...Panel mode active	36 .. Alarm cat. 1	63...Digital input DI3
13...Motor 1 active	37 .. Alarm cat. 2	64...Digital input DI4
14...Motor 2 active	38 .. Alarm cat. 3	65...Digital input DI5
15...Param.-set 1 active	41 .. Output T1	66...Digital input DI6
16...Param.-set 2 active	42 .. Output T2	
19...Safe standstill active	43 .. Output T3	

Parameter D6.197 assigns the respective digital state information to bit 11 of the status word. A description of the individual digital output functions can be found in the *>pDRIVE< MX eco* Description of functions (matrix field D4).

D6.198	Bit 12 ZTW1 selection				0 .. Not used
D6.199	Bit 13 ZTW1 selection				0 .. Not used
D6.200	Bit 14 ZTW1 selection				0 .. Not used
D6.201	Bit 15 ZTW1 selection				0 .. Not used

Setting possibilities see D6.179.

Bus - Diagnostics

Diagnostics of the control / status word

Diagnostics STW (Bus → Inverter)

D6.218	Bus STW hex				hex

D6.219	Bus STW bin	0110			

0 .. STW1 Bit 0	☐ / ☑	8 .. STW1 Bit 8	☐ / ☑
1 .. STW1 Bit 1	☐ / ☑	9 .. STW1 Bit 9	☐ / ☑
2 .. STW1 Bit 2	☐ / ☑	10 .. STW1 Bit 10	☐ / ☑
3 .. STW1 Bit 3	☐ / ☑	11 .. STW1 Bit 11	☐ / ☑
4 .. STW1 Bit 4	☐ / ☑	12 .. STW1 Bit 12	☐ / ☑
5 .. STW1 Bit 5	☐ / ☑	13 .. STW1 Bit 13	☐ / ☑
6 .. STW1 Bit 6	☐ / ☑	14 .. STW1 Bit 14	☐ / ☑
7 .. STW1 Bit 7	☐ / ☑	15 .. STW1 Bit 15	☐ / ☑

Presentation of the control word received at the bus.

Diagnostics ZTW (Inverter → Bus)

D6.222	Bus ZTW hex				hex

D6.223	Bus ZTW bin	0110			

0 .. ZTW1 Bit 0	☐ / ☑	8 .. ZTW1 Bit 8	☐ / ☑
1 .. ZTW1 Bit 1	☐ / ☑	9 .. ZTW1 Bit 9	☐ / ☑
2 .. ZTW1 Bit 2	☐ / ☑	10 .. ZTW1 Bit 10	☐ / ☑
3 .. ZTW1 Bit 3	☐ / ☑	11 .. ZTW1 Bit 11	☐ / ☑
4 .. ZTW1 Bit 4	☐ / ☑	12 .. ZTW1 Bit 12	☐ / ☑
5 .. ZTW1 Bit 5	☐ / ☑	13 .. ZTW1 Bit 13	☐ / ☑
6 .. ZTW1 Bit 6	☐ / ☑	14 .. ZTW1 Bit 14	☐ / ☑
7 .. ZTW1 Bit 7	☐ / ☑	15 .. ZTW1 Bit 15	☐ / ☑

Presentation of the status word sent at the bus.

Diagnostics of the operating state

D6.226	Internal control word				hex

D6.227	Internal condition	0110			

0 .. Ready to switch on	☐ / ☑	6 .. Lock switching on	☐ / ☑
1 .. Ready to run	☐ / ☑	7 .. Alarm	☐ / ☑
2 .. Operation released	☐ / ☑	8 .. f = f ref.	☐ / ☑
3 .. Fault	☐ / ☑	9 .. Control	☐ / ☑
4 .. No Off 2	☐ / ☑	10 .. f > level	☐ / ☑
5 .. No Off 3	☐ / ☑		

Presentation of the internal affecting drive state.

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Diagnostics of the "Bus raw data"

D6.228	PRx 01				hex
D6.229	PRx 02				hex
D6.230	PRx 03				hex
D6.231	PRx 04				hex
D6.232	PRx 05				hex
D6.233	PRx 06				hex
D6.234	PRx 07				hex
D6.235	PRx 08				hex
D6.236	PRx 09				hex
D6.237	PRx 10				hex

Presentation of the incoming data words 1...10 at the bus.

D6.242	PTx 01				hex
D6.243	PTx 02				hex
D6.244	PTx 03				hex
D6.245	PTx 04				hex
D6.246	PTx 05				hex
D6.247	PTx 06				hex
D6.248	PTx 07				hex
D6.249	PTx 08				hex
D6.250	PTx 09				hex
D6.251	PTx 10				hex

Presentation of the outgoing data words 1...10 at the bus.

Application examples

General

In addition to the typical "Bus operation" (all inverters are controlled via fieldbus) also a "Mixed operation" (i.e. simultaneous use of bus control and conventional control via terminals) is available due to the simple configuration of the reference and actual values and the free areas of the control and status word.

Following all three basic control types are described in form of block diagrams.

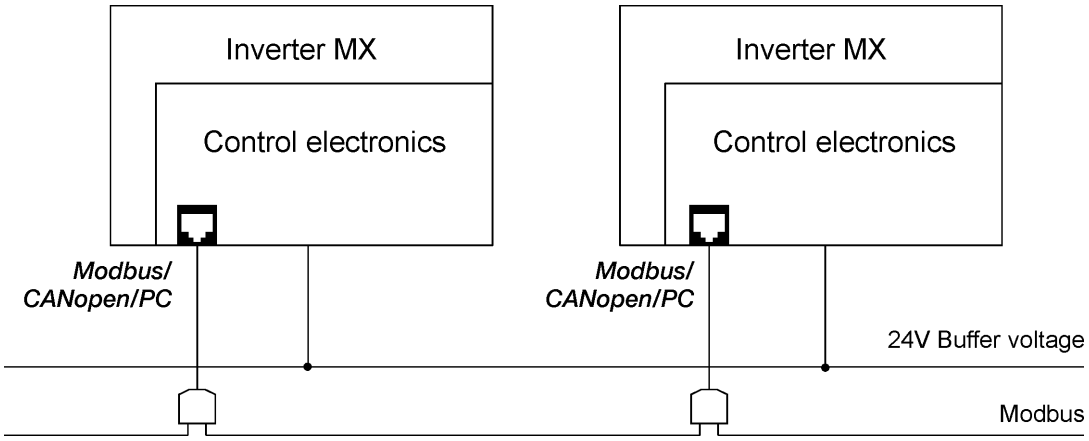
A mixed operation of these variants is certainly possible.

Controlling the MX by means of the fieldbus interface → "Pure bus operation"

The whole control and diagnostics of the inverter is carried out by means of the bus coupling.

The possibility to implement conventional control elements is not used.

In order to address an inverter via fieldbus also during mains cut-off (line contactor control, disconnecting switch, ...) the *>pDRIVE< MX eco* has to be supplied with an external 24 V buffer voltage.



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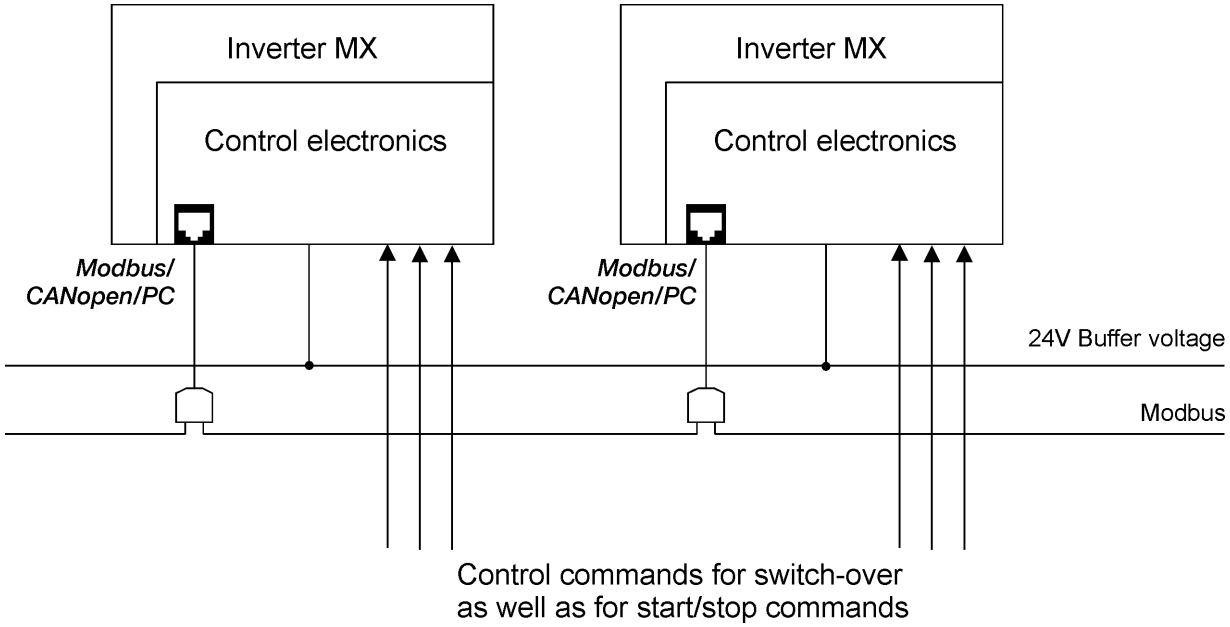
Controlling the MX alternatively by means of the fieldbus interface or the terminals → "Control source switch-over"

The inverter is controlled depending on a digital signal (at the terminals or the bus) via the bus control word or digital commands at the inverter terminals. Further information about the selection of the control source are given in matrix field E4 and the presetting of macro 4 in matrix field B2.



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In order to address an inverter via fieldbus also during mains cut-off (line contactor control, disconnecting switch, ...) the *>pDRIVE< MX eco* has to be supplied with an external 24 V buffer voltage.

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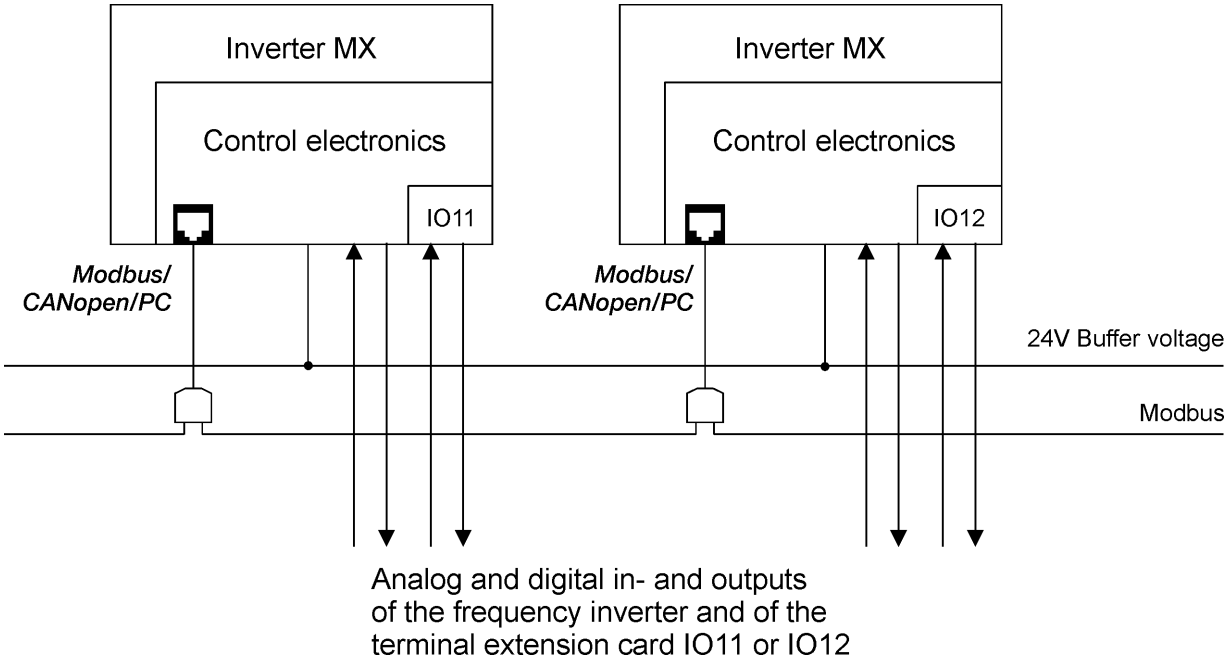
Controlling the MX by means of the fieldbus interface and the terminals of the device → "Mixed operation"

The whole control and diagnostics of the inverter is carried out by means of the bus coupling. However, also additionally external information for inverter operation (additional reference values, control signals) or system information which do not directly affect the drive are implemented in the automation concept using the standard terminals or the terminal extension IO11 or IO12.

An external supply of the inverter electronics with 24 V buffer voltage is necessary if the system information have to be exchanged furthermore via the DP master even if the inverter is cut from the mains.



Example 1: *Use of the MX internal PID process controller*

Reference value: provided serial from the fieldbus

Actual value: A sensor provides a 0...10 V analog signal directly for the control terminals of the inverter.

Example 2: *A screw conveyor is connected and disconnected by means of a filling level indicator.*

The filling level indicator provides two floating-ground signals which can be directly integrated in the telegram to the DP master by means of the digital inputs DI1 and DI2 of the inverter and thus they are available for the control program of the system.

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Appendix

Parameter list of the >pDRIVE< MX eco

Parameter name		Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
A2	**Motor values**								
Motor values									
A2.01	Speed	101	65			1			rpm
A2.02	Direction of rotation	102	66						
A2.03	Torque	103	67			see table			Nm
A2.04	Operating quadrant	104	68						
A2.05	Motor current in A	105	69			see table			A
A2.06	Motor current in %	106	6A			1			%
A2.07	Shaft power in kW	107	6B			see table			kW
A2.08	Shaft power in HP	108	6C			see table			Hp
A2.09	Apparent power	109	6D			see table			kVA
A2.10	Motor voltage	110	6E			1			V
A2.11	Thermal load M1	111	6F			1			%
A2.12	Thermal load M2	112	70			1			%
A2.13	Process speed	113	71			10			rpm
A2.14	Multiplier - n	451	1C3			1	-1000	1000	
A2.15	Divisor - n	452	1C4			1	1	1000	
A2.16	Offset - n	453	1C5			100	-100	100	
A2.17	Symbol for A2.13	454	1C6	txt					
	Ensuing parameter	458	1CA	txt					
A2.18	Unit for A2.13	456	1C8	txt					
	Ensuing parameter	457	1C9	txt					
A2.19	Process torque	459	1CB			1			%
A2.20	Multiplier - T	460	1CC			1	1	10000	
A2.21	Divisor - T	461	1CD			1	1	1000	
A2.22	Offset - T	462	1CE			100	-100	100	
A2.23	Symbol for A2.19	463	1CF	txt					
	Ensuing parameter	464	1D0	txt					
A2.24	Unit for A2.19	465	1D1	txt					
	Ensuing parameter	466	1D2	txt					
A2.25	Active motor	114	72						
A3	**Inverter values**								
Inverter values									
A3.01	Output frequency	117	75			100			Hz
A3.02	Inverter load	118	76			1			%
A3.03	Mains voltage	119	77			1			V
A3.04	DC voltage	120	78			1			V
A3.05	Thermal load VSD	121	79			1			%
A3.06	Active pulse frequency	122	7A			10			kHz
A4	**Reference values**								
Monitoring of analog inputs									
A4.01	AI1 ref. value [%]	125	7D			10			%
A4.02	AI1 ref. value scaled	126	7E			100			Hz / %
A4.03	AI2 ref. value [%]	127	7F			10			%
A4.04	AI2 ref. value scaled	128	80			100			Hz / %
A4.05	AI3 ref. value [%]	129	81			10			%
A4.06	AI3 ref. value scaled	130	82			100			Hz / %
A4.07	AI4 ref. value [%]	131	83			10			%
A4.08	AI4 ref. value scaled	132	84			100			Hz / %

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Parameter name		Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
A4.09	FP ref. value in kHz	133	85			100			kHz
A4.10	FP ref. value scaled	134	86			100			Hz / %
Monitoring of digital reference sources									
A4.11	Motor pot. ref. value	135	87			100			Hz / %
A4.12	MX - wheel ref. value	136	88			100			Hz
A4.13	Pre-set reference	137	89			100			Hz / %
Monitoring of internal reference sources									
A4.14	Ref. value switch-over	138	8A			100			Hz / %
A4.15	Calculator	139	8B			100			Hz / %
A4.16	Act. value selection	140	8C			100			Hz / %
A4.17	Curve generator	141	8D			100			Hz / %
Monotor logic input									
A4.18	DI state basic device	142	8E	0110					
A4.19	DI state IO11	143	8F	0110					
A4.20	DI state IO12	144	90	0110					
Monitoring of bus reference sources									
A4.21	Bus reference 1 scaled	145	91			100			Hz / %
A4.22	Bus reference 2 scaled	146	92			100			Hz / %
A4.23	Bus reference 3 scaled	147	93			100			Hz / %
A4.24	Bus reference 4 scaled	148	94			100			Hz / %
A4.25	Bus reference 5 scaled	149	95			100			Hz / %
A4.26	Bus reference 6 scaled	150	96			100			Hz / %
A4.27	Bus reference 7 scaled	151	97			100			Hz / %
A4.28	Bus reference 8 scaled	152	98			100			Hz / %
A4.29	Bus reference 9 scaled	153	99			100			Hz / %
A5	**Counter**								
Operating hours									
A5.01	Operating hours motor1	154	9A			1			h
A5.02	Interval motor 1	468	1D4			1	0	10000	h
A5.03	Interval counter M1	155	9B			1			h
A5.04	Operating hours motor2	156	9C			1			h
A5.05	Interval motor 2	469	1D5			1	0	10000	h
A5.06	Interval counter M2	157	9D			1			h
A5.07	Power on hours	158	9E			1			h
A5.08	Interval power on	470	1D6			1	0	10000	h
A5.09	Interval count. PowerOn	159	9F			1			h
A5.10	Operating hours fan	160	A0			1			h
A5.11	Interval fan	471	1D7			1	0	10000	h
A5.12	Interval counter fan	161	A1			1			h
A5.13	Clear intervall counter	162	A2						
Energy meter									
A5.14	MWh meter mot.	163	A3			1			MWh
A5.15	kWh meter mot.	164	A4			10			kWh
A5.16	MWh meter gen.	165	A5			1			MWh
A5.17	kWh meter gen.	166	A6			10			kWh
A6	**Display configuration**								
Configuration of the display									
A6.01	Selection upper field	472	1D8						
A6.02	Selection middle field	473	1D9						
A6.03	Selection lower field	474	1DA						
A6.04	View all parameters	475	1DB						

Parameter name		Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
A6.05	Limitations	398	18E						
B1	**Language selection**								
Language selection									
B1.01	Select language	477	1DD						
B2	**Macro configuration**								
Parameter management									
B2.01	Active parameter set	167	A7						
B2.02	Macro selection	478	1DE						
B2.03	Parameter mode	479	1DF						
B2.04	Create backup	1801	709						
B2.05	Restore backup	1802	70A						
B2.06	Copy parameter set	1803	70B						
B2.07	Name parameter set 1	481	1E1	txt					
	Ensuing parameter	482	1E2	txt					
	Ensuing parameter	483	1E3	txt					
	Ensuing parameter	484	1E4	txt					
	Ensuing parameter	485	1E5	txt					
	Ensuing parameter	486	1E6	txt					
	Ensuing parameter	487	1E7	txt					
B2.08	Name parameter set 2	488	1E8	txt					
	Ensuing parameter	489	1E9	txt					
	Ensuing parameter	490	1EA	txt					
	Ensuing parameter	491	1EB	txt					
	Ensuing parameter	492	1EC	txt					
	Ensuing parameter	493	1ED	txt					
	Ensuing parameter	494	1EE	txt					
B3	**Inverter data**								
Line voltage									
B3.01	Mains voltage	495	1EF						
Motor control									
B3.02	Control mode	496	1F0						
B3.03	Starting voltage	497	1F1			1	0	1000	V
B3.04	V/f - V1	498	1F2			1	0	1000	V
B3.05	V/f - f1	499	1F3			10	0	300	Hz
B3.06	V/f - V2	500	1F4			1	0	1000	V
B3.07	V/f - f2	501	1F5			10	0	300	Hz
B3.08	V/f - V3	502	1F6			1	0	1000	V
B3.09	V/f - f3	503	1F7			10	0	300	Hz
B3.10	V/f - V4	504	1F8			1	0	1000	V
B3.11	V/f - f4	505	1F9			10	0	300	Hz
B3.12	V/f - V5	506	1FA			1	0	1000	V
B3.13	V/f - f5	507	1FB			10	0	300	Hz
B3.17	Starting torque	508	1FC			1	25	200	%
B3.18	Slip compensation	509	1FD			1	0	150	%
B3.19	Vmax field weakening	510	1FE			1	100	200	%
B3.20	Dynamic 1	511	1FF			100	0	25	
B3.21	Dynamic 2	512	200			100	0	10	
General settings									
B3.24	Stop mode	513	201						
B3.25	decel. persistant freq.	515	203			10	0	50	Hz
B3.26	decel. persistant time	516	204			1	0	3600	s
B3.27	Motor fluxing	514	202						

Parameter name		Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
B3.30	Skip frequency	517	205			10	2	16	kHz
B3.31	Noise reduction	518	206						
B3.32	Vmot optimization	519	207						
B3.35	Catch on the fly	520	208						
B3.36	Allowed catch direction	521	209						
B3.37	Sensibility	522	20A			10	0.4	12	
B3.40	Output filter	523	20B						
B3.41	Fan control	524	20C						
B3.42	Auto tune at power on	525	20D						
B3.43	Automatic SC test	526	20E						
B3.44	Operation with IR	527	20F						
B4	**Motor data**								
Motor selection									
B4.01	Motor type	528	210						
B4.02	Motor selection	529	211						
B4.03	Start tuning	1804	70C						
Motor data M1									
B4.05	Nominal power M1	531	213			see table	0.2	3500	kW
B4.06	Nominal current M1	532	214			see table	0	4000	A
B4.07	Nominal voltage M1	533	215			1	0	1000	V
B4.08	Nominal frequency M1	534	216			10	0	300	Hz
B4.09	Nominal speed M1	535	217			1	0	65000	rpm
B4.10	Nominal slip M1	168	A8			100			Hz
B4.11	No. of pole pairs M1	169	A9			1			
B4.12	Stator resistor M1	536	218			see table	0	65000	mOhm
B4.13	Rotortime constant M1	537	219			1	0	10000	ms
B4.14	Fluxing current M1	538	21A			10	0	4000	A
B4.15	Stray reactance M1	539	21B			100	0	655.35	mH
B4.16	Data M1	540	21C						
Motor data M2									
B4.17	Nominal power M2	541	21D			see table	0.2	3500	kW
B4.18	Nominal current M2	542	21E			see table	0	4000	A
B4.19	Nominal voltage M2	543	21F			1	0	1000	V
B4.20	Nominal frequency M2	544	220			10	0	300	Hz
B4.21	Nominal speed M2	545	221			1	0	65000	rpm
B4.22	Nominal slip M2	170	AA			100			Hz
B4.23	No. of pole pairs M2	171	AB			1			
B4.24	Stator resistor M2	546	222			see table	0	65000	mOhm
B4.25	Rotortime constant M2	547	223			1	0	10000	ms
B4.26	Fluxing current M2	548	224			10	0	4000	A
B4.27	Stray reactance M2	549	225			100	0	655.35	mH
B4.28	Data M2	550	226						
Motor data default macro M0									
B4.29	Nominal power M0	172	AC			see table			kW
B4.30	Nominal current M0	173	AD			see table			A
B4.31	Nominal voltage M0	174	AE			1			V
B4.32	Nominal frequency M0	175	AF			10			Hz
B4.33	Nominal speed M0	176	B0			1			rpm
B4.34	Nominal slip M0	177	B1			100			Hz
B4.35	No. of pole pairs M0	178	B2			1			
B4.36	Stator resistor M0	179	B3			see table			mOhm
B4.37	Rotortime constant M0	180	B4			1			ms
B4.38	Fluxing current M0	181	B5			10			A

Parameter name		Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
B4.39	Stray reactance M0	182	B6			100			mH
B4.40	Load default motor	397	18D						
B5	**Brake function**								
Brake mode									
B5.01	Braking mode	570	23A						
C1	**Int. reference**								
Preset reference values									
C1.01	Pre-set ref. selection	588	24C						
C1.02	Pre-set reference 1	589	24D			100	-300	300	Hz / %
C1.03	Pre-set reference 2	590	24E			100	-300	300	Hz / %
C1.04	Pre-set reference 3	591	24F			100	-300	300	Hz / %
C1.05	Pre-set reference 4	592	250			100	-300	300	Hz / %
C1.06	Pre-set reference 5	593	251			100	-300	300	Hz / %
C1.07	Pre-set reference 6	594	252			100	-300	300	Hz / %
C1.08	Pre-set reference 7	595	253			100	-300	300	Hz / %
C1.09	Pre-set reference 8	596	254			100	-300	300	Hz / %
C1.10	Pre-set reference 9	597	255			100	-300	300	Hz / %
C1.11	Pre-set reference 10	598	256			100	-300	300	Hz / %
C1.12	Pre-set reference 11	599	257			100	-300	300	Hz / %
C1.13	Pre-set reference 12	600	258			100	-300	300	Hz / %
C1.14	Pre-set reference 13	601	259			100	-300	300	Hz / %
C1.15	Pre-set reference 14	602	25A			100	-300	300	Hz / %
C1.16	Pre-set reference 15	603	25B			100	-300	300	Hz / %
C1.17	Pre-set reference 16	604	25C			100	-300	300	Hz / %
Motor potentiometer									
C1.18	Motor pot. selection	605	25D						
C1.19	Motor pot. control	606	25E						
C1.20	Motor pot. min. value	607	25F			100	-300	300	Hz / %
C1.21	Motor pot. max. value	608	260			100	-300	300	Hz / %
C1.22	Motor pot. accel. time	609	261			10	0	6500	s
C1.23	Motor pot. decel. time	610	262			10	0	6500	s
C1.24	Motor pot. ref. storage	611	263						
C1.25	Motor pot. tracking	612	264						
Panel reference sources									
C1.29	MX-wheel selection	613	265						
C1.30	MX-wheel min. value	614	266			10	0	300	Hz
C1.31	MX-wheel max. value	615	267			10	0	300	Hz
C1.34	MX-wheel single step	618	26A			100	0	50	
C1.35	Store MX-wheel ref.	619	26B						
Calculator									
C1.38	Calculator selection	620	26C						
C1.39	Calculator input A	621	26D						
C1.40	Calculator input B	622	26E						
C1.41	Calculator function	623	26F						
C1.42	Reference value	624	270				-300	300	
C1.43	Multiplier	625	271			1	1	30000	
C1.44	Divisor	626	272			1	1	1000	
C1.45	Calculator min. value	627	273			100	-300	300	Hz / %
C1.46	Calculator max. value	628	274			100	-300	300	Hz / %
Actual value selection									
C1.49	Actual value usage	629	275						
C1.50	Actual value selection	630	276						
C1.51	Actual value filter time	631	277			100	0	20	s

Parameter name		Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
C1.52	Value at 0Hz [%]	632	278			100	-300	300	Hz / %
C1.53	Value at 100Hz [%]	633	279			100	-300	300	Hz / %
Reference value switch									
C1.54	Ref. val. switch usage	634	27A						
C1.55	Ref. val. switch selec.	635	27B						
C1.56	Ref. val. switch input A	636	27C						
C1.57	Ref. val. switch input B	637	27D						
Curve generator									
C1.61	Curve generator selec.	639	27F						
C1.63	Ref. value 0	641	281			100	-300	300	Hz / %
C1.64	Time - Δt1	642	282			100	0	650	s
C1.65	Ref. value 1	643	283			100	-300	300	Hz / %
C1.66	Time - Δt2	644	284			100	0	650	s
C1.67	Ref. value 2	645	285			100	-300	300	Hz / %
C1.68	Time - Δt3	646	286			100	0	650	s
C1.69	Ref. value 3	647	287			100	-300	300	Hz / %
C1.70	Time - Δt4	648	288			100	0	650	s
C1.71	Ref. value 4	649	289			100	-300	300	Hz / %
C1.72	Time - Δt5	650	28A			100	0	650	s
C1.73	Ref. value 5	651	28B			100	-300	300	Hz / %
C1.74	Time - Δt6	652	28C			100	0	650	s
C1.75	Ref. value 6	653	28D			100	-300	300	Hz / %
C1.76	Time - Δt7	654	28E			100	0	650	s
C2	**Ramp / frequency**								
Frequency range									
C2.01	Minimum frequency	655	28F			10	0	300	Hz
C2.02	Maximum frequency	656	290			10	10	300	Hz
Direction of rotation									
C2.03	Direction enable	657	291						
C2.04	Phase rotation	658	292						
Acceleration/deceleration ramps									
C2.05	Acceleration ramp 1	659	293			10	0	6000	s
C2.06	Deceleration ramp 1	660	294			10	0	6000	s
C2.07	Acceleration ramp 2	661	295			10	0	6000	s
C2.08	Deceleration ramp 2	662	296			10	0	6000	s
C2.09	Switch 1st/2nd accel.	663	297			10	0	300	Hz
C2.10	Switch 2nd/1st decel.	664	298			10	0	300	Hz
C2.11	Start ramp	665	299			10	0	6000	s
C2.12	S-ramp mode	666	29A						
C2.13	S-ramp	667	29B			1	1	100	%
C3	**Cascade control**								
Cascade control - activation									
C3.01	Cascade mode	668	29C						
Cascade state									
C3.02	Cascade state	191	BF	0110					
C3.03	Oper. hours C.Mot1	192	C0			1			h
C3.04	Oper. hours C.Mot2	193	C1			1			h
C3.05	Oper. hours C.Mot3	194	C2			1			h
C3.06	Oper. hours C.Mot4	195	C3			1			h
Basic settings									
C3.09	No. of cascade pumps	669	29D			1	1	4	
C3.10	Manual / auto switch	670	29E						

Parameter name		Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
C3.11	Oper. mode C.Mot1	671	29F						
C3.12	Oper. mode C.Mot2	672	2A0						
C3.13	Oper. mode C.Mot3	673	2A1						
C3.14	Oper. mode C.Mot4	674	2A2						
C3.15	Switching mode	675	2A3						
Switching points pressure									
C3.18	Max. PID-deviation	676	2A4			10	0	100	%
C3.19	Overdrive limit	677	2A5			10	0	100	%
Switching points frequency									
C3.22	Frequency C.Mot1 on	678	2A6			10	0	300	Hz
C3.23	Frequency C.Mot1 off	679	2A7			10	0	300	Hz
C3.24	Frequency C.Mot2 on	680	2A8			10	0	300	Hz
C3.25	Frequency C.Mot2 off	681	2A9			10	0	300	Hz
C3.26	Frequency C.Mot3 on	682	2AA			10	0	300	Hz
C3.27	Frequency C.Mot3 off	683	2AB			10	0	300	Hz
C3.28	Frequency C.Mot4 on	684	2AC			10	0	300	Hz
C3.29	Frequency C.Mot4 off	685	2AD			10	0	300	Hz
Switching dynamic									
C3.32	Switch on delay	686	2AE			10	0	500	s
C3.33	Turn-off delay	687	2AF			10	0	500	s
C3.34	Overdrive time	688	2B0			10	0	500	s
C3.35	Min. switch-over time	689	2B1			10	0	500	s
Change of motor									
C3.38	Motor change	690	2B2						
C3.39	Change master drive	691	2B3						
C3.40	Time-frame	692	2B4			10	0	1000	h
C3.41	Time master drive	693	2B5			1	0	10000	h
C4	**PID configuration**								
Monitoring of PID values									
C4.01	PID reference value	196	C4			10			%
C4.02	PID actual value	197	C5			10			%
C4.03	PID deviation	198	C6			1			%
C4.04	PID output	199	C7			10			Hz / %
Basic setting									
C4.07	Control mode	694	2B6						
C4.08	Control sense	695	2B7						
C4.09	Proportional gain	696	2B8			1000	0	30	
C4.10	Integration time	697	2B9			100	0	600	s
C4.11	Derive time	698	2BA			100	0	600	s
C4.12	Max. D-part	699	2BB			100	0	300	
C4.13	Output level min.	700	2BC			10	-300	300	
C4.14	Output level max.	701	2BD			10	-300	300	
C4.17	Frequency tracking	702	2BE						
C4.18	Ref. value acceleration	703	2BF			10	0	6000	s
C4.19	Ref. value deceleration	704	2C0			10	0	6000	s
Compensation of pressure drop									
C4.22	Pressure drop	705	2C1			10	0	300	%
C4.23	Start compensation	706	2C2			10	0	300	Hz
C4.24	Compensation dynamic	707	2C3			10	0	300	s
Advanced functions									
C4.32	PID-lock	711	2C7						
C4.33	Wind-up behaviour	712	2C8						
C4.34	PID multiplier	713	2C9			1	-1000	1000	
C4.35	PID divisor	714	2CA			1	1	1000	

Parameter name		Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
C4.36	PID offset	715	2CB			100	-100	100	
C4.37	Process unit	716	2CC	txt					
	Ensuing parameter	717	2CD	txt					
C6	**Special functions**								
Economy mode									
C6.01	Economy mode	719	2CF						
C6.02	Max. fluxing reduction	720	2D0			1	25	100	%
C6.03	V/f level	721	2D1			1	0	100	%
Motor heating									
C6.05	Motor heating	722	2D2						
C6.06	Heating current	723	2D3			1	0	50	%
Line contactor control									
C6.07	Contactor control	724	2D4						
Motor contactor control									
C6.08	Motor contactor control	725	2D5						
Standby Mode									
C6.11	Standby mode	726	2D6						
C6.12	Off delay time	727	2D7			10	1	3000	s
C6.13	On delay time	728	2D8			10	1	100	s
C6.14	Max. level	729	2D9			10	0	300	%
C6.15	Min. level	730	2DA			10	0	300	%
Impulse Counter									
C6.18	Pulse counter	731	2DB						
C6.19	Total counter	200	C8			10			
C6.20	Counter (average)	201	C9			10			
C6.21	Scaling	732	2DC			1000	0	65	
C6.22	Time base pulse counter	733	2DD			1	0	3600	s
C6.23	Pulse type	734	2DE						
C6.24	Symbol pulse counter	735	2DF	txt					
	Ensuing parameter	736	2E0	txt					
C6.25	Pulse counter unit	737	2E1	txt					
	Ensuing parameter	738	2E2	txt					
C6.26	f-correction	740	2E4						
D1	**Analog inputs**								
Analog input AI1									
D1.01	AI1 selection	741	2E5						
D1.02	AI1 level	742	2E6						
D1.03	AI1 min. value	743	2E7			100	-300	300	Hz / %
D1.04	AI1 max. value	744	2E8			100	-300	300	Hz / %
D1.05	AI1 filter-time	745	2E9			100	0	30	s
Analog input AI2									
D1.08	AI2 selection	746	2EA						
D1.09	AI2 level	747	2EB						
D1.10	AI2 min. value	748	2EC			100	-300	300	Hz / %
D1.11	AI2 max. value	749	2ED			100	-300	300	Hz / %
D1.12	AI2 filter-time	750	2EE			100	0	30	s
Analog input AI3									
D1.15	AI3 selection	751	2EF						
D1.16	AI3 level	752	2F0						
D1.17	AI3 min. value	753	2F1			100	-300	300	Hz / %
D1.18	AI3 max. value	754	2F2			100	-300	300	Hz / %
D1.19	AI3 filter-time	755	2F3			100	0	30	s
Analog input AI4									

Parameter name		Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
D1.22	AI4 selection	756	2F4						
D1.23	AI4 level	757	2F5						
D1.24	AI4 min. value	758	2F6			100	-300	300	Hz / %
D1.25	AI4 max. value	759	2F7			100	-300	300	Hz / %
D1.26	AI4 filter-time	760	2F8			100	0	30	s
Frequency input									
D1.29	FP selection	761	2F9						
D1.30	FP min.	762	2FA			100	0	30	kHz
D1.31	FP max.	763	2FB			100	0	30	kHz
D1.32	FP min. value	764	2FC			100	-300	300	Hz / %
D1.33	FP max. value	765	2FD			100	-300	300	Hz / %
D1.34	FP filter-time	766	2FE			100	0	30	s
D2	**Digital inputs**								
Logic Inputs									
D2.01	DI1 selection	767	2FF						
D2.02	DI2 selection	768	300						
D2.03	DI3 selection	769	301						
D2.04	DI4 selection	770	302						
D2.05	DI5 selection	771	303						
D2.06	DI6 selection	772	304						
D2.07	DI7 selection	773	305						
D2.08	DI8 selection	774	306						
D2.09	DI9 selection	775	307						
D2.10	DI10 selection	776	308						
D2.11	DI11 selection	777	309						
D2.12	DI12 selection	778	30A						
D2.13	DI13 selection	779	30B						
D2.14	DI14 selection	780	30C						
D2.15	DI at bus mode active	781	30D	0110					
D3	**Analog outputs**								
Analog output AO1									
D3.01	AO1 selection	782	30E						
D3.02	AO1 level	783	30F						
D3.03	AO1 min. value	784	310			100	-300	300	
D3.04	AO1 max. value	785	311			100	-300	300	
D3.05	AO1 filter-time	786	312			100	0	30	s
Analog output AO2									
D3.08	AO2 selection	787	313						
D3.09	AO2 level	788	314						
D3.10	AO2 min. value	789	315			100	-300	300	
D3.11	AO2 max. value	790	316			100	-300	300	
D3.12	AO2 filter-time	791	317			100	0	30	s
Analog output AO3									
D3.15	AO3 selection	792	318						
D3.16	AO3 level	793	319						
D3.17	AO3 min. value	794	31A			100	-300	300	
D3.18	AO3 max. value	795	31B			100	-300	300	
D3.19	AO3 filter-time	796	31C			100	0	30	s
D4	**Digital outputs**								
Logic outputs									
D4.01	R1 selection	797	31D						
D4.02	R2 selection	798	31E						

Parameter name		Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
D4.03	R3 selection	799	31F						
D4.04	DO1 selection	800	320						
D4.05	DO2 selection	801	321						
D4.06	R4 selection	802	322						
D4.07	DO3 selection	803	323						
D4.08	DO4 selection	804	324						
D4.11	DO invertation	805	325	0110					
D6	**Fieldbus**								
Fieldbus configuration									
D6.01	Bus selection	1301	515						
D6.02	Control requested	1302	516						
D6.03	Bus error behaviour	1303	517						
D6.04	Bus error delay time	1304	518			10	0	3200	s
D6.10	Modbus address	1305	519			1	0	247	
D6.11	Modbus baud rate	1306	51A						
D6.12	Modbus format	1307	51B						
D6.13	Modbus frame count	202	CA			1			
D6.14	Modbus CRC errors	203	CB			1			
D6.15	Modbus time-out	1308	51C			10	0	300	s
D6.20	CANopen address	1319	527			1	0	127	
D6.21	CANopen baud rate	1320	528						
D6.30	DP slave address	1321	529			1			
D6.31	DP baud rate	208	D0						
D6.32	Slave state	209	D1						
D6.33	On after off 1	1322	52A						
D6.34	Request master	210	D2	0110					
D6.35	DP master address	211	D3			1			
D6.36	Config buffer 1	212	D4			1			hex
D6.37	Config buffer 2	213	D5			1			hex
D6.38	Config buffer 3	214	D6			1			hex
D6.39	DP diagnostic buffer 1	215	D7			1			hex
D6.40	DP diagnostic buffer 2	216	D8			1			hex
D6.41	Group number	217	D9			1			
D6.42	Global command	218	DA			1			
Fieldbus references									
D6.100	No. of Bus-ref. values	1323	52B						
D6.101	Ref. value1 selection	1324	52C						
D6.102	Ref. value1 min. value	1325	52D			100	-300	300	Hz / %
D6.103	Ref. value1 max. value	1326	52E			100	-300	300	Hz / %
D6.104	Ref. value1 emergency	1327	52F			1	0	65535	hex
D6.105	Ref. value2 selection	1328	530						
D6.106	Ref. value2 min. value	1329	531			100	-300	300	Hz / %
D6.107	Ref. value2 max. value	1330	532			100	-300	300	Hz / %
D6.108	Ref. value2 emergency	1331	533			1	0	65535	hex
D6.109	Ref. value3 selection	1332	534						
D6.110	Ref. value3 min. value	1333	535			100	-300	300	Hz / %
D6.111	Ref. value3 max. value	1334	536			100	-300	300	Hz / %
D6.112	Ref. value3 emergency	1335	537			1	0	65535	hex
D6.113	Ref. value4 selection	1336	538						
D6.114	Ref. value4 min. value	1337	539			100	-300	300	Hz / %
D6.115	Ref. value4 max. value	1338	53A			100	-300	300	Hz / %
D6.116	Ref. value4 emergency	1339	53B			1	0	65535	hex
D6.117	Ref. value5 selection	1340	53C						
D6.118	Ref. value5 min. value	1341	53D			100	-300	300	Hz / %

Parameter name	Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
D6.119 Ref. value5 max. value	1342	53E			100	-300	300	Hz / %
D6.120 Ref. value5 emergency	1343	53F			1	0	65535	hex
D6.121 Ref. value6 selection	1344	540						
D6.122 Ref. value6 min. value	1345	541			100	-300	300	Hz / %
D6.123 Ref. value6 max. value	1346	542			100	-300	300	Hz / %
D6.124 Ref. value6 emergency	1347	543			1	0	65535	hex
D6.125 Ref. value7 selection	1348	544						
D6.126 Ref. value7 min. value	1349	545			100	-300	300	Hz / %
D6.127 Ref. value7 max. value	1350	546			100	-300	300	Hz / %
D6.128 Ref. value7 emergency	1351	547			1	0	65535	hex
D6.129 Ref. value8 selection	1352	548						
D6.130 Ref. value8 min. value	1353	549			100	-300	300	Hz / %
D6.131 Ref. value8 max. value	1354	54A			100	-300	300	Hz / %
D6.132 Ref. value8 emergency	1355	54B			1	0	65535	hex
D6.133 Ref. value9 selection	1356	54C						
D6.134 Ref. value9 min. value	1357	54D			100	-300	300	Hz / %
D6.135 Ref. value9 max. value	1358	54E			100	-300	300	Hz / %
D6.136 Ref. value9 emergency	1359	54F			1	0	65535	hex
Fieldbus actual values								
D6.137 Number actual values	1360	550						
D6.138 Act. value1 selection	1361	551						
D6.139 Act. value1 min. value	1362	552			100	-300	300	
D6.140 Act. value1 max. value	1363	553			100	-300	300	
D6.141 Act. value1 filter-time	1364	554			100	0	30	s
D6.142 Act. value2 selection	1365	555						
D6.143 Act. value2 min. value	1366	556			100	-300	300	
D6.144 Act. value2 max. value	1367	557			100	-300	300	
D6.145 Act. value2 filter-time	1368	558			100	0	30	s
D6.146 Act. value3 selection	1369	559						
D6.147 Act. value3 min. value	1370	55A			100	-300	300	
D6.148 Act. value3 max. value	1371	55B			100	-300	300	
D6.149 Act. value3 filter-time	1372	55C			100	0	30	s
D6.150 Act. value4 selection	1373	55D						
D6.151 Act. value4 min. value	1374	55E			100	-300	300	
D6.152 Act. value4 max. value	1375	55F			100	-300	300	
D6.153 Act. value4 filter-time	1376	560			100	0	30	s
D6.154 Act. value5 selection	1377	561						
D6.155 Act. value5 min. value	1378	562			100	-300	300	
D6.156 Act. value5 max. value	1379	563			100	-300	300	
D6.157 Act. value5 filter-time	1380	564			100	0	30	s
D6.158 Act. value6 selection	1381	565						
D6.159 Act. value6 min. value	1382	566			100	-300	300	
D6.160 Act. value6 max. value	1383	567			100	-300	300	
D6.161 Act. value6 filter-time	1384	568			100	0	30	s
D6.162 Act. value7 selection	1385	569						
D6.163 Act. value7 min. value	1386	56A			100	-300	300	
D6.164 Act. value7 max. value	1387	56B			100	-300	300	
D6.165 Act. value7 filter-time	1388	56C			100	0	30	s
D6.166 Act. value8 selection	1389	56D						
D6.167 Act. value8 min. value	1390	56E			100	-300	300	
D6.168 Act. value8 max. value	1391	56F			100	-300	300	
D6.169 Act. value8 filter-time	1392	570			100	0	30	s
D6.170 Act. value9 selection	1393	571						
D6.171 Act. value9 min. value	1394	572			100	-300	300	
D6.172 Act. value9 max. value	1395	573			100	-300	300	
D6.173 Act. value9 filter-time	1396	574			100	0	30	s

Parameter name	Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
Assignment free bits STW								
D6.174 Bit 11 STW1 selection	1397	575						
D6.175 Bit 12 STW1 selection	1398	576						
D6.176 Bit 13 STW1 selection	1399	577						
D6.177 Bit 14 STW1 selection	1400	578						
D6.178 Bit 15 STW1 selection	1401	579						
D6.179 Bit at term.-mode act.	1402	57A	0110					
Assignment free bits ZTW								
D6.197 Bit 11 ZTW1 selection	1420	58C						
D6.198 Bit 12 ZTW1 selection	1421	58D						
D6.199 Bit 13 ZTW1 selection	1422	58E						
D6.200 Bit 14 ZTW1 selection	1423	58F						
D6.201 Bit 15 ZTW1 selection	1424	590						
Diagnosis STW (BUS -> VSD)								
D6.218 Bus STW hex	219	DB			1			hex
D6.219 Bus STW bin	220	DC	0110					
Diagnosis ZTW (VSD -> BUS)								
D6.222 Bus ZTW hex	223	DF			1			hex
D6.223 Bus ZTW bin	224	E0	0110					
D6.224 Bus ZTW2 hex	225	E1			1			hex
D6.225 Bus ZTW2 bin	226	E2	0110					
Diagnosis of the operating state								
D6.226 Internal control word	227	E3			1			hex
D6.227 Internal condition	228	E4	0110					
Diagnosis BUS -> VSD								
D6.228 PRx 01	230	E6			1			hex
D6.229 PRx 02	231	E7			1			hex
D6.230 PRx 03	232	E8			1			hex
D6.231 PRx 04	233	E9			1			hex
D6.232 PRx 05	234	EA			1			hex
D6.233 PRx 06	235	EB			1			hex
D6.234 PRx 07	236	EC			1			hex
D6.235 PRx 08	237	ED			1			hex
D6.236 PRx 09	238	EE			1			hex
D6.237 PRx 10	239	EF			1			hex
D6.238 SRx 01	240	F0			1			hex
D6.239 SRx 02	241	F1			1			hex
D6.240 SRx 03	242	F2			1			hex
D6.241 SRx 04	243	F3			1			hex
Diagnosis VSD -> BUS								
D6.242 PTx 01	250	FA			1			hex
D6.243 PTx 02	251	FB			1			hex
D6.244 PTx 03	252	FC			1			hex
D6.245 PTx 04	253	FD			1			hex
D6.246 PTx 05	254	FE			1			hex
D6.247 PTx 06	255	FF			1			hex
D6.248 PTx 07	256	100			1			hex
D6.249 PTx 08	257	101			1			hex
D6.250 PTx 09	258	102			1			hex
D6.251 PTx 10	259	103			1			hex
D6.252 STx 01	260	104			1			hex
D6.253 STx 02	261	105			1			hex
D6.254 STx 03	262	106			1			hex

Parameter name		Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
D6.255	STx 04	263	107			1			hex
E1	**Process protection**								
Limitations									
E1.01	I max VSD	806	326			1	10	135	%
E1.05	T max. motor	808	328			1	10	300	%
E1.07	T lim activation	810	32A						
E1.13	P max. motor	814	32E			1	10	300	%
Behaviour at limitations									
E1.17	Reaction at limitation	816	330						
E1.18	Time setting	817	331			100	0	300	s
E1.19	Ref. after acc. extension	818	332						
E1.21	Reaction at deceleration	819	333						
E1.22	Time setting	820	334			100	0	300	s
E1.23	Ref. after dec. extension	821	335						
Skip frequencies									
E1.25	Skip frequency 1	822	336			10	-300	300	Hz
E1.26	Hysteresis 1	823	337			100	0	10	Hz
E1.27	Skip frequency 2	824	338			10	-300	300	Hz
E1.28	Hysteresis 2	825	339			100	0	10	Hz
E1.29	Skip frequency 3	826	33A			10	-300	300	Hz
E1.30	Hysteresis3	827	33B			100	0	10	Hz
E1.31	Skip frequency 4	828	33C			10	-300	300	Hz
E1.32	Hysteresis 4	829	33D			100	0	10	Hz
Speed monitoring									
E1.38	n-monitoring	830	33E						
E1.39	Pulse / rotation	831	33F			1	0	100	
E1.40	Filter-time	832	340			10	0	300	s
E1.41	Detected speed	270	10E			10			rpm
E1.42	Ratio factor	833	341			100	0	10	
E1.43	Calculated slip	271	10F			10			rpm
E1.44	Tolerance	834	342			10	0	500	rpm
E1.45	n-monitoring response	835	343						
E1.46	Time setting	836	344			10	0	300	s
Feed-in monitoring									
E1.49	Feed in monitoring	837	345						
E1.50	Feed in mon. reaction	838	346						
E1.51	Time setting	839	347			10	0	300	s
E2	**Motor protection**								
Thermistor control									
E2.01	TH1 motor allocation	840	348						
E2.02	TH1 activation	841	349						
E2.03	TH1 response	842	34A						
E2.04	TH1 time setting	843	34B			1	0	300	s
E2.05	TH1 verification	844	34C						
E2.06	TH2 motor allocation	845	34D						
E2.07	TH2 activation	846	34E						
E2.08	TH2 response	847	34F						
E2.09	TH2 time setting	848	350			1	0	300	s
E2.10	TH2 verification	849	351						
E2.11	TH3 motor allocation	850	352						
E2.12	TH3 activation	851	353						
E2.13	TH3 response	852	354						
E2.14	TH3 time setting	853	355			1	0	300	s

Parameter name		Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
E2.15	TH3 verification	854	356						
Thermal mathematical motor model									
E2.18	M1 - overl. monitoring	855	357						
E2.19	M1 - response	856	358						
E2.20	M1 - Imax at 0Hz	857	359			1	0	300	%
E2.21	M1 - Imax at f nom.	858	35A			1	0	300	%
E2.22	M1 - therm. f-limitation	859	35B			10	0	300	Hz
E2.23	M1 - motor-time	860	35C			1	0	500	min
E2.24	M1 - cooling temp.	861	35D			1	-10	80	°C
E2.25	M1 - alarm level	862	35E			1	0	300	%
E2.26	M1 - trigger level	863	35F			1	0	300	%
E2.27	M1 - thermal load	272	110			1			%
E2.30	M2 - overl. monitoring	864	360						
E2.31	M2 - response	865	361						
E2.32	M2 - Imax at 0Hz	866	362			1	0	300	%
E2.33	M2 - Imax at f nom.	867	363			1	0	300	%
E2.34	M2 - therm. f-limitation	868	364			10	0	300	Hz
E2.35	M2 - motor-time	869	365			1	0	500	min
E2.36	M2 - cooling temp.	870	366			1	-10	80	°C
E2.37	M2 - alarm level	871	367			1	0	300	%
E2.38	M2 - trigger level	872	368			1	0	300	%
E2.39	M2 - thermal load	273	111			1			%
Stall protection									
E2.42	Stall protection	873	369						
E2.43	Stalling time	874	36A			10	0	200	s
E2.44	Stalling frequency	875	36B			10	0	20	Hz
E2.45	Stalling current	876	36C			1	0	150	%
Overspeed protection									
E2.48	Overspeed monitoring	877	36D						
E2.49	Overspeed response	878	36E						
E2.50	Overspeed level	879	36F			1	0	20000	rpm
E2.51	Time setting	880	370			10	0	300	s
Loss of motor phase									
E2.54	Motor phase monitor	881	371						
Underload protection									
E2.61	Underload monitor	882	372						
E2.62	Underload response	883	373						
E2.63	Underload level n²	884	374			1	0	100	%
E2.64	Underload level ½ fn	885	375			1	0	100	%
E2.65	Underload level fn	886	376			1	0	100	%
E2.66	Underload start time	887	377			10	0	300	s
E2.67	Time setting	888	378			10	0	300	s
E2.68	Filter-time	889	379			10	0	300	s

E3 Fault configuration

Behaviour in case of faults									
E3.01	Reaction at a trip	890	37A						
E3.03	Auto reset	891	37B						
E3.04	Auto reset selection	892	37C	0110					
E3.06	Auto reset trials	893	37D			1	1	20	
E3.07	Period	275	113			1	60	600	s
Emergency operation									
E3.09	Enable emergency op.	894	37E						
E3.10	Emergency op. active	276	114						
Loss of reference value									

Parameter name		Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
E3.13	AI2 - 4mA monitor	895	37F						
E3.14	AI2 - 4mA response	896	380						
E3.15	AI2 - emergency val.	897	381			10	4	20	mA
E3.16	AI3 - 4mA monitor	898	382						
E3.17	AI3 - 4mA response	899	383						
E3.18	AI3- emergency val.	900	384			100	4	20	
E3.19	AI4 - 4mA monitor	901	385						
E3.20	AI4 - 4mA response	902	386						
E3.21	AI4 - emergency val.	903	387			100	4	20	
E3.22	FP - f monitoring	904	388						
E3.23	FP - monitoring resp.	905	389						
E3.24	FP - emergency val.	906	38A			100	0	30	kHz
Loss of line phase									
E3.27	Mains phase monitoring	907	38B						
Behaviour at undervoltage									
E3.29	V< response	908	38C						
E3.30	Allowed V< time	909	38D			10	0	300	s
E3.31	Max. V< time	910	38E			10	0	3000	s
External fault									
E3.34	Ext. fault 1 monitor	911	38F						
E3.35	Ext. fault 1 response	912	390						
E3.36	Start delay time	913	391			10	0	600	s
E3.37	Time setting	914	392			10	0	300	s
E3.38	Ext. fault 1 name	915	393	txt					
	Ensuing parameter	916	394	txt					
	Ensuing parameter	917	395	txt					
	Ensuing parameter	918	396	txt					
	Ensuing parameter	919	397	txt					
	Ensuing parameter	920	398	txt					
	Ensuing parameter	921	399	txt					
	Ensuing parameter	922	39A	txt					
E3.41	Ext. fault 2 monitor	923	39B						
E3.42	Ext. fault 2 response	924	39C						
E3.43	Start delay time	925	39D			10	0	600	s
E3.44	Time setting	926	39E			10	0	300	s
E3.45	Ext. fault 2 name	927	39F	txt					
	Ensuing parameter	928	3A0	txt					
	Ensuing parameter	929	3A1	txt					
	Ensuing parameter	930	3A2	txt					
	Ensuing parameter	931	3A3	txt					
	Ensuing parameter	932	3A4	txt					
	Ensuing parameter	933	3A5	txt					
	Ensuing parameter	934	3A6	txt					
ON lock									
E3.48	ON lock activation	935	3A7						
E3.49	ON lock response	936	3A8						
E3.50	Time setting	937	3A9			10	0	300	s
Alarm categories									
E3.51	Alarm category 1	938	3AA	0110					
E3.54	Alarm category 2	940	3AC	0110					
E3.57	Alarm category 3	942	3AE	0110					

E4	Control configuration								
Control logic									
E4.01	Control source 1	944	3B0						
E4.02	Control source 2	945	3B1						

Parameter name		Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
E4.03	3-wire-control	946	3B2						
E5	**Keypad**								
Panel operation									
E5.01	Local mode	947	3B3						
E5.02	Local reset	948	3B4						
E5.03	Keypad stop button	949	3B5						
Parametertransfer with keypad									
E5.04	Copy: MX -> Keypad	1805	70D						
E5.05	Copy: Keypad -> MX	1806	70E						
E6	**Function blocks**								
Comparator C1 - C4									
E6.01	Comparator C1	950	3B6						
E6.02	C1 signal A selection	951	3B7						
E6.03	C1 signal A filter-time	952	3B8			100	0	300	s
E6.04	C1 signal B selection	953	3B9						
E6.05	C1 signal B ref. value	954	3BA			100	-300	300	
E6.06	C1 signal B filter-time	955	3BB			100	0	300	s
E6.07	C1 function	956	3BC						
E6.08	C1 hysteresis/band	957	3BD			100	0	650	
E6.09	C1 output	277	115						
E6.10	Comparator C2	958	3BE						
E6.11	C2 signal A selection	959	3BF						
E6.12	C2 signal A filter-time	960	3C0			100	0	300	s
E6.13	C2 signal B selection	961	3C1						
E6.14	C2 signal B ref. value	962	3C2			100	-300	300	
E6.15	C2 signal B filter-time	963	3C3			100	0	300	s
E6.16	C2 function	964	3C4						
E6.17	C2 hysteresis/band	965	3C5			100	0	650	
E6.18	C2 output	278	116						
E6.19	Comparator C3	966	3C6						
E6.20	C3 signal A selection	967	3C7						
E6.21	C3 signal A filter-time	968	3C8			100	0	300	s
E6.22	C3 signal B selection	969	3C9						
E6.23	C3 signal B ref. value	970	3CA			100	-300	300	
E6.24	C3 signal B filter-time	971	3CB			100	0	300	s
E6.25	C3 function	972	3CC						
E6.26	C3 hysteresis/band	973	3CD			100	0	650	
E6.27	C3 output	279	117						
E6.28	Comparator C4	974	3CE						
E6.29	C4 signal A selection	975	3CF						
E6.30	C4 signal A filter-time	976	3D0			100	0	300	s
E6.31	C4 signal B selection	977	3D1						
E6.32	C4 signal B ref. value	978	3D2			100	-300	300	
E6.33	C4 signal B filter-time	979	3D3			100	0	300	s
E6.34	C4 function	980	3D4						
E6.35	C4 hysteresis/band	981	3D5			100	0	650	
E6.36	C4 output	280	118						
Logic module L1 - L6									
E6.46	Logic 1	982	3D6						
E6.47	LM1 signal A selection	983	3D7						
E6.48	LM1 signal B selection	984	3D8						
E6.49	LM1 signal C selection	985	3D9						
E6.50	LM1 function	986	3DA						

Parameter name		Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
E6.51	LM1 output reverse	987	3DB						
E6.52	LM1 output	281	119						
E6.53	Logic 2	988	3DC						
E6.54	LM2 signal A selection	989	3DD						
E6.55	LM2 signal B selection	990	3DE						
E6.56	LM2 signal C selection	991	3DF						
E6.57	LM2 function	992	3E0						
E6.58	LM2 output reverse	993	3E1						
E6.59	LM2 output	282	11A						
E6.60	Logic 3	994	3E2						
E6.61	LM3 signal A selection	995	3E3						
E6.62	LM3 signal B selection	996	3E4						
E6.63	LM3 signal C selection	997	3E5						
E6.64	LM3 function	998	3E6						
E6.65	LM3 output reverse	999	3E7						
E6.66	LM3 output	283	11B						
E6.67	Logic 4	1000	3E8						
E6.68	LM4 signal A selection	1001	3E9						
E6.69	LM4 signal B selection	1002	3EA						
E6.70	LM4 signal C selection	1003	3EB						
E6.71	LM4 function	1004	3EC						
E6.72	LM4 output reverse	1005	3ED						
E6.73	LM4 output	284	11C						
E6.74	Logic 5	1006	3EE						
E6.75	LM5 signal A selection	1007	3EF						
E6.76	LM5 signal B selection	1008	3F0						
E6.77	LM5 signal C selection	1009	3F1						
E6.78	LM5 function	1010	3F2						
E6.79	LM5 output reverse	1011	3F3						
E6.80	LM5 output	285	11D						
E6.81	Logic 6	1012	3F4						
E6.82	LM6 signal A selection	1013	3F5						
E6.83	LM6 signal B selection	1014	3F6						
E6.84	LM6 signal C selection	1015	3F7						
E6.85	LM6 function	1016	3F8						
E6.86	LM6 output reverse	1017	3F9						
E6.87	LM6 output	286	11E						
Flip Flop									
E6.94	SR module 1	1018	3FA						
E6.95	SR1 signal S selection	1019	3FB						
E6.96	SR1 signal R selection	1020	3FC						
E6.97	SR1 function	1021	3FD						
E6.98	SR1 output	287	11F						
E6.99	SR module 2	1022	3FE						
E6.100	SR2 signal S selection	1023	3FF						
E6.101	SR2 signal R selection	1024	400						
E6.102	SR2 function	1025	401						
E6.103	SR2 output	288	120						
Time device									
E6.109	Time module 1	1026	402						
E6.110	T1 signal A selection	1027	403						
E6.111	T1 function	1028	404						
E6.112	T1 time setting	1029	405			10	0	6500	s
E6.113	T1 output	289	121						
E6.114	T1 selection	1030	406						

Parameter name		Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
E6.115	Time module 2	1031	407						
E6.116	T2 signal A selection	1032	408						
E6.117	T2 function	1033	409						
E6.118	T2 time setting	1034	40A			10	0	6500	s
E6.119	T2 output	290	122						
E6.120	T2 selection	1035	40B						
E6.121	Time module 3	1036	40C						
E6.122	T3 signal A selection	1037	40D						
E6.123	T3 function	1038	40E						
E6.124	T3 time setting	1039	40F			10	0	6500	s
E6.125	T3 output	291	123						
E6.126	T3 selection	1040	410						
E6.127	Time module 4	1041	411						
E6.128	T4 signal A selection	1042	412						
E6.129	T4 function	1043	413						
E6.130	T4 time setting	1044	414			10	0	6500	s
E6.131	T4 output	292	124						
E6.132	T4 selection	1045	415						
E6.133	Time module 5	1046	416						
E6.134	T5 signal A selection	1047	417						
E6.135	T5 function	1048	418						
E6.136	T5 time setting	1049	419			10	0	6500	s
E6.137	T5 output	293	125						
E6.138	T5 selection	1050	41A						
E6.139	Time module 6	1051	41B						
E6.140	T6 signal A selection	1052	41C						
E6.141	T6 function	1053	41D						
E6.142	T6 time setting	1054	41E			10	0	6500	s
E6.143	T6 output	294	126						
E6.144	T6 selection	1055	41F						

F1	Info								
Identification of the device									
F1.01	Drive reference	11	B	txt					
	Ensuing parameter	12	C	txt					
	Ensuing parameter	13	D	txt					
	Ensuing parameter	14	E	txt					
	Ensuing parameter	15	F	txt					
	Ensuing parameter	16	10	txt					
	Ensuing parameter	17	11	txt					
	Ensuing parameter	18	12	txt					
F1.02	Nominal power	295	127						
F1.03	Nominal current	296	128			10			A
F1.04	Nominal voltage	297	129						
F1.05	Drive serial number	19	13			1			
F1.06	Facility description	23	17	txt					
	Ensuing parameter	24	18	txt					
	Ensuing parameter	25	19	txt					
	Ensuing parameter	26	1A	txt					
	Ensuing parameter	27	1B	txt					
	Ensuing parameter	28	1C	txt					
	Ensuing parameter	29	1D	txt					
	Ensuing parameter	30	1E	txt					
F1.07	APP software	31	1F	txt					
	Ensuing parameter	32	20	txt					
	Ensuing parameter	33	21	txt					

Parameter name		Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
	Ensuing parameter	34	22	txt					
	Ensuing parameter	35	23	txt					
	Ensuing parameter	36	24	txt					
	Ensuing parameter	37	25	txt					
	Ensuing parameter	38	26	txt					
F1.08	Service notice	1993	7C9	txt					
	Ensuing parameter	1994	7CA	txt					
	Ensuing parameter	1995	7CB	txt					
	Ensuing parameter	1996	7CC	txt					
	Ensuing parameter	1997	7CD	txt					
	Ensuing parameter	1998	7CE	txt					
	Ensuing parameter	1999	7CF	txt					
	Ensuing parameter	2000	7D0	txt					
	Ensuing parameter	2001	7D1	txt					
	Ensuing parameter	2002	7D2	txt					
	Ensuing parameter	2003	7D3	txt					
	Ensuing parameter	2004	7D4	txt					

F2	Test routines								
Force operation									
F2.01	Force operation	1807	70F						
F2.02	Force DI1	1056	420						
F2.03	Force DI2	1057	421						
F2.04	Force DI3	1058	422						
F2.05	Force DI4	1059	423						
F2.06	Force DI5	1060	424						
F2.07	Force DI6	1061	425						
F2.08	Force DI7	1062	426						
F2.09	Force DI8	1063	427						
F2.10	Force DI9	1064	428						
F2.11	Force DI10	1065	429						
F2.12	Force DI11	1066	42A						
F2.13	Force DI12	1067	42B						
F2.14	Force DI13	1068	42C						
F2.15	Force DI14	1069	42D						
F2.16	Force R1	1070	42E						
F2.17	Force R2	1071	42F						
F2.18	Force R3	1072	430						
F2.19	Force DO1	1073	431						
F2.20	Force DO2	1074	432						
F2.21	Force R4	1075	433						
F2.22	Force DO3	1076	434						
F2.23	Force DO4	1077	435						
F2.24	Force AI1	1078	436						
F2.25	Force value AI1	1079	437			100	-10	10	
F2.26	Force AI2	1080	438						
F2.27	Force value AI2	1081	439			100	0	20	
F2.28	Force AI3	1082	43A						
F2.29	Force value AI3	1083	43B			100	0	20	
F2.30	Force AI4	1084	43C						
F2.31	Force value AI4	1085	43D			100	0	20	
F2.32	Force FP	1086	43E						
F2.33	Force value FP	1087	43F			100	0	30	kHz
F2.34	Force AO1	1088	440						
F2.35	Force value AO1	1089	441			100	0	20	
F2.36	Force AO2	1090	442						

Parameter name		Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
F2.37	Force value AO2	1091	443			100	-20	20	
F2.38	Force AO3	1092	444						
F2.39	Force value AO3	1093	445			100	-20	20	
Test routines									
F2.40	Start IGBT test	1808	710	0110					
F2.41	Test charging circuit	1809	711	0110					
F2.45	Simulation mode	1094	446						
F2.46	Software reset	1095	447						

F3 Fault memory

Fault memory									
F3.01	Number of faults	298	12A						
F3.02	Review	1096	448						
F3.03	Fault number	299	12B						
F3.04	Fault cause	300	12C						
F3.05	Operating hours	301	12D			1			h
F3.06	Min / sec	302	12E			100			m:s
F3.07	Reference value [Hz]	303	12F			10			Hz
F3.08	Actual value [Hz]	304	130			10			Hz
F3.09	Output current	305	131			see table			A
F3.10	DC voltage	306	132			1			V
F3.11	Thermal load VSD	307	133			1			%
F3.12	Control mode	308	134						
F3.13	Operating status	309	135						
F3.14	Alarm message	310	136						
F3.15	Drive state	312	138						hex
F3.16	Control word bus	311	137	0110					---
F3.17	Bus statusword	313	139	0110					

F4 Diagnosis

Data-Logger									
F4.01	Data logger channel 1	1097	449			1			
F4.02	Data logger channel 2	1098	44A			1			
F4.03	Data logger channel 3	1099	44B			1			
F4.04	Time base	1100	44C			1	0	1500	min
F4.05	Rating channel 1	1101	44D			1			
F4.06	Rating channel 2	1102	44E			1			
F4.07	Rating channel 3	1103	44F			1			
State logic inputs									
F4.10	DI state basic device	314	13A	0110		1			
F4.11	DI state IO11	315	13B	0110		1			
F4.12	DI state IO12	316	13C	0110		1			
state logic outputs									
F4.13	DO state basic device	317	13D	0110		1			
F4.14	DO state IO11	318	13E	0110		1			
F4.15	DO state IO12	319	13F	0110		1			
Analog checkpoints									
F4.16	f-reference 1 [Hz]	320	140			10			Hz
F4.17	f-reference 2 [Hz]	321	141			10			Hz
F4.18	f-reference after sel.	322	142			10			Hz
F4.19	f-ref. val. after FW/REV	323	143			10			Hz
F4.20	f-correction	324	144			10			Hz
F4.21	f-ref. val. before ramp	325	145			10			Hz

Parameter name		Log. address dec	hex	Type	Adjust-ability	Factor	Setting range min	max	Unit
F4.22	f-ref. val. after ramp	326	146			10			Hz
F4.23	f-ref. val. after PID act.	327	147			10			Hz
F4.24	f-ref. val. after loc/rem	328	148			10			Hz
F4.25	f-ref. val. after f-corr.	329	149			10			Hz
F4.26	PID reference value	330	14A			10			%
F4.27	PID actual value	331	14B			10			%
F4.28	PID deviation	332	14C			1			%
F4.29	PID output	333	14D			10			
F4.38	I limit	342	156			10			A
Power part									
F4.44	DC voltage	344	158			1			V
F4.45	IGBT overload time	123	7B			1		65535	s
F4.46	Thermal load VSD	345	159			1			%
F4.47	Thermal load M1	346	15A			1			%
F4.48	Thermal load M2	347	15B			1			%
F4.50	Fan status	349	15D			1			
State option cards									
F4.56	Option 1 type	350	15E			1			
F4.57	Option 2 type	351	15F			1			
F4.60	Status APP	354	162			1			
F4.61	Status MC	355	163			1			
F4.62	Status LCD-keypad	356	164			1			
F6	**Code**								
Security settings									
F6.01	Code	1144	478			1	0	9999	
F6.02	Code value	1145	479			1	0	9999	
F6.03	Parametrising station	1146	47A						
F6.04	Impulse inhibit	1147	47B						
F6.05	Service code	1148	47C			1	0	59999	
System parameters									
	Store parameter values	40	28						

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Factors depending on the device

>*pDRIVE*< devices	Unit A	kW	kVA	Hp	Nm	mΩ
MX eco 4V0,75...4V7,5	100	100	100	100	100	1
MX eco 4V11...4V75	10	10	10	10	10	1
MX eco 4V90...4V630	1	1	1	1	1	1000

Inverter messages

Alarm/Info messages

Matrix operating panel	Alarm index (dec.)	Description
Force active	01	The force mode is active (see F2.01 Force operation).
Emergency op. active	02	The inverter is switched over to the status "Emergency operation" via a digital input command. See parameter E3.10.
Ext. fault 1 (or free editable text E3.38)	03	An external fault is signalized via a digital input function (see E3.34 to E3.38). It is processed as an alarm message corresponding to the setting of E3.35 Ext. fault 1 response.
Ext. fault 2 (or free editable text E3.45)	04	An external fault is signalized via a digital input function (see E3.41 to E3.45). It is processed as an alarm message corresponding to the setting of E3.42 Ext. fault 2 response.
Undervoltage	05	There is an undervoltage situation. This leads to an alarm message corresponding to the setting of E3.29 V< response.
Reference fault AI2	06	At the analog input AI2 the reference value fell below 3 mA. This leads to an alarm message corresponding to the setting of E3.13 AI2 - 4mA monitor and E3.14 AI2 - 4mA response.
Reference fault AI3	07	At the analog input AI3 the reference value fell below 3 mA. This leads to an alarm message corresponding to the setting of E3.16 AI3 - 4mA monitor and E3.17 AI3 - 4mA response.
Reference fault AI4	08	At the analog input AI4 the reference value fell below 3 mA. This leads to an alarm message corresponding to the setting of E3.19 AI4 - 4mA monitor and E3.20 AI4 - 4mA response.
Bus fault	10	According to the setting of D6.03 Bus error behaviour a bus fault caused by exceeded runtime or a loss of control leads to an alarm message.
Reference fault FP	11	At the frequency input FP the reference value fell short by 50 % of the setting f_{min}. This leads to an alarm message corresponding to the setting of E3.22 FP - f monitoring and E3.23 FP - monitoring resp..
Feed in <	12	According to the setting of E1.49 Feed in monitoring and E1.50 Feed in mon. reaction the trigger of the feed-in monitoring leads to an alarm message.
ON-lock from DI	13	The digital input function ON-lock (E3.48) signalizes a problem which leads to an alarm message corresponding to the setting of E3.49 ON lock response.
Speed check fault	14	The function n-monitoring (E1.38) leads to an alarm message corresponding to the setting of E1.45 n-monitoring response.
ϑ M1 >	15	The thermal mathematical motor model has reached the set alarm level for motor M1. See parameter E2.19 M1 - response.
ϑ M2 >	16	The thermal mathematical motor model has reached the set alarm level for motor M2. See parameter E2.31 M2 - response.
Overspeed	17	The overspeed protection (E2.48) has triggered and signalizes an alarm corresponding to the setting of the parameter E2.49 Overspeed response.

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Matrix operating panel	Alarm index (dec.)	Description
TH - ϑ M1 >	18	The thermistor (PTC) or thermal switch, assigned to motor M1 (see motor assignment E2.01, E2.06, E2.11) has detected an overtemperature. As a result an alarm message is activated corresponding to the set reaction for the respective thermistor.
TH - ϑ M2 >	19	The thermistor (PTC) or thermal switch, assigned to motor M2 (see motor assignment E2.01, E2.06, E2.11) has detected an overtemperature. As a result an alarm message is activated corresponding to the set reaction for the respective thermistor.
TH - ϑ Ext >	20	The thermistor (PTC) or thermal switch (see motor assignment E2.01, E2.06, E2.11), which is planned for the general use, has detected an overtemperature. An alarm message is as a result activated corresponding to the reaction setting for the respective thermistor.
Underload	21	The underload function (E2.61) recognises a motor underload and activates an alarm message corresponding to the setting of E2.62 Underload response
Limitation active	22	A limitation function is active.
Ramp adaption	23	The set acceleration or deceleration ramp cannot be maintained and is automatically extended.
Service M1	24	The operating hours counter (A5.01) for motor M1 has exceeded the set time interval (A5.02).
Service M2	25	The operating hours counter (A5.04) for motor M2 has exceeded the set time interval (A5.05).
Service Power On	26	The operating hours counter (A5.08) for the power part of the device (device is supplied with mains voltage) has exceeded the set time interval.
Service fan	27	The operating hours counter (A5.10) for the power part fan has exceeded the set time interval (A5.11).
Simulation active	28	The Simulation mode (F2.45) is activated.
Download active	29	The PC program Matrix 3 executes a parameter download.
E6 incomplete	30	One or several function modules are incompletely parameterized (the end of each function group belonging together must be a time module !).
Wrong control mode	32	The selected function cannot be combined with the actual control mode.
Para. Set 1	36	Faulty Eprom-zone for parameter set 1
Para. Set 2	37	Faulty Eprom-zone for parameter set 2
IGBT ϑ >	38	IGBT overtemperature, determined by the thermal mathematical inverter model

These alarm/info messages can be read out under address 43 dec / 002B hex.

Matrix operating panel	Trip index (dec.)	Description
Undervoltage	01	There is an undervoltage situation. See parameter E3.29 V< response.
V>> at deceleration	02	The DC link voltage has exceeded the hardware protection level of 825 V due to a deceleration. Extend deceleration ramps or activate motor brakes B5.01 Braking mode.
Line overvoltage	03	The DC link voltage has exceeded the protection level of 756 V. As the fault evaluation only occurs with impulse inhibit, a line overvoltage situation takes place !
DC charging fault	04	The charging process of the DC link could not be completed.
DC missing	05	The frequency inverter is operated at the intelligent >*pDRIVE*< *LX* rectifier. The DC link voltage, made available by this rectifier, has shut down.
Precharging fault	06	Fault of the soft charge device (half controlled thyristor bridge). Only for devices larger than >*pDRIVE*< *MX eco* 4V18.
Line fault 1p	08	Loss of one mains phase
Line fault 2-3p	09	Loss of two or three mains phases
Motor short circuit	10	Phase short circuit at the output (shut down due to overcurrent)
Motor earth fault	11	Earth fault at the output Registration by means of the software (only for devices up to and including >*pDRIVE*< *MX eco* 4V75)
Motor earth fault 1	12	The differential current determined from the three motor phases is larger than 25 % of the nominal current of the inverter.
Overcurrent	13	Overcurrent at the output Registration by means of the software (only with devices up to and including >*pDRIVE*< *MX eco* 4V75)
IGBT ϑ >>	14	IGBT overtemperature, determined by the thermal mathematical inverter model
Motor phase fault 3p	15	Loss of the three motor phases
Motor phase U lost	16	Loss of motor phase U
Motor phase V lost	17	Loss of motor phase V
Motor phase W lost	18	Loss of motor phase W
Inverter overtemp.	19	Inverter overtemperature (overload, cooling problem)
Unknown MC	20	Unknown power part
PTC short circuit	21	Short-circuit at a thermistor sensor (PTC).
PTC open circuit	22	A thermistor sensor (PTC) is open
ASIC Init fault	23	Asic on the motor control cannot be initialised.
IGBT fault	25	The desaturation protection of an IGBT has triggered. The registration of this fault occurs only with devices larger than >*pDRIVE*< *MX eco* 4V75.
Motor short circuit	28	The automatically running test routine B3.43 Automatic SC test has detected a short circuit at the output.
Current measure defect	30	Fault of the current transformer, its voltage supply or the evaluation electronics. The registration of this fault occurs only with devices larger than >pDRIVE< *MX eco* 4V75.
MC E² zones invalid	32	Motor control EEProm defect
CPU fault	33	Internal electronic fault

Matrix operating panel	Trip index (dec.)	Description
ISL fault	34	Communication fault on the internal serial link
MTHA fault	35	Asic for time measurement defect (undervoltage time determination)
Overspeed	36	The motor has exceeded the maximum allowed Overspeed level (E2.50).
Security hold	37	There is a fault in the area of the internal monitoring for function "Safe Standstill" (PWR).
IO12 comm. failue	38	Communication fault at option card *>pDRIVE< IO12*
Opt. comm fault	39	Communication fault at an option card
Wrong otion board	40	Defect or unknown option card used
Bus fault	41	A bus fault occurred due to exceeded run time or loss of control.
Param. config. fault	42	Parameter settings invalid
Reference fault AI2	43	At analog input AI2 the reference value fell below 3 mA.
Reference fault AI3	44	At the analog input AI3 the reference value fell below 3 mA.
Reference fault AI4	45	At the analog input AI4 the reference value fell below 3 mA.
Reference fault FP	46	At the frequency input FP the reference value fell short by 50 % of the setting f_{min}.
TH M1 ϑ >>	47	The thermistor (PTC) or thermal switch, assigned to motor M1 (see motor assignment E2.01, E2.06, E2.11), has detected an overtemperature.
TH M2 ϑ >>	48	The thermistor (PTC) or thermal switch, assigned to motor M2 (see motor assignment E2.01, E2.06, E2.11), has detected an overtemperature.
TH - ϑ gen. >>	49	The thermistor (PTC) or thermal switch (see motor assignment E2.01, E2.06, E2.11), which is planned for the general use, has detected an overtemperature.
ϑ M1 >	50	The thermal mathematical motor model has reached the set trigger level for motor M1.
ϑ M2 >	51	The thermal mathematical motor model has reached the set trigger level for motor M2.
Stall protection	52	The stall protection has triggered due to a rotor blockade or a highly overloaded starting. See parameters E2.42 to E2.45.
Underload	53	The underload function (E2.61) has recognized a motor underload.
Speed check fault	54	The function n-monitoring (E1.38) has recognised an overspeed.
Feed in <<	55	The function Feed in monitoring (E1.49) has triggered.
AT-fault 1	56	Fault at the execution of the autotuning routine
Config. fault	57	EEProm application software incompatible or changed power part
Ext. fault 1	58	An external fault is signalized via a digital input function (see E3.34 to E3.38).
Ext. fault 2	59	An external fault is signalized via a digital input function (see E3.41 to E3.45).
Contactor fault	60	Line contactor control defect (response monitoring)
Motor contactor err (c)	61	Motor contactor control (response monitoring) active
Motor contactor err (o)	62	Motor contactor control (release monitoring) active
ON-lock	63	The digital input function ON-lock (E3.48) caused a protective shut-down.
Internal SW error	64	Internal software fault (e.g. defect parameter settings)
Power rating fault	65	Unclear power part assignment

Matrix operating panel	Trip index (dec.)	Description
Incompatible MC	66	Motor control is not compatible to the application software
Flash fault APP	67	Flash Eprom on the application software defect
Indus zone fault	68	Value for calibration on the application software defect
Eprom fault APP	69	EEProm on the application software defect
Limitation active	71	A limit function is active
Ramp adaption	72	The set acceleration or deceleration ramp cannot be maintained and is automatically extended.
24V fault	73	Problem with the external 24 V buffer voltage

These trip messages can be read out under address 72 dec / 0048 hex.

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