>pDRIVE<

Operating instructions CANopen

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

CANopen

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 document

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 document at any time, particular those referring to weights 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.

All foreign-language translations result from the German or English version. Please consider those in case of unclarity.

Basis of contract

The specifications in text and drawings of this document are no subject of contract in the legal sense without explicit confirmation.

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.

Copyright

Option CANopen for the frequency inverters *>pDRIVE< MX eco*

This instructions describe the functions software version APSeco_B05_07 and higher

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

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

The slave-specific configuration file MX1D1.eds (8 783 554) is required for parameterization and configuration of the CANopen network. It is provided on the CD-ROM which is attached to each inverter as well as under www.pdrive.com.

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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Function CANopen

All frequency inverters of the *>pDRIVE< MX eco* range support the fieldbus system CANopen as standard. For the integration of the CANopen-typical Sub-D fieldbus connection, an optional CANopen adapter must be installed at the RJ45 interface next to the terminals of the inverter (see chapter "Mechanical construction", page 20).

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

Principle function

CANopen is a higher transfer protocol according to CiA DS-301 based on the serial bus system "Controller Area Network" (CAN). It uses the multi-master capability to exchange data between the individual subscribers quickly and efficiently.

This data exchange takes place in an object-oriented manner in the form of "broadcasting". This means that a message is transferred to all bus subscribers and the subscriber itself decides whether the message is executed.

Typically the data is transferred only as required.

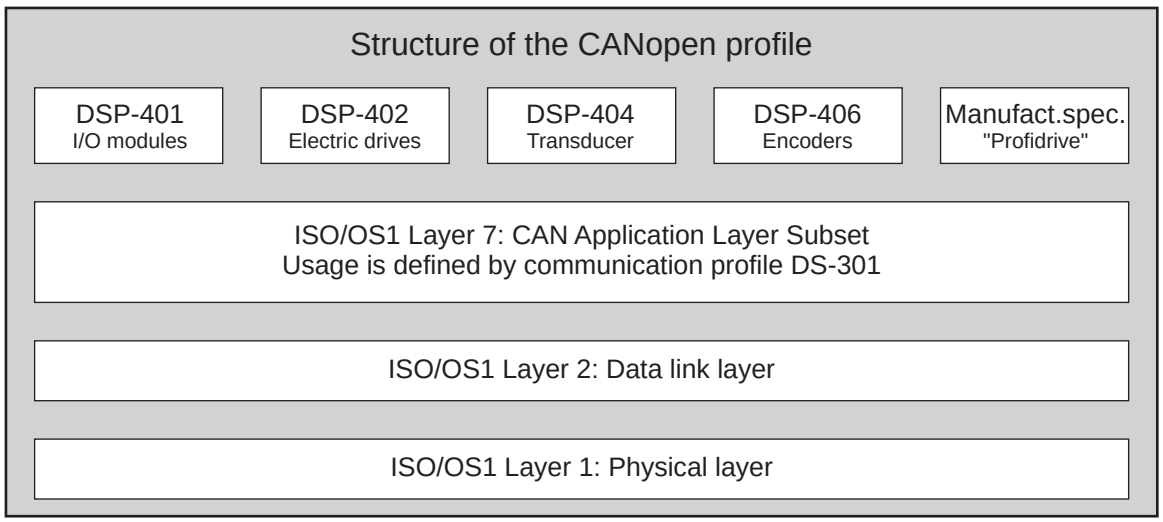
A bus access method must regulate conflict situations since several bus subscribers communicate via the same physical medium and the basic principle applies that only one transmitter, but several receivers may be active.

In the CANopen protocol, a stochastic (random) access method is used. In case of two or more simultaneous transmission accesses to the bus, the conflict is solved by bit-by-bit arbitration. Access thus automatically falls on the message with the highest priority.

The priority allocation corresponds with the identifier of the sent message (a low identifier corresponds with higher priority).

For error recognition during the data exchange, a combination of five different mechanisms is used (bit-level monitor, CRC, acknowledgement check, bit stuffing, and message frame monitoring).

The fieldbus interface implemented in the *>pDRIVE< MX eco* is realized up to communication profile DS301 (ISO/OSI Layer 7). Based on this, the Profidrive profile (on the basis of VDI/VDE 3689) is used as the manufacturer-specific profile variant.



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The object library is the main connecting link between the inverter and the CANopen master (PLC). All communication and user objects are included in this object library. In the process, an object represents a parameter with an address and a subindex in the communication memory of the inverter.

In the process, the CANopen DS301 communication profile describes permanently defined objects used for the setting of communication properties, for example, but also manufacturer-specific ranges, for example, for the application-specific settings (parameters) of the inverter.

Structure of the CANopen object library

Object index	Use
0001...009F	Data types (static, complex,...)
00A0...0FFF	Reserved
1000...1FFF	CANopen communication profile
2000...5FFF	Manufacturer-specific range (>*pDRIVE*< *MX eco* parameters)
6000...9FFF	Range for standardized device profiles
A000...AFFF	Process images of IEC61131 devices
B000...FFFF	Reserved

CANopen communication services

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The communication services of the CANopen interface on the >*pDRIVE*< *MX eco* are designed according to the CAN 2.A (DS301 V4.02) specification. In the process, every request is connected with the CANopen device address (node ID) and a telegram identifier for a COB ID (Communication Object Identifier). In this way, individual telegrams can be handled with priority during the transfer. The CANopen device address is transferred in bits 0...6 of the COB ID and the request code in bits 7...11.

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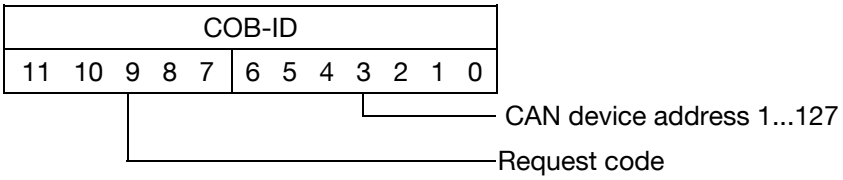


Predefined connection set / Request code:

Object	Request code (bit 10 ... bit 7)		COB ID		Note
NMT	0000 bin	0000 hex	0000 hex	PLC → MX	NMT (Network Management) services for the operation of the CANopen status machine
SYNC	0001 bin	080 hex	080 hex	PLC → MX	SYNC service (also see object 1005 hex)
EMCY	0001 bin	080 hex	080 hex+ Node ID	PLC → MX	Emergency service (also see object 1014 hex)
PDO1 Transmit	0011 bin	180 hex	180 hex+ Node ID	MX → PLC	Also see objects 1800 hex, 1600 hex
PDO1 Receive	0100 bin	200 hex	200 hex+ Node ID	PLC → MX	Also see objects 1400 hex, 1A00 hex
PDO2 Transmit	0101 bin	280 hex	280 hex+ Node ID	MX → PLC	Also see objects 1801 hex, 1A01 hex
PDO2 Receive	0110 bin	300 hex	300 hex+ Node ID	PLC → MX	Also see objects 1401 hex, 1601 hex
SDO Transmit	1011 bin	580 hex	580 hex+ Node ID	MX → PLC	Also see object 1200 hex
SDO Receive	1100 bin	600 hex	600 hex+ Node ID	PLC → MX	Also see object 1200 hex
Heartbeat	1110 bin	700 hex	700 hex+ Node ID	PLC → MX	NMT, Node Guard, Heartbeat Also see objects 1016 hex, 1017 hex

The >*pDRIVE*< *MX eco* supports the automatic formation of the COB ID (request code + node ID).

The transfer direction and the definition of output/input should be seen from the viewpoint of the CANopen slave (>*pDRIVE*< *MX eco*).

Communication objects

In the CANopen network, the following communication objects are differentiated:

- *Process data objects* (PDO) for the transport of control data
- *Service data objects* (SDO) for the parameterization of object library entries
- *Network management objects* for the control of the CANopen state machine and for subscriber monitoring
- Further objects, like synchronization objects, time stamps and fault messages

PDO (Process Data Object)

PDO telegrams are used for the fast transfer of control and status data, as well as reference and actual values. These are sent as unconfirmed telegrams (broadcast). In the >*pDRIVE*< *MX eco* two PDO telegrams with four words (8 bytes) each are available for transmitting and receiving. Through the use of the method "static PDO mapping", the individual reference and actual values are allocated in the respective PDO telegram using the inverter parameterization.

The PDO telegrams can be prioritized over the SDO objects due to their low identifiers and are transferred in a cyclic, event-oriented or synchronized manner.

PDO 1 is processed inverter-internally in the 1.5 ms task, while PDO 2 is processed by the background task.

Further information is given in chapter "Process Data Object PDO", page 24).

PDO type	Object	Word 1	Word 2	Word 3	Word 4
PDO1 - transmit	180 hex	Control word (STW)	SW 1 (D6.101)	SW 2 (D6.105)	SW 3 (D6.109)
PDO1 - receive	200 hex	Status word (ZTW)	IW 1 (D6.138)	IW 2 (D6.142)	IW 3 (D6.146)
PDO2 - transmit	280 hex	SW 4 (D6.113)	SW 5 (D6.117)	SW 6 (D6.121)	SW 7 (D6.125)
PDO2 - receive	300 hex	IW 4 (D6.150)	IW 5 (D6.154)	IW 6 (D6.158)	IW 7 (D6.162)

SDO (Service Data Object)

SDO telegrams represent a service for direct access to the object library. The identifiers for the SDO transmit and SDO receive telegrams lie at 580/600 hex and thus lead to a lower-priority transfer within the CANopen network.

SDO	Object
SDO - transmit	600 hex
SDO - receive	580 hex

SDO telegrams are used for adjustment of the CANopen-specific communication settings during network configuration (objects 00 00 hex...1F FF hex), but can also be used to parameterize the inverter (objects 20 00 hex...5F FF hex).

Parameter F6.03 "Parametrising station" must be set to "3 .. CANopen" in order to adjust parameters on the *>pDRIVE< MX eco* via the CANopen interface.

Network management / CANopen state machine

NMT telegram PLC → *>pDRIVE< MX eco*

By means of the NMT (network management) telegrams the CANopen state machine is operated. The telegram consists of a request code and the node ID of the desired subscriber.

If the node ID transferred in Byte 1 equals zero, the request transferred in the telegram applies for all subscribers operated in the network.

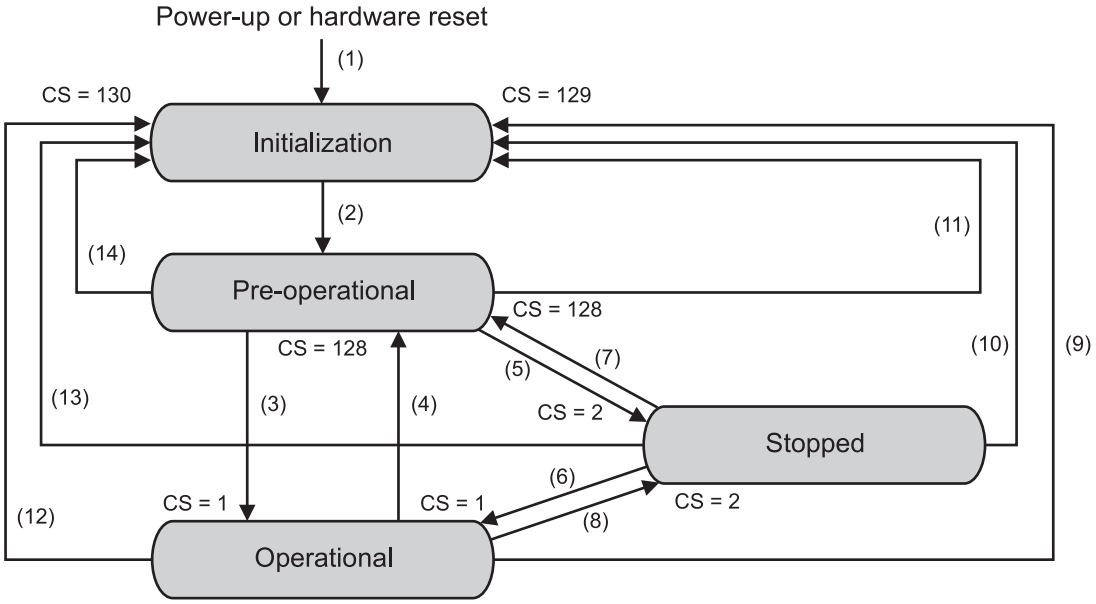
COB ID	Byte 0	Byte 1
00 hex	Command (CS)	Node ID

Command (CS)	Command
01 hex	Start_Remote_Node
02 hex	Stop_Remote_Node
80 hex	Enter_Pre-Operational_State
81 hex	Reset_Node
82 hex	Reset_Communication

Example: Start of the CANopen subscriber with address 5 (Start Remote Node)

00hex 01hex 05hex

CANopen state machine



Change of state	Command		Description
(1)	–	–	When connecting to the mains the CANopen subscriber automatically switches to state "*Initialization*".
(2)	–	–	If the initialization has been completed successfully, the state automatically switches to "*Pre-operational*".
(3), (6)	Start_Remote_Node	01 hex	Change to state "*Operational*"; processing of PDO and SDO telegrams
(4), (7)	Enter_Pre_Operational_State	80 hex	Change to state "*Pre-Operational_State*". Only SDO telegrams are processed.
(5), (8)	Stop_Remote_Node	02 hex	Change to state "*Stopped*"
(9), (10), (11)	Reset_Node	81 hex	Change to state "*Initialization*"
(12), (13), (14)	Reset_Communication	82 hex	Change to state "*Initialization*"

Depending on the communication status of the CANopen connection, the following services are possible:

Service	Initialization	Pre-operational	Operational	Stopped
PDO			X	
SDO		X	X	
Synchronization (SYNC)		X	X	
Emergency (EMCY)		X	X	
Bootup service	X		X	
Network management (NMT)		X	X	X

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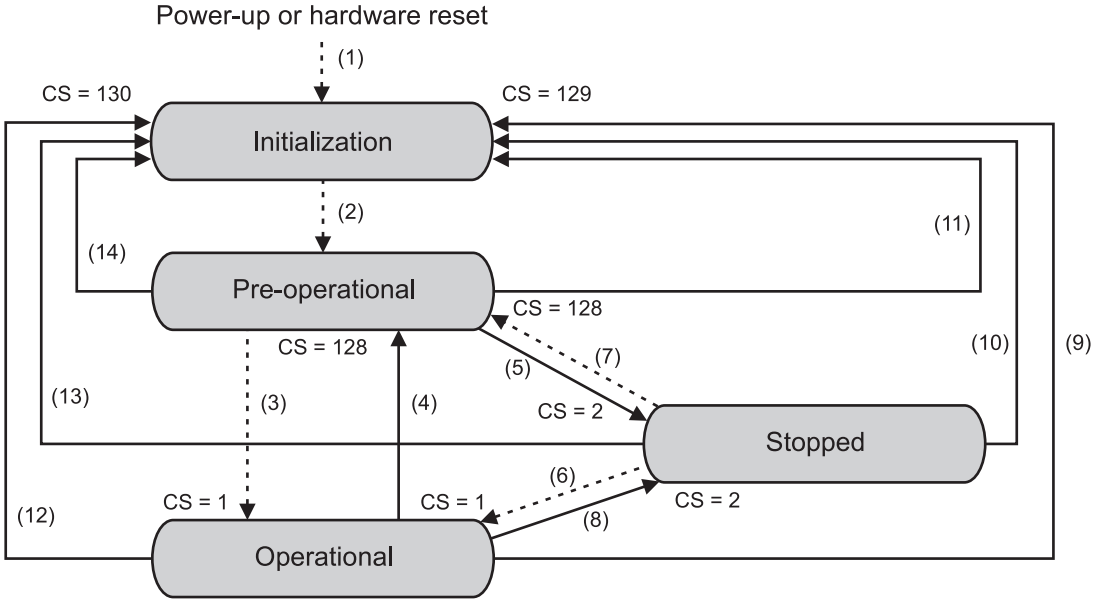
Many state changes within the NMT state machine lead to CANopen communication errors. The following diagram and table list these states in detail.



Change of state	Command		Description
(4)	Enter_Pre_Operational_State	80 hex	No PDO services possible
(5)	Stop_Remote_Node	02 hex	No SDO services possible
(8)	Stop_Remote_Node	02 hex	Neither PDO nor SDO services possible
(9), (10), (11)	Reset_Node	81 hex	Neither PDO nor SDO services possible
(12), (13), (14)	Reset _Communication	82 hex	Neither PDO nor SDO services possible

A fault message on the inverter can be reset using bit 7 in the control word (reset) only if the NMT state machine is in "*Operational*" state (PDO telegrams can be transferred only in this state).

If this is not the case, the CANopen master (PLC) must send an NMT telegram with a request code of 01 hex (Start_Remote_Node) to the corresponding subscriber.

The active NMT state is transferred in the response telegram in case of active node guarding. Alternatively it can be read directly on the inverter under parameter D6.22 "CANopen status".

Bootup service >*pDRIVE*< *MX* → PLC

By means of this telegram, the CANopen subscriber indicates that it has switched to the "Pre-operational" state when initialization has been completed. The data byte sent in the process is always 00 hex.

COB-ID	Byte 0
700 hex + Node ID	00 hex

Synchronization object –SYNC PLC → >*pDRIVE*< *MX*

The SYNC object is sent cyclically to all subscribers from the CANopen master (PLC). It consists only of the identifier and is used by CANopen subscribers for cyclic communication modes.

COB-ID
80 hex

Emergency object – EMCY >*pDRIVE*< *MX* → PLC

Using the emergency telegram, the >*pDRIVE*< *MX eco* indicates an active fault state as the CANopen slave. Both communication faults and general inverter faults are indicated in the process.

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
80 hex + Node ID	Fault code *		Fault register					
	LSB	MSB	Bit 0 = 0 No fault Bit 0 = 1 Fault					

*) A detailed overview of the fault messages can be found in chapter "Inverter messages", page 92.

Node Guarding

The "node guarding" function represents a monitoring of the bus subscribers initiated by the CANopen master. In the process, the master sends an RTR (Remote Transmit Request) telegram to the subscribers being monitored at cyclic intervals. This telegram triggers the lifetime counter in the CANopen slave. If the set time of the lifetime counter expires without a new RTS telegram being received, the drive reacts with the fault message "Life Guarding Fault" and sends an emergency telegram (EMCY).

The time of the lifetime counter is determined using the "Guard Time" (100C/00 hex) and "Lifetime Factor" (100D/00 hex) objects. These objects can be set using the SDO service during bus configuration. The time results from the multiplication of time [ms] and factor.

Example: 3 seconds monitoring time = 500 ms x 6

Parameter	Index	Subindex	Format	Unit
Guard Time	100C hex	00 hex	unsigned16	ms
Life Time Factor	100D hex	00 hex	unsigned8	-

Node guarding (RTR) telegram PLC → >*pDRIVE*< *MX*

COB-ID
700 hex + Node ID

Node guarding telegram >*pDRIVE*< *MX* → PLC

COB-ID	Byte 0	
700 hex + Node ID	bit 7	bit 6 to 0
	Togglebit	NMT State

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NMT State: 00 hex Initialization
04 hex Stopped
05 hex Operational
7F hex Pre Operational

Toggle bit: The state of this bit changes with every response.

The "node guarding" and "heartbeat" functions cannot be used at the same time.

The active NMT state can be read directly on the inverter under parameter D6.22.

The node guarding parameters 100C and 100D can be set only in the "Pre-operational" state.

Heartbeat

The "Heartbeat" function represents an effective monitoring of the communication of any CANopen subscribers. The devices to be monitored are divided into heartbeat transmitters and receivers. The transmitter cyclically (Producer Heartbeat Time) transmits a heartbeat telegram with its actual NMT state.

This telegram triggers a timer in the heartbeat receiver. If the set time of the timer (Consumer Heartbeat Time) expires without a new heartbeat telegram being received, the subscriber defined as the heartbeat receiver reacts with the fault message "Heartbeat Fault" and sends an emergency telegram (EMCY).

Heartbeat telegram transmitter → receiver

COB-ID	Byte 0	
700 hex + Node ID	bit 7	bit 6...0
	Zero	NMT state (transmitter)

NMT State: 00 hex Initialization
04 hex Stopped
05 hex Operational
7F hex Pre-operational

Bit 7 is reserved and always zero

Parameter	Index	Subindex	Format	Unit
Consumer Heartbeat Time	1,016 hex	01 hex	Unsigned32	ms
Producer Heartbeat Time	1,017 hex	00 hex	Unsigned16	ms

The "node guarding" and "heartbeat" functions cannot be used at the same time.

Object library

Index	Subindex	R/W	Type	Factory default	Comment
10 00 hex	00 hex	R	unsigned32	00 00 00 00 hex	**Type of Device:** Bits 24...31: Not used (0) Bits 16...23: Type of device (0) Bits 0...15: Device profile number (000)
1,001 hex	00 hex	R	unsigned8	00 hex	**Fault register:** Fault (Bit 0 = 1) No fault (Bit 0 = 0)
1,003 hex	00 hex	R	unsigned8	01 hex	**Number of Errors**
	01 hex	R	unsigned32	00 00 00 00 hex	**Standard Error Field:** Bits 16...31: Always 0 Bits 0...15: For fault code parameters, also see Emergency Object / Fault Messages.
1005 hex	00 hex	R/W	unsigned32	00 00 00 80 hex	**COB-ID Entry for SYNC message**
1008 hex	00 hex	R	string	MX eco V4xxx	**Device name:** Read via segmented SDO services.
100B hex	00 hex	R	unsigned32	00 00 00 00 hex	**Node-ID:** This object shows the CANopen address configured on the *>pDRIVE< MX eco*.
100C hex	00 hex	R/W	unsigned16	00 00 hex	**Guard Time:** The node guarding function is deactivated (value: 0 ms) standard-like. The simultaneous use of the node guarding and heartbeat functions is not possible! (see 1017/00)
100D hex	00 hex	R/W	unsigned8	00 hex	**Life Time Factor:** 100C/00 (guard time) * 100D/00 (lifetime factor) = lifetime A value of 0 deactivates the node guarding function on the respective *>pDRIVE< MX eco*!
100E hex	00 hex	R	unsigned32	00 00 07 00 hex +Node-ID	**Node Guarding Identifier:** COB ID entries are used for the node guarding protocol (configuration tool).
100F hex	00 hex	R	unsigned32	00 00 00 01 hex	**Number of SDOs supported**
1014 hex	00 hex	R	unsigned32	00 00 00 80 hex + Node-ID	**COB ID entry for emergency message**
1016 hex	00 hex	R	Unsigned8	01 hex	**Consumer Heartbeat Time:** Number of entries
	01 hex	R/W	unsigned32	00 00 00 00 hex	**Consumer Heartbeat Time:** Bits 24...31: Not used (0) Bits 16...23: Node ID from heartbeat producer Bits 0...15: Max. heartbeat time (factor = 1 ms)
1017 hex	00 hex	R/W	unsigned16	00 00 hex	**Producer Heartbeat Time**: The heartbeat function is deactivated (value: 0 ms) standard-like. The simultaneous use of the node guarding and heartbeat functions is not possible! (see 100C/00)

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Index	Subindex	R/W	Type	Factory default	Comment
1018 hex	00 hex	R	unsigned8	03 hex	**ID Object:** Number of entries
	01 hex	R	unsigned32	00 00 01 D1 hex	**ID Object:** Supplier ID: VA TECH ELIN EBG Elektronik = 01D1
	02 hex	R	unsigned32	1E6C hex	**ID Object:** Product Identification code *>pDRIVE< MX eco* = 1E6C hex (7788 dec)
	03 hex	R	unsigned32	00 00 00 00 hex	**ID Object:** Product version: Bits 16...31 = Primary version ID Bits 0...15 = Secondary version ID
1400 hex	00 hex	R	unsigned8	02 hex	**Receive PDO1: Number of entries**
	01 hex	R/W	unsigned32	00 00 02 00 hex + Node-ID	**Receive PDO1:** COB ID entry Bits 0...10 can be changed in write mode to activate the slave-to-slave communication.
	02 hex	R/W	unsigned8	FF hex	**Receive PDO1:** Transfer method "Asynchronous" (FE or FF) "Cyclically synchronous" (1 to F0) "Acyclically synchronous" (0)
1401 hex	00 hex	R	unsigned8	02 hex	**Receive PDO2:** Number of entries
	01 hex	R/W	unsigned32	80 00 03 00 hex + Node-ID	**Receive PDO2:** COB ID entry Bits 0...10 can be changed in write mode to activate the slave-to-slave communication.
	02 hex	R/W	unsigned8	FF hex	**Receive PDO2:** Transfer method "Asynchronous" (FE or FF) "Cyclically synchronous" (1 to F0) "Acyclically synchronous" (0)
1600 hex	00 hex	R	unsigned8	04 hex	**Receive PDO1 assignment:** Number of used process data 4 objects are used standard-like (D6.100 “No. of Bus-ref. values”).
	01 hex	R	unsigned32	30 00 01 10 hex	**Receive PDO1 assignment:** 1st Object Control word "STW"
	02 hex	R	unsigned32	30 00 02 10 hex	**Receive PDO1 assignment:** 2nd Object Ref. value1 selection (see parameter D6.101)
	03 hex	R	unsigned32	30 00 03 10 hex	**Receive PDO1 assignment:** 3rd Object Ref. value2 selection (see parameter D6.105)
	04 hex	R	unsigned32	30 00 04 10 hex	**Receive PDO1 assignment:** 4th Object Ref. value3 selection (see parameter D6.109)

Index	Subindex	R/W	Type	Factory default	Comment
1601 hex	00 hex	R	unsigned8	04 hex	**Receive PDO2 assignment:** Number of used process data 4 objects are used standard-like (D6.100 “No. of Bus-ref. values”).
	01 hex	R	unsigned32	30 00 05 10 hex	**Receive PDO2 assignment:** 1st Object Ref. value4 selection (see parameter D6.113)
	02 hex	R	unsigned32	30 00 06 10 hex	**Receive PDO2 assignment:** 2nd Object Ref. value5 selection (see parameter D6.117)
	03 hex	R	unsigned32	30 00 07 10 hex	**Receive PDO2 assignment:** 3rd Object Ref. value6 selection (see parameter D6.121)
	04 hex	R	unsigned32	30 00 08 10 hex	**Receive PDO2 assignment:** 4th Object Ref. value7 selection (see parameter D6.125)
1800 hex	00 hex	R	unsigned8	05 hex	**Transmit PDO1:** Number of entries
	01 hex	R/W	unsigned32	00 00 01 80 hex + Node-ID	**Transmit PDO1:** COB ID entry
	02 hex	R/W	unsigned8	FF hex	**Transmit PDO1:** Transfer method "Asynchronous" (FE or FF) "Cyclically synchronous" (1...F0) "Acyclically synchronous" (0)
	03 hex	R/W	unsigned16	12C (300 dec)	**Transmit PDO1:** Inhibit Time Minimum time between two transfers. Factor: 10 ms Min. value: 100 (100 x 100 µs = 10 ms)
	05 hex	R/W	unsigned16	3E8 hex (1000dez)	**Transmit PDO1:** Event Timer In "asynchronous" mode, this object defines the minimum transfer frequency. Factor: 1 ms Min. value:= 10 (10 ms) The run time of the event timer must be greater than the inhibit time (subindex: 1800/03).

Index	Subindex	R/W	Type	Factory default	Comment
1801 hex	00 hex	R	unsigned8	05 hex	**Transmit PDO2:** Number of entries
	01 hex	R/W	unsigned32	00 00 02 80 hex + Node-ID	**Transmit PDO2:** COB ID entry
	02 hex	R/W	unsigned8	FF hex	**Transmit PDO2:** Transfer method "Asynchronous" (254 or 255) "Cyclically synchronous" (1...240) "Acyclically synchronous" (0)
	03 hex	R/W	unsigned16	12C (300 dec)	**Transmit PDO2:** Inhibit Time Minimum time between two transfers. Factor: 10 ms Min. value: 100 (100 x 100 µs = 10 ms)
	05 hex	R/W	unsigned16	3E8 hex (1000 dec)	**Transmit PDO2:** Event Timer In "asynchronous" mode, this object defines the minimum transfer frequency. Factor: 1 ms Min. value:= 10 (10 ms) The run time of the event timer must be greater than the inhibit time (subindex: 1801/03).
1A 00 hex	00 hex	R	unsigned8	04 hex	**Transmit PDO1 assignment:** Number of used process data 4 objects are used standard-like (D6.137 “Number actual values”)
	01 hex	R	unsigned32	30 10 01 10 hex	**Transmit PDO1 assignment:** 1st Object Status word "ZTW"
	02 hex	R	unsigned32	30 10 02 10 hex	**Transmit PDO1 assignment:** 2nd Object Act. value1 selection (see parameter D6.138)
	03 hex	R	unsigned32	30 10 03 10 hex	**Transmit PDO1 assignment:** 3rd Object Act. value2 selection (see parameter D6.142)
	04 hex	R	unsigned32	30 10 04 10 hex	**Transmit PDO1 assignment:** 4th Object (Act. value3 selection, see parameter D6.146)
1A 01 hex	00 hex	R	unsigned8	04 hex	**Transmit PDO2 assignment:** Number of used process data 4 objects are used standard-like (D6.137 “Number actual values”)
	01 hex	R	unsigned32	30 10 05 10 hex	**Transmit PDO2 assignment:** 1st Object Act. value4 selection (see parameter D6.150)
	02 hex	R	unsigned32	30 10 06 10 hex	**Transmit PDO2 assignment:** 2. Object Act. value5 selection (see parameter D6.154)
	03 hex	R	unsigned32	30 10 07 10 hex	**Transmit PDO2 assignment:** 3rd Object Act. value6 selection (see parameter D6.158)
	04 hex	R	unsigned32	30 10 08 10 hex	**Transmit PDO2 assignment:** 4th Object Act. value7 selection (see parameter D6.162)

Network configuration

Use the slave-specific EDS file (Electronic Data Sheet) for the network configuration of the CANopen master connection. For the frequency inverter *>pDRIVE< MX eco* the configuration file **MX1D1.eds** (8 783 554) has to be used. It is provided on the CD-ROM which is attached to each inverter as well as in the Internet under www.pdrive.com.

```
; ------------------------------------------------------------------
; VA TECH ELIN EBG Elektronik GmbH & Co
; (C) 2005
; CANopen Electronic Data Sheet (EDS) fuer
; die Frequenzumrichterreihen >pDRIVE< >pDRIVE< MX eco/pro
;
; 8 782 811.01
;
; 09.11.2005  TS/DJ:   erstellt
; 22.12.2005  VP/Kp:   formatiert
; ------------------------------------------------------------------


[Comments]
Lines  =10
Line1  =EDS file for >pDRIVE< MXeco/pro CANopen Slave

[FileInfo]
FileName      =D:\\pDRIVE\MX1D1.eds
FileVersion   =1
FileRevision  =0
EDSVersion    =4.0
Description   =EDS for >pDRIVE< MXeco/pro
CreationTime  =11:35AM
CreationDate  =09-11-2005
CreatedBy     =TS/Jagodic

[DeviceInfo]
Vendorname    =VA TECH ELIN EBG Elektronik
VendorNumber  =0x000001D1
ProductName   =>pDRIVE< MXeco/pro
ProductNumber =0x00001E6C
RevisionNumber       =0x00000000
OrderCode     =0
BaudRate_10   =0
BaudRate_20   =1
BaudRate_50   =1
.
.
.
```

The EDS file contains the whole information (according to the CANopen standard) which are required for coupling of the *>pDRIVE< MX eco* to a CANopen network. The file is designed in such a manner that it can be read by means of a text editor.

Due to the reading of the EDS file using the bus configuration tool, all slave-specific bus data is available to the bus master according to the "predefined connection set". The address ranges are defined by means of configuration and the configuration setting is transmitted during boot up of the network from the PLC to the individual slaves using SDO telegrams.

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In addition to the EDS file also three graphic files are available which can be optionally used in the configuration tool.

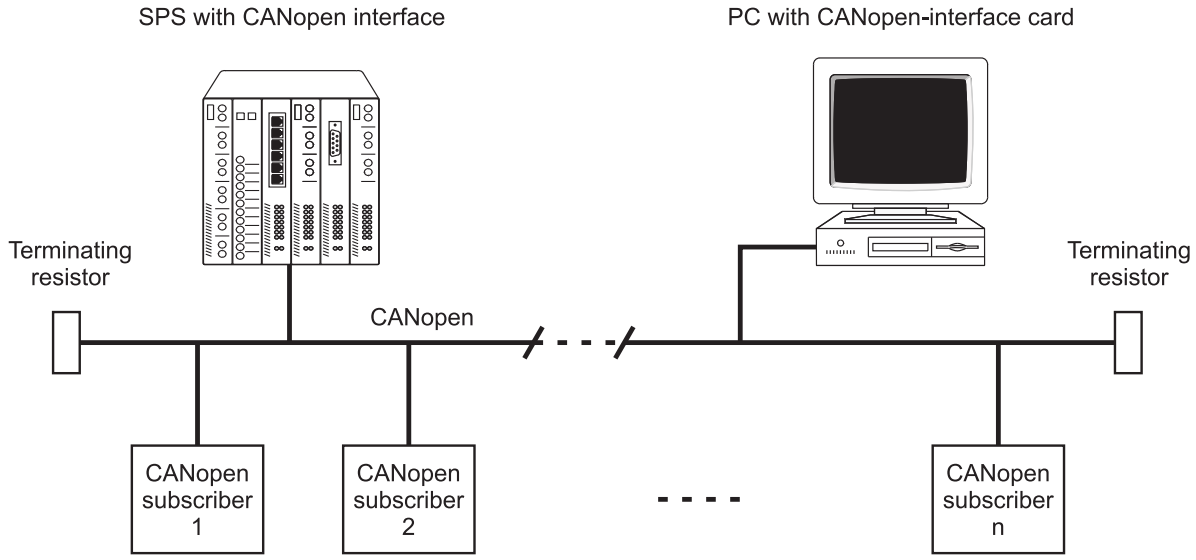
MX09F9_s.dib

MX09F9_r.dib

MX09F9_d.dib

Modifying the EDS-file leads to faulty action and is therefore not allowed!

Structure of the network



Due to the principle of bit-by-bit arbitration for the avoidance of bus access conflicts, the signal run time must be taken into consideration depending on the baud rate. Decreasing line lengths result at increasing bus speeds. Drop lines have a particularly negative influence on signal transmission. Generally, the drop lines should be kept as short as possible (max. 0.3 m drop line length at 1000 kBit/s).

Permissible line length depending on the baud rate:

Baud rate [kBit/s]	20	50	125	250	500	1000
Length [m]	2500	1000	500	250	100	25

Technical key data of the CANopen network

Interface according to:	CiA DS 102
Maximum number of subscribers:	32...126 according to the CAN controller used
Bus cable:	Use a screened, twisted, two-wire line as bus cable (e.g. LAPPKABEL UNITRONIC® BUS CAN)
	Characteristic impedance: 120 Ω (108...132 Ω) Distributed capacitance: < 60 nF/km Loop resistance: < 186 Ω/km Wire cross-section: > 0.50 mm^2 Specific line lag: 5 ns/m
Terminating resistor:	The bus should be terminated on both ends using a 120 Ω (108...132 Ω) resistor. Terminating resistors are located in the bus plugs of the bus subscribers at both ends. The CANopen network functions only when the bus termination is properly installed!
Galvanic isolation:	No

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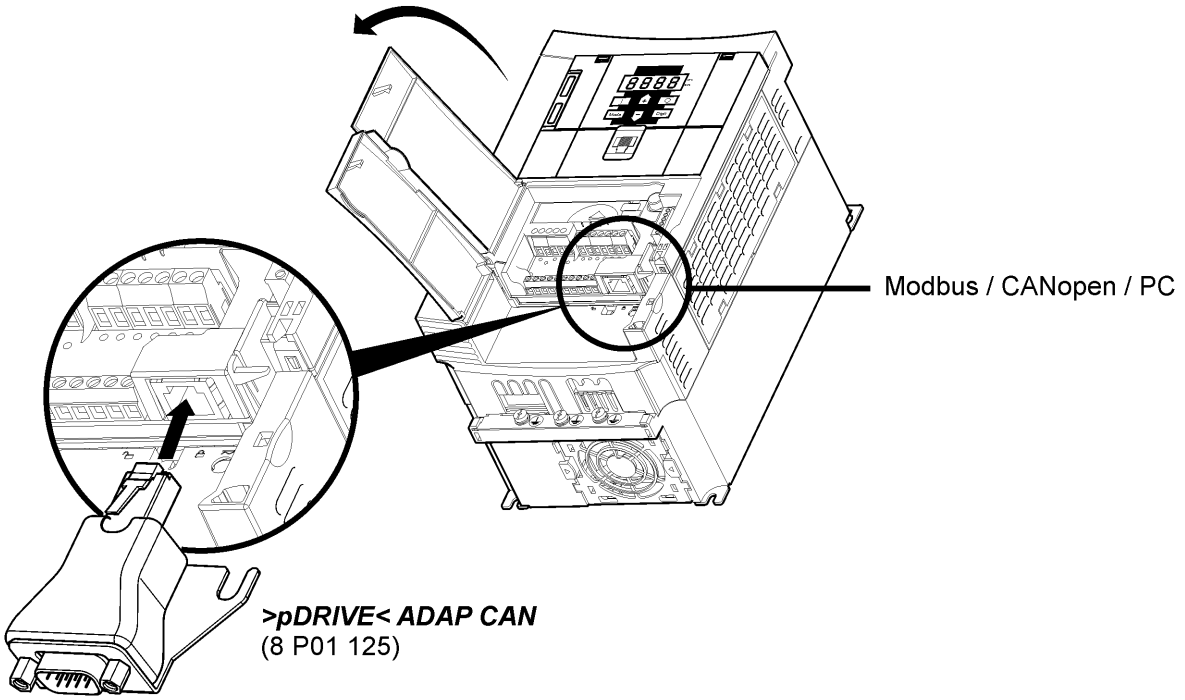
Mechanical construction

Installation of the option >*pDRIVE*< *ADAP CAN*



Plug assignment

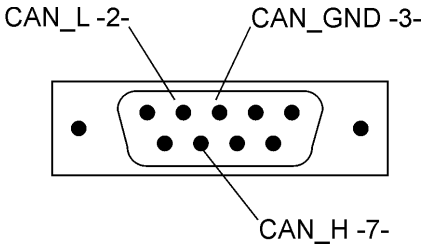
Plug assignment of the CANopen communication interface (corresponding to ISO 11898)

Pin assignment: RJ45 plug Modbus/CANopen/PC
(on inverter)

8.....1

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

Pin assignment: SUB-D plug CANopen
(on >*pDRIVE*< *ADAP CAN*)



*) Modbus signal

**) Voltage supply for the RS232/RS485 interface converter (PC software MatriX 3)

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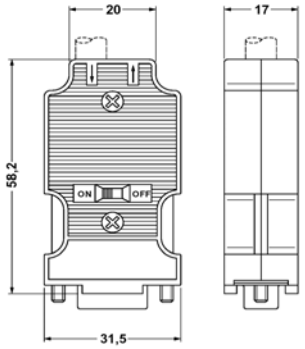
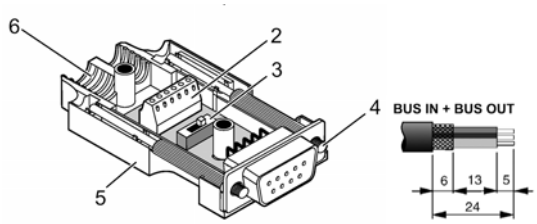
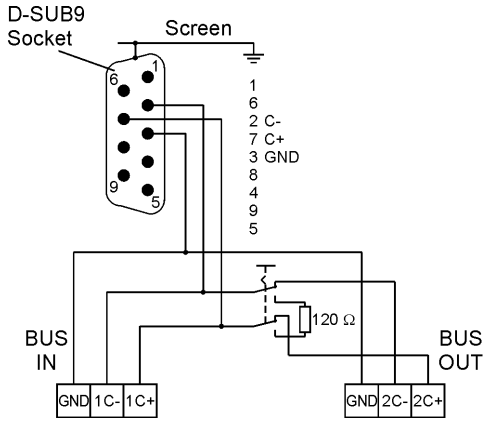
Plug connector: The bus is connected via a 9-pole Sub-D plug connector. Female multipoint connector on the bus cable, male multipoint connector on the bus subscriber.

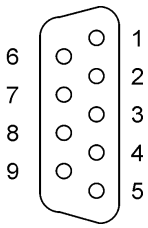
The bus plugs option *>pDRIVE< CANOPEN PLUG* (order number 8 P01 307) are designed as T junctions, whereby the bus line sections are connected inside of the plug connector. The terminal resistors are located in the bus plug and can be switched on and off using DIP switches.







Pin assignment of the option *>pDRIVE< CANOPEN PLUG*

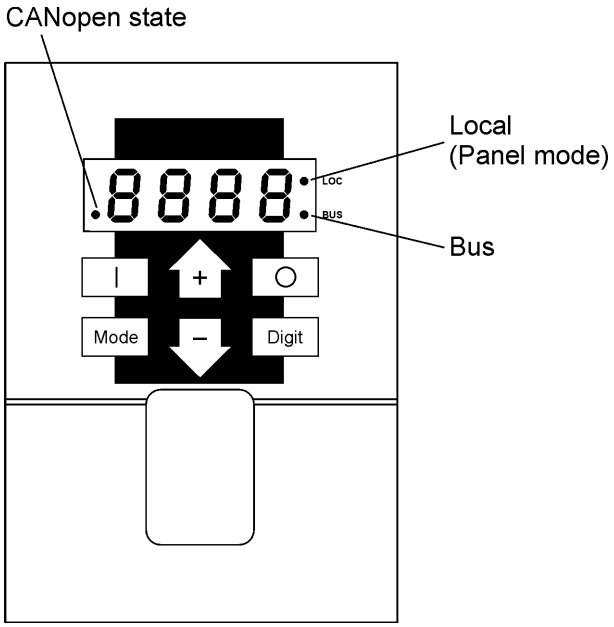


9-pin Sub-D (female)

Pole	Signal	Meaning
1		
2	CAN-L	CANopen signal -
3	CAN-GND	CANopen Ground
4		
5		
6		
7	CAN-H	CANopen signal +
8		
9		

LED - Indicator lamps

Typically the diagnostics of the CANopen connection is executed by means of the matrix operating panel BE11 in plain text. 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 CANopen state		Bus state
Dark		The CANopen controller is in the OFF state or the NMT state is "*Stopped*".
Flashing	100ms	The NMT state is "*Pre-operational*".
Lights		The NMT state is "*Operational*".

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Process Data Object PDO

Process Data Object PDO

PDO telegrams are used for the fast transfer of process data used for the control and monitoring of the drive. In the *>pDRIVE< MX eco* two PDO telegrams with 4 words each (8 bytes) are available. For each of the two PDOs, one transmit and one receive telegram is defined.

Receive PDO1 telegram PLC → *>pDRIVE< MX eco*

COB ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
200 hex + Node ID	Control word (STW)		Reference value 1 (D6.101)		Reference value 2 (D6.105)		Reference value 3 (D6.109)	
	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB

Receive PDO2 telegram PLC → *>pDRIVE< MX eco*

COB ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
300 hex + Node ID	Reference value 4 (D6.113)		Reference value 5 (D6.117)		Reference value 6 (D6.121)		Reference value 7 (D6.125)	
	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB

In the PDO receive telegram, the bus control word (STW) and a maximum of 7 selectable bus reference values is transferred to the CANopen slave from the CAN open master (PLC). In the process, a PDO1 telegram received from the inverter is processed immediately (1.5 ms), while a PDO2 telegram is processed in a lower-priority background task.

Because of using the method "*static PDO mapping*", the telegram structure of both PDOs is permanently predefined. The transferred bus reference values are allocated by means of the inverter parameterization in matrix group D6. The first word in the telegram "*PDO1 receive*" always contains the bus control word.

Transmit PDO1 telegram *>pDRIVE< MX eco* → PLC

COB ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
180 hex + Node ID	Status word (ZTW)		Actual value 1 (D6.138)		Actual value 2 (D6.142)		Actual value 3 (D6.146)	
	LSB	MSB	LSB	MSB		LSB	MSB	LSB

Transmit PDO2 telegram *>pDRIVE< MX eco* → PLC

COB ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
280 hex + Node ID	Actual value 4 (D6.150)		Actual value 5 (D6.154)		Actual value 6 (D6.158)		Actual value 7 (D6.162)	
	LSB	MSB	LSB	MSB		LSB	MSB	LSB

In the PDO transmit telegram, the device status word (ZTW) and a maximum of 7 selectable actual values of the inverter is transferred to the CANopen master (PLC) from the CANopen slave.

Because of using the method "static PDO mapping", the telegram structure of both PDOs is permanently predefined. The actual values being transferred are selected by means of the inverter parameterization in matrix group D6. Word 1 in the telegram "*PDO1 Transmit*" always contains the device status word.

The PDO transmit telegrams generated by *>pDRIVE< MX eco* can be transferred using parameter groups 1800/1801 hex (PDO1, 2) cyclically or synchronized in event-oriented form.

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Parameter	Index	Subindex	Format	Setting	Transfer mode
Transfer method	1800 hex 1801 hex	02 hex	Unsigned8	FE hex FF hex	Event-oriented transfer
				01...F0 hex	Cyclically (triggered by the SYNC telegram)
				00 hex	Event-oriented (triggered by SYNC)
				FC, FD hex	Triggered by RTR (not supported)

The selection of the transfer method is accepted only in the NMT state "Pre-operational".

Event-oriented transfer

In case of this transfer mode, a PDO transmit telegram is sent by the *>pDRIVE< MX eco* only if a value is changed. If a PDO of a subscriber contains values that are constantly changing (such as current, torque or controller values), this subscriber constantly tries to send PDOs. In order not to impair the data flow of other subscribers, the event-oriented transfer can be influenced as follows using two adjustable timers:

Parameter	Index	Subindex	Format	Factor	Function
Inhibit time	1800 hex	03 hex	Unsigned16	100 µs	Prevents the transfer of a PDO for a set period
Event timer	1800 hex	05 hex	Unsigned16	1 ms	Maximum time between 2 PDOs When this time is up, a PDO is transferred even if the value is not changed. The event timer must be set longer than the inhibit time!

Cyclic, synchronized transfer

In case of this transfer mode, the sending of a PDO telegram is triggered by the SYNC telegram sent by the CANopen master. In the process, it is possible to select whether the PDO should be sent with every SYNC telegram or after a certain number of SYNC telegrams have been received. The setting takes place using parameter 1800, 1801/02 hex (setting range 1...240).

Event-oriented, synchronized transfer

The PDO telegram is triggered depending on the received SYNC telegrams, as in case of the cyclically synchronous transfer. This occurs, however, only if the value has changed since the last transfer.

The setting takes place using parameter 1800, 1801/02 hex (setting range 1...240).

Control word

The *>pDRIVE< MX eco* is controlled using the bus control word, which is designed on the basis of the Profidrive profile (VDE 3689). The standardized information of the control and status word (bit 0...10) is described subsequently and requires no inverter-internal settings. The reference use, the assignment of actual values, and the use of bits 11...15 (STW and ZTW) must be adjusted accordingly in matrix field "D6 - Fieldbus".

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	Jog 1 start (only MX pro)	Jog 1 stop (only MX pro)
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

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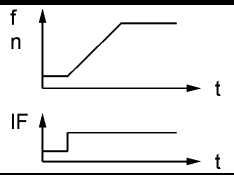
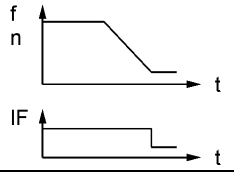
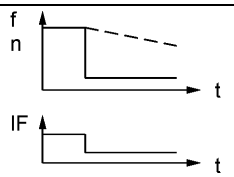
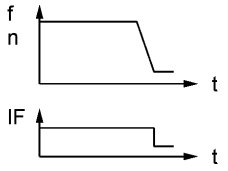
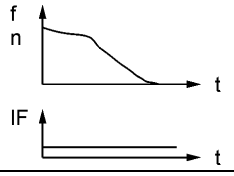
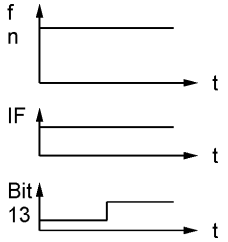
Description of control word bits

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 already 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.
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 !

Bit	Value	Meaning	Note
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	
8	1	Jog 1 start	Command is only provided by MX pro! The command "Jog 1 start" is only accepted during drive state "4 Operation released". The drive accelerates with right-handed rotary field and the set "Jog ramp" C1.59 to "Jog frequency" C1.58. The drive state changes to "11 Jog 1 active". If jog mode is required also with left-handed rotary field, a free control word bit and the function "Jog REV" can be used for realization.
	0	Jog 1 off	Command is only provided by MX pro! This command is only accepted when "Jog 1" was set to 1 before. The drive decelerates with the set "Jog ramp" to 0 Hz and changes to drive state "12 Jog 1 pause". If a renewed "Jog 1 start" command occurs within 0.5 seconds it is executed immediately. After this time the drive state changes back to "4 Operation released".
9	1	Jog 2 start	Command not provided
	0	Jog 2 off	Command not provided

Bit	Value	Meaning	Note
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

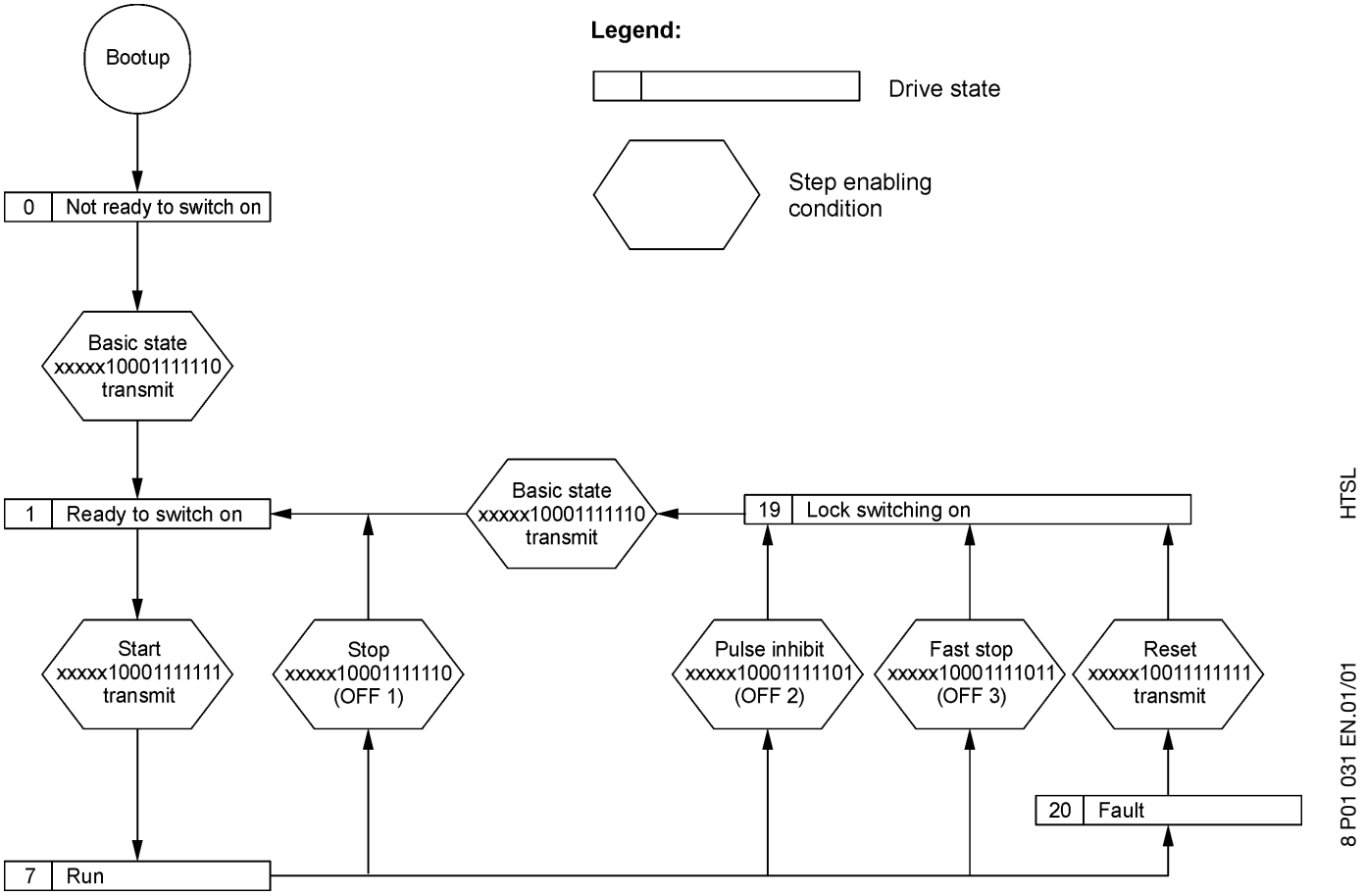
Summary of the most important control commands

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

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

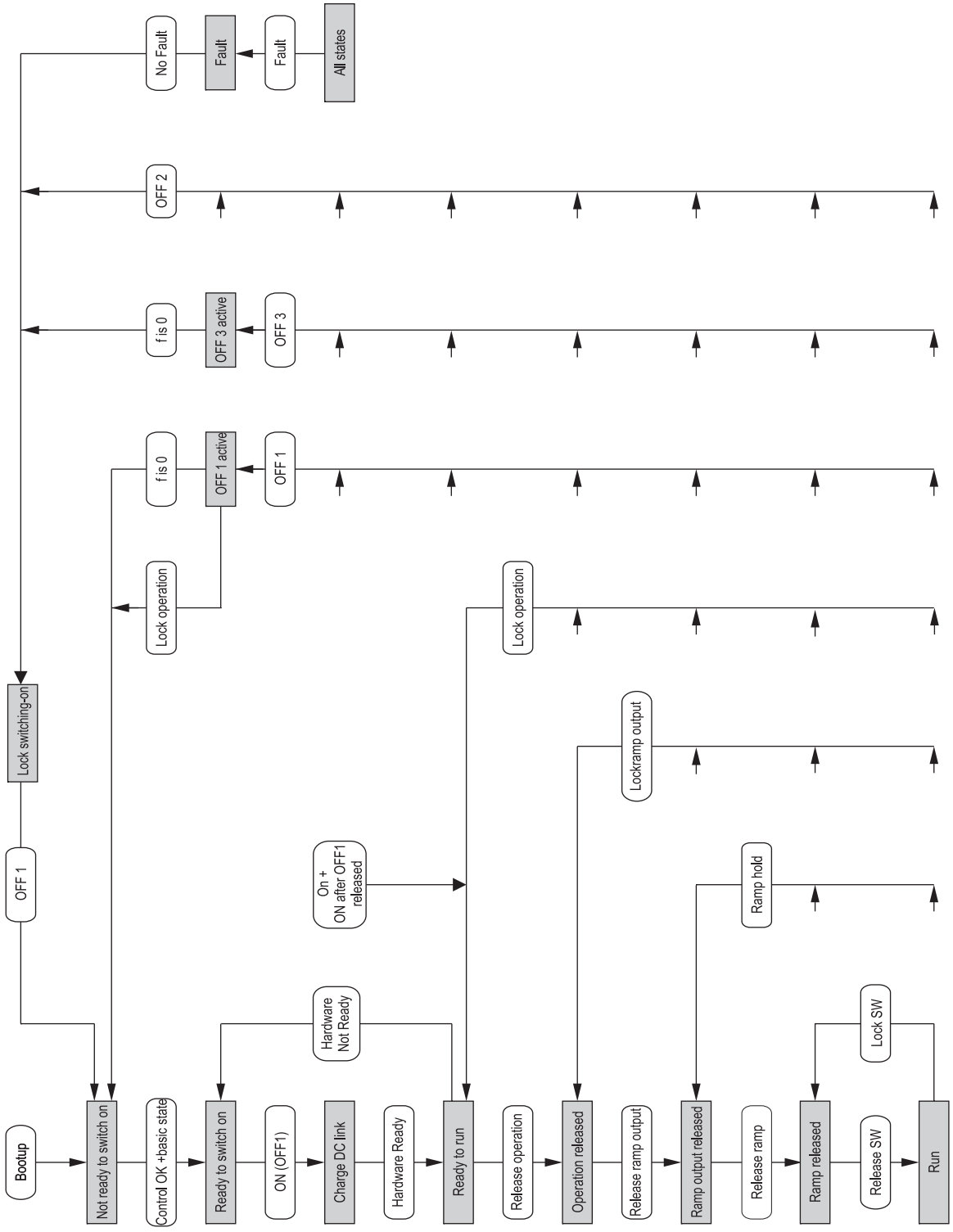


The commands Impulse inhibit (OFF 2), Fast stop (OFF 3) as well as a fault which has been reset always result in drive state "*Lock switching-on*" !

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)

In the PDO1 three reference values (each 16 bit) are available, in PDO2 four reference values. The meaning of the individual reference value words 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

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

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

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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

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	

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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	Output of the comparator time module T1 = high Parameterization see parameter group E6
	0	f ≤ f level	Output of the comparator time module T1 = low Parameterization see parameter group E6

Main actual value (Auxiliary actual values)

In the PDO1 three actual values (each 16 bit) are available, in PDO2 four actual values. 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 field D6)	(for the complete list see matrix field D6)
Inverter – "external"	DI1...DI6 DI7...DI10 or DI11...DI14	Analog inputs of the basic card or the option card >*pDRIVE*< IO12

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Service Data Object SDO

SDO telegrams provide a service for direct access to the object library. On the one hand, they are used for adjustment of the CANopen-specific communication settings during network configuration (objects 00 00 hex...1F FF hex), while, on the other hand, they have read and write access to all parameters in the *>pDRIVE< MX eco* (objects 20 00 hex...5F FF hex).

An SDO telegram is always executed as a confirmed telegram. If the *>pDRIVE< MX eco* receives an SDO request telegram from the CANopen master, the request is processed inside the inverter and the response is returned to the master in form of an SDO response telegram.

Request SDO telegram PLC → *>pDRIVE< MX eco*

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
600 hex + Node ID	Request code	Object index		Object Sub Index	Request Data			
		LSB	MSB		Bits 7...0	Bits 15...8	Bits 23...16	Bits 31...24

Response SDO telegram *>pDRIVE< MX eco* → PLC

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
580 hex + Node ID	Response code	Object index		Object Sub Index	Response Data			
		LSB	MSB		Bits 7...0	Bits 15...8	Bits 23...16	Bits 31...24

Request code

Request Code	Meaning	Byte 4	Byte 5	Byte 6	Byte 7
23 hex	Write 4-byte parameter	Bit 7...0	Bit 15...8	Bit 23...16	Bit 31...24
2B hex	Write 2-byte parameter	Bit 7...0	Bit 15...8	00 hex	00 hex
2F hex	Write 1-byte parameter	Bit 7...0	00 hex	00 hex	00 hex
40 hex	Read parameter (4/2/1 bytes)	00 hex	00 hex	00 hex	00 hex
80 hex	Cancel request	00 hex	00 hex	00 hex	00 hex

Response code

Response Code	Meaning	Byte 4	Byte 5	Byte 6	Byte 7
43 hex	Transfer 4-byte parameter	Bit 7...0	Bit 15...8	Bit 23...16	Bit 31...24
4B hex	Transfer 2-byte parameter	Bit 7...0	Bit 15...8	00 hex	00 hex
4F hex	Transfer 1-byte parameter	Bit 7...0	00 hex	00 hex	00 hex
60 hex	Write parameter (4/2/1 bytes)	00 hex	00 hex	00 hex	00 hex
80 hex	Request not executed / fault code	00 hex	00 hex	00 hex	00 hex

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If a request cannot be executed, response Code 80 hex is transferred together with the respective fault code as the response.

Fault code	Meaning
05 03 00 00 hex	Segmented transfer; the toggle bit was not changed.
05 04 00 01 hex	Unknown request code
06 01 00 00 hex	Parameter cannot be adjusted (cannot be adjusted during operation, double assignment or active parameter lock)
06 01 00 02 hex	Parameter cannot be adjusted (actual value)
06 02 00 00 hex	Non-existent parameter index
06 09 00 11 hex	Non-existent parameter subindex
06 09 00 30 hex	Parameter value outside the permitted limits
06 09 00 31 hex	Parameter value too large
08 00 00 00 hex	General parameterization fault

General remarks regarding the use of the SDO parameterizing service

- For write requests, use a request that corresponds to the parameter type and enter the value to be transferred in the corresponding bytes (LSB before MSB).
- The master must recognize the response to a request made by evaluating the response code of the parameter index/subindex and the parameter value.
- If an SDO request cannot be executed, the *>pDRIVE< MX eco* sends an SDO telegram with response code 80 hex (request not executed). The corresponding fault code is transferred in the data bytes (4...7).
- Parameter write requests are not permissible if they do not refer to objects that are assigned to a PDO.
- To protect the data against voltage loss, a storage command must be sent after changing a parameter. This takes place by writing a value of 1 to the "*Save Parameter Values*" object (Index 2000/29).
- Read requests for parameter types greater than 4 bytes (multiple-byte data) are transferred using a segmented SDO routine. The transfer can be interrupted using request code 80 hex.

Detailed information on the individual inverter parameters, such as the index, subindex, setting range and data type can be found in the parameter list in the appendix.

Parameter F6.03 "Parametrising station" (Index 2000/29) must be set to "3 .. CANopen" in order to adjust parameters on the *>pDRIVE< MX eco* via the CANopen interface.

Examples

In the following examples, all COB IDs refer to slave address 1

All values stated in the telegram structure are represented in hexadecimal form.

Reading of the actual motor current (parameter A2.05)

→ A2.05 = Index: 2001 hex Subindex: 06 hex

SDO request

COB ID	Req	Index		Sub	Byte 4	Byte 5	Byte 6	Byte 7
601	40	01	20	06	00	00	00	00

SDO response

COB ID	Res	Index		Sub	Byte 4	Byte 5	Byte 6	Byte 7
581	4B	01	20	06	02	DA	00	00

02DA hex = 730 dec

Scaling: Real value = transferred value / factor (for factor, see chapter "Parameter list of the ***>pDRIVE< MX eco*** ", page 68)

P = 730 / 100 = 7.30 A

Programming of the parameterizing station on CANopen (F6.03 = setting "3 .. CANopen")

→ F6.03 = Index: 200B hex Subindex: 2F hex

SDO request

COB ID	Req	Index		Sub	Byte 4	Byte 5	Byte 6	Byte 7
601	2B	0B	20	2F	03	00	00	00

SDO response

COB ID	Res	Index		Sub	Byte 4	Byte 5	Byte 6	Byte 7
581	60	0B	20	2F	00	00	00	00

It is necessary to set parameter F6.03 "Parametrising station" to setting "3 .. CANopen" (Index 2000/29) in order to be qualified for adjusting other parameters.

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Programming of the digital input DI1 to Motorpot + (D2.01 = setting "14 .. Motor pot. +")

→ D2.01 = Index: 2007 hex Subindex: 44 hex

SDO request

COB ID	Req	Index		Sub	Byte 4	Byte 5	Byte 6	Byte 7
601	2B	07	20	44	0E	00	00	00

Positive SDO response

COB ID	Res	Index		Sub	Byte 4	Byte 5	Byte 6	Byte 7
581	60	07	20	44	00	00	00	00

Negative SDO response (not assignable due to double assignment)

COB ID	Res	Index		Sub	Byte 4	Byte 5	Byte 6	Byte 7
581	80	07	20	44	00	00	00	08

Response code 80 refers to a request that cannot be performed. The corresponding fault code is transferred in the value field (08 00 00 00 = general parameterizing error due to double assignment).

Adjustment of an analog value (D3.04 "AO1 max. value" = 150 %)

→ D3.04 = Index: 2007 hex Subindex: 56 hex

SDO request

COB ID	Req	Index		Sub	Byte 4	Byte 5	Byte 6	Byte 7
601	2B	07	20	56	98	3A	00	00

SDO response

COB ID	Res	Index		Sub	Byte 4	Byte 5	Byte 6	Byte 7
581	60	07	20	56	00	00	00	00

Scaling: Value to be transferred = real value * factor (for factor, see chapter "Parameter list of the ***>pDRIVE< MX eco*** ", page 68)

Setting 150 %, factor 100

Value to be transferred = 150 * 100 = 15000 dec = 3A98 hex

Reading of the drive reference (F1.01 "Inverter type")

→ F1.01 = Index: 2000 hex Subindex: 0C hex

The drive reference is a parameter of the 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 chapter "Parameter list of the ***>pDRIVE< MX eco*** ", page 68).

1. SDO request

COB ID	Req	Index		Sub	Byte 4	Byte 5	Byte 6	Byte 7
601	40	00	20	0C	00	00	00	00

1. SDO response

COB ID	Res	Index		Sub	Byte 4	Byte 5	Byte 6	Byte 7
581	4B	00	20	0C	58	4D	00	00

Transferred value = 4D 58 → ASCII "M" "X"

2. SDO request

COB ID	Req	Index		Sub	Byte 4	Byte 5	Byte 6	Byte 7
601	40	00	20	0D	00	00	00	00

2. SDO response

COB ID	Res	Index		Sub	Byte 4	Byte 5	Byte 6	Byte 7
581	4B	00	20	0D	63	65	00	00

Transferred value = 65 63 → ASCII "e" "c"

…….

8. SDO request

COB ID	Req	Index		Sub	Byte 4	Byte 5	Byte 6	Byte 7
601	40	00	20	14	00	00	00	00

8. SDO response

COB ID	Res	Index		Sub	Byte 4	Byte 5	Byte 6	Byte 7
581	4B	00	20	14	00	00	00	00

Transferred value = 00 00 → ASCII "_" "_"

Summary: 4D 58 65 63 6F 34 56 31 2E 35 20 00 00 00 00 00 = MX eco4V1.5_

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.

D6.06	Mode tracking				1 .. Active

0 ...Not active
1 ...Active

Mode tracking defines the behaviour of the inverter if the control source is switched. Depending on the process demands one of the following reactions can be selected:

Setting	Behaviour when changing from Remote / Panel mode → Bus
0 .. not active	The drive changes to bus state "Lock switching on". Changing the control source has to be confirmed by the bus by sending the drive state (OFF1 = 0).
1 .. active	The drive permits a direct change from remote / panel mode to bus operation. Thereby the active operating state is assumed shock-free.

CANopen settings

D6.20	CANopen address				0
	0...127				

Setting of the CANopen slave address. In this manual, the slave address is also called the node ID according to CiA □ DS301.

The setting of address 0 is not permissible!

D6.21	CANopen baud rate				52 .. 125 kBaud
	34...20 kBaud 38...50 kBaud 52...125 kBaud 60...250 kBaud 68...500 kBaud 76...1 Mbaud				

The transmission rate must have the same setting in the whole CANopen network. Also see the chapter "Hardware" (for cable lengths). The setting of 20 kBaud is not supported by all CANopen devices and may lead to communication problems.

The parameters "CANopen address" and "CANopen baud rate" do not become effective until after a boot procedure. For this purpose, the device should be completely disconnected (including the 24 V buffer voltage) or a software reset F2.46 should be performed.

Diagnostics of the configuration settings

D6.22	CANopen status				

0 ...Boot-up
4 ...Stopped
5 ...Operational
127.Pre-operational

Display of the active NMT state. This is also transferred in the response telegram to the CANopen master during active node guarding.

D6.23	CANopen error register	0110			

0 ...No Error	☐ / ☑	4 .. Heartbeat	☐ / ☑
1 ...Bus Off	☐ / ☑	5 .. Wrong State	☐ / ☑
2 ...Node Guarding	☐ / ☑		
3 ...Overrun	☐ / ☑		

In the fault register, the corresponding fault is displayed during a CANopen communication problem.

No.	Fault	Required reaction
0	No fault	–
1	Bus OFF	Communication must be started.
2	Node Guarding	Return to the NMT state initialisation required
3	CAN overrun	–
4	Heartbeat	Return to the NMT state initialisation required
5	NMT state fault	Return to the NMT state initialisation required

D6.24	CANopen Rx errorcount				

Counts all faulty received telegrams (SDO, PDO, etc.).

D6.25	CANopen Tx errorcount				

Counts all incorrectly sent telegrams (SDO, PDO,....). (Hardware problems, bus overload,....)

Configuration of the fieldbus reference values

Corresponding to the configured telegram length one to seven 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.

Depending on the setting of parameter D6.100 "No. of Bus-ref. values" PDO1 or PDO2 (receive) is activated. When using both PDO's at most 7 bus reference values can be transmitted.

PDO type	Number of bus reference values
PDO1	1 STW + 3 SW
PDO2	1 STW + 7 SW

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).

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 %.

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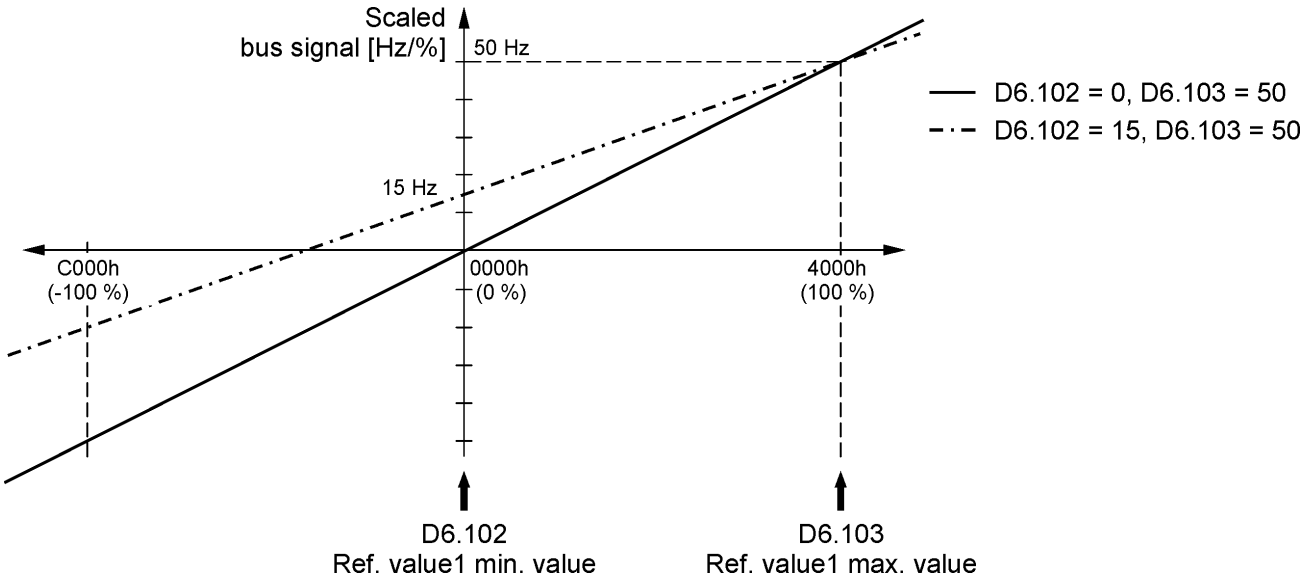
Bus SW-1 scaling



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

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.

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 the alarm message " Multiple usage of inputs not possible !" 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.

Depending on the setting of parameter D6.137 "Fieldbus actual values" PDO1 or PDO2 (transmit) is activated. When using both PDO's at most 7 bus actual values can be transmitted.

PDO type	Number of bus actual values
PDO1	1 ZTW + 3 IW
PDO2	1 ZTW + 7 IW

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.

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Following process sizes can be transmitted as actual values:

Process size	Value	Unit	Scaling
1 .. Actual frequency	100.0	Hz	100.0
2 .. |Actual 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
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	% / Hz	100.0
25 .. Curve generator	100.0	% / Hz	100.0
26 .. Counter (average)	100.0	%	100.0
27 .. Total counter	100.0	%	100.0
33 .. DC voltage	100.0	%	1000 V DC
36 .. Thermal load M1	100.0	%	100.0
37 .. Thermal load M2	100.0	%	100.0
39 .. Thermal load VSD	100.0	%	100.0
41 .. AI 1	100.0	%	10 V = 4000 hex
42 .. AI 2	100.0	%	10 V or 20 mA = 4000 hex
43 .. AI 3	100.0	%	20 mA = 4000 hex
44 .. AI 4	100.0	%	10V or 20 mA = 4000 hex
45 .. Frequency input	100.0	% / Hz	D1.33 = 4000 hex
46 .. LFP input	100.0	% / Hz	D1.41 = 4000 hex
47 .. Bus SW 1	100.0	% / Hz	100.0
48 .. Bus SW 2	100.0	% / Hz	100.0
49 .. Bus SW 3	100.0	% / Hz	100.0
50 .. Bus SW 4	100.0	% / Hz	100.0
51 .. Bus SW 5	100.0	% / Hz	100.0
52 .. Bus SW 6	100.0	% / Hz	100.0
53 .. Bus SW 7	100.0	% / Hz	100.0
54 .. Bus SW 8	100.0	% / Hz	100.0
55 .. Bus SW 9	100.0	% / Hz	100.0
58 .. Act. Error Code	–	Integer	See table alarm index given in the appendix
59 .. Act. alarm Code	–	Integer	See table alarm index given in the appendix
66 .. Ref. value C. motor 1	100.0	Hz	100.0
67 .. Ref. value C. motor 2	100.0	Hz	100.0
68 .. Ref. value C. motor 3	100.0	Hz	100.0
69 .. Ref. value C. motor 4	100.0	Hz	100.0

D6.138	Act. value1 selection				1 .. Actual frequency
0 ...Not used	20 .. PID-output	47.. Bus SW 1			
1 ...Actual frequency	23 .. Int. ref. switch-over	48.. Bus SW 2			
2 ...|Actual frequency|	24 .. Calculator	49.. Bus SW 3			
3 ...Motor current	25 .. Curve generator	50.. Bus SW 4			
4 ...Torque	26 .. Counter (average)	51.. Bus SW 5			
5 ...|Torque|	27 .. Total counter	52.. Bus SW 6			
8 ...Power	33 .. DC voltage	53.. Bus SW 7			
9 ...|Power|	36 .. Thermal load M1	54.. Bus SW 8			
10...Motor voltage	37 .. Thermal load M2	55.. Bus SW 9			
11...Speed	39 .. Thermal load VSD	58.. Act. Error Code			
12...|Speed|	41 .. AI 1	59.. Act. alarm Code			
15...Int. f-ref. before ramp	42 .. AI 2	66.. Ref. value C. motor 1			
16...Int. f-ref. after ramp	43 .. AI 3	67.. Ref. value C. motor 2			
17...PID-reference val. [%]	44 .. AI 4	68.. Ref. value C. motor 3			
18...PID-actual value [%]	45 .. Frequency input	69.. Ref. value C. motor 4			
19...PID-deviation [%]	46 .. LFP input				

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					

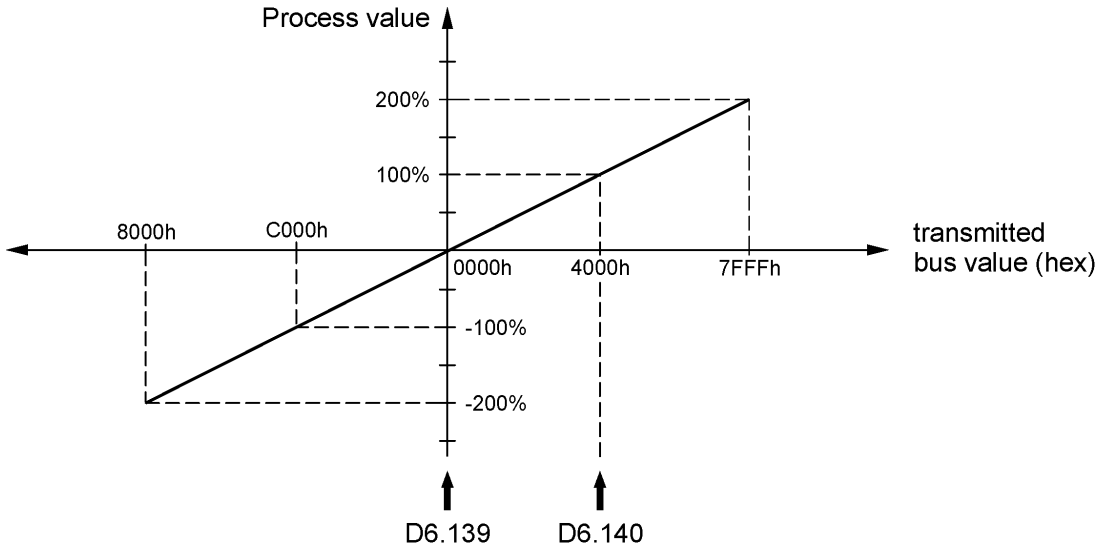
D6.140	Act. value1 max. value				50 % or Hz
-300...300 % or Hz					

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	32 .. Emergency operation	60.. Motor heating
11 ...f-ref reverse	35 .. PID-active	61.. Operation with IR
14 ...Motor pot. +	36 .. PID-lock	64.. Pulse counter input
15 ...Motor pot. -	37 .. PID-wind up	65.. Pulse counter reset
16 ...Pre-set A	40 .. Feed in pressure OK	66.. n-monitoring
17 ...Pre-set B	41 .. Level OK	67.. Parameter locked
18 ...Pre-set C	42 .. Level <	77.. P15-set B
19 ...Pre-set D	50 .. C. motor 1 ready	78.. P15-set C
22 ...f-reference 2 [Hz]	51 .. C. motor 2 ready	106 LFP input
23 ...Control source 2	52 .. C. motor 3 ready	107 Process fault 1
24 ...2nd ramp	53 .. C. motor 4 ready	108 Process fault 2
25 ...Reference value B	56 .. Mains cut-off	109 Process fault 3
26 ...Panel operation	57 .. ON lock	
29 ...External fault 1	58 .. Locking	
30 ...External fault 2	59 .. Feedb. motor cont.	

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

Setting possibilities see D6.174.

D6.179	STW1 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 "STW1 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 .. External fault 1"

If a switch-over from bus operation to terminal strip operation takes place, the commands of the control word become ineffective ! So the parameterized function "External 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 "STW1 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	27 .. DC link charged	57...Bus STW bit 14
1 ...Ready	28 .. Line Contactor ON	58...Bus STW bit 15
2 ...Operation	29 .. Motor contactor ON	61...Digital input DI1
3 ...Ready / run	30 .. C. motor 1 ON	62...Digital input DI2
4 ...Trip	31 .. C. motor 2 ON	63...Digital input DI3
5 ...Sum alarm	32 .. C. motor 3 ON	64...Digital input DI4
6 ...Motor turns	33 .. C. motor 4 ON	65...Digital input DI5
7 ...f = f ref	36 .. Alarm category 1	66...Digital input DI6
8 ...Generator operation	37 .. Alarm category 2	67...Digital input DI7
11...Shut down	38 .. Alarm category 3	68...Digital input DI8
12...Panel mode active	41 .. Output T1	69...Digital input DI9
13...Motor 1 active	42 .. Output T2	70...Digital input DI10
14...Motor 2 active	43 .. Output T3	71...Digital input DI11
15...Param.-set 1 active	44 .. Output T4	72...Digital input DI12
16...Param.-set 2 active	45 .. Output T5	73...Digital input DI13
19...Safe standstill active	46 .. Output T6	74...Digital input DI14
20...Limitation active	54 .. Bus STW bit 11	76...Pulse generator
24...Motor heating active	55 .. Bus STW bit 12	
25...Motorfluxing active	56 .. Bus STW bit 13	

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 STW1 received at the *>pDRIVE< MX eco*.

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 ZTW1 sent at the *>pDRIVE< MX eco*.

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 control word in hex (D6.226) and as bit field (D6.227).

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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.

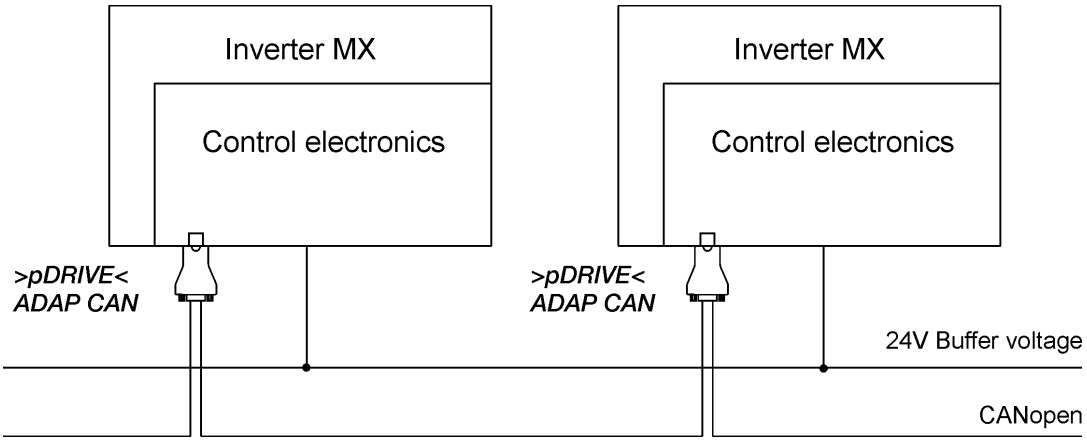
A mixed operation of these variants is certainly possible.

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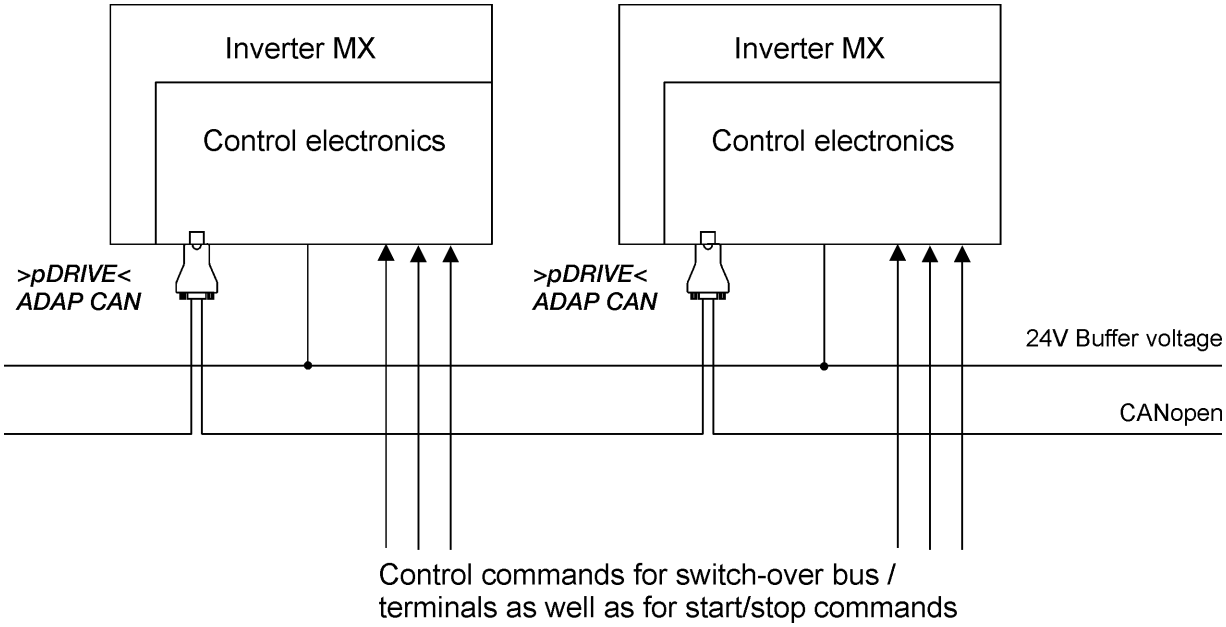
Controlling the MX alternatively by means of the fieldbus interface or the terminals → "Control source switch-over"

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.

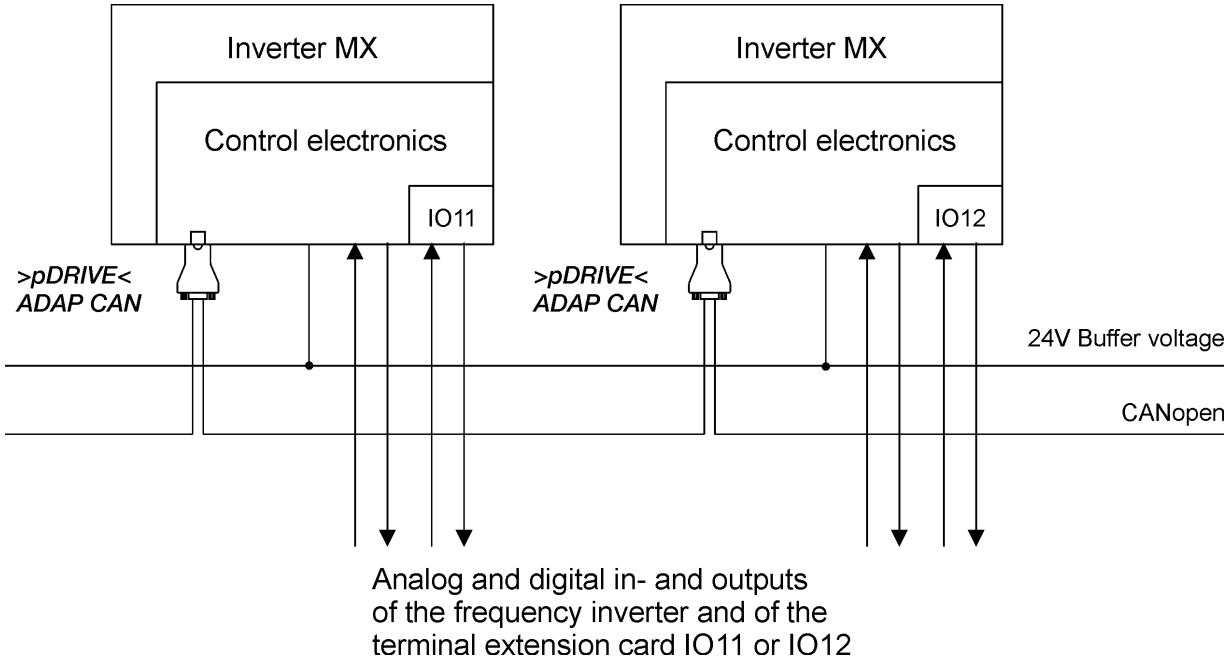


In order to address an inverter via fieldbus also during mains cut-off (line contactor control, disconnecting switch, ...) the *>pDRIVE< MX eco* has to be supplied with an external 24 V buffer voltage.

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		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
A2	**Motor values**							
Motor values								
A2.01	|Speed|	2001/02			1			rpm
A2.02	Direction of rotation	2001/03						
A2.03	|Torque|	2001/04			see table			Nm
A2.04	Operating quadrant	2001/05						
A2.05	Motor current in A	2001/06			see table			A
A2.06	Motor current in %	2001/07			1			%
A2.07	Shaft power in kW	2001/08			see table			kW
A2.08	Shaft power in HP	2001/09			see table			Hp
A2.09	Apparent power	2001/0A			see table			VA
A2.10	Motor voltage	2001/0B			1			V
A2.11	Thermal load M1	2001/0C			1			%
A2.12	Thermal load M2	2001/0D			1			%
A2.13	Process speed	2001/0E			10			rpm
A2.14	Multiplier - n	2004/34			1	-1000	1000	
A2.15	Divisor - n	2004/35			1	1	1000	
A2.16	Offset - n	2004/36			100	-100	100	rpm
A2.17	Symbol for A2.13	2004/37	txt					
A2.18	Unit for A2.13	2004/39	txt					
A2.19	Process torque	2004/3C			1			%
A2.20	Multiplier - T	2004/3D			1	1	10000	
A2.21	Divisor - T	2004/3E			1	1	1000	
A2.22	Offset - T	2004/3F			100	-100	100	%
A2.23	Symbol for A2.19	2004/40	txt					
A2.24	Unit for A2.19	2004/42	txt					
A2.25	Active motor	2001/0F						
A2.28	Inertia	2017/2C			1			gm2
A3	**Inverter values**							
Inverter values								
A3.01	Output frequency	2017/26			100			Hz
A3.02	Inverter load	2001/13			1			%
A3.03	Mains voltage	2001/14			1			V
A3.04	DC voltage	2001/15			1			V
A3.05	Thermal load VSD	2001/16			1			%
A3.06	Active pulse frequency	2001/17			10			kHz
A4	**Reference values**							
Monitoring of analog inputs								
A4.01	AI1 ref. value [%]	2001/1A			10			%
A4.02	AI1 ref. value scaled	2001/1B			100			% / Hz
A4.03	AI2 ref. value [%]	2001/1C			10			%
A4.04	AI2 ref. value scaled	2001/1D			100			% / Hz
A4.05	AI3 ref. value [%]	2001/1E			10			%

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Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
A4.06	AI3 ref. value scaled	2001/1F			100			% / Hz
A4.07	AI4 ref. value [%]	2001/20			10			%
A4.08	AI4 ref. value scaled	2001/21			100			% / Hz
A4.09	FP ref. value in kHz	2001/22			100			kHz
A4.10	FP ref. value scaled	2001/23			100			% / Hz
Monitoring of digital reference sources								
A4.11	Motor pot. ref. value	2001/24			100			% / Hz
A4.12	MX-wheel ref. value	2001/25			100			Hz
A4.13	Pre-set reference	2001/26			100			% / Hz
Monitoring of internal reference sources								
A4.14	Reference val. switch	2001/27			100			% / Hz
A4.15	Calculator	2001/28			100			% / Hz
A4.16	Act. value selection	2001/29			100			% / Hz
A4.17	Curve generator	2001/2A			100			% / Hz
Monitoring of digital inputs								
A4.18	DI state basic device	2001/2B	0110					
A4.19	DI state IO11	2001/2C	0110					
A4.20	DI state IO12	2001/2D	0110					
Monitoring of bus reference sources								
A4.21	Bus reference 1 scaled	2001/2E			100			% / Hz
A4.22	Bus reference 2 scaled	2001/2F			100			% / Hz
A4.23	Bus reference 3 scaled	2001/30			100			% / Hz
A4.24	Bus reference 4 scaled	2001/31			100			% / Hz
A4.25	Bus reference 5 scaled	2001/32			100			% / Hz
A4.26	Bus reference 6 scaled	2001/33			100			% / Hz
A4.27	Bus reference 7 scaled	2001/34			100			% / Hz
A4.28	Bus reference 8 scaled	2001/35			100			% / Hz
A4.29	Bus reference 9 scaled	2001/36			100			% / Hz
Monitoring of analog inputs								
A4.30	LFP ref. value in Hz	201C/63			100			Hz
A4.31	LFP ref. value scaled	201C/64			100			

A5	Counter							
Operating hours								
A5.01	Operating hours motor1	2001/37			1			h
A5.02	Interval motor 1	2004/45			1	0	60000	h
A5.03	Interval counter M1	2001/38			1			h
A5.04	Operating hours motor2	2001/39			1			h
A5.05	Interval motor 2	2004/46			1	0	60000	h
A5.06	Interval counter M2	2001/3A			1			h
A5.07	Power on hours	2001/3B			1			h
A5.08	Interval power on	2004/47			1	0	60000	h
A5.09	Interval count. PowerOn	2001/3C			1			h
A5.10	Operating hours fan	2001/3D			1			h
A5.11	Interval fan	2004/48			1	0	60000	h
A5.12	Interval counter fan	2001/3E			1			h

Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
A5.13	Clear interval counter	2001/3F						
Energy meter								
A5.14	MWh meter mot.	2001/40			1			MWh
A5.15	kWh meter mot.	2001/41			10			kWh
A5.16	MWh meter gen.	2001/42			1			MWh
A5.17	kWh meter gen.	2001/43			10			kWh
A6	**Display configuration**							
Configuration of the display								
A6.01	Selection upper field	2004/49						
A6.02	Selection middle field	2004/4A						
A6.03	Selection lower field	2004/4B						
A6.04	View all parameters	2004/4C						
A6.05	Limitations	2003/63						
B1	**Language selection**							
Language selection								
B1.01	Language selection	2004/4E						
B2	**Macro configuration**							
Parameter management								
B2.01	Macro selected	2000/4F						
B2.02	Macro selection	2004/4F						
B2.03	Parameter mode	2004/50						
B2.04	Create backup	2012/02						
B2.05	Restore backup	2012/03						
B2.06	Copy parameter set	2012/04						
B2.07	Name parameter set 1	2004/52	txt					
	Ensuing parameter	2004/53	txt					
	Ensuing parameter	2004/54	txt					
	Ensuing parameter	2004/55	txt					
	Ensuing parameter	2004/56	txt					
	Ensuing parameter	2004/57	txt					
	Ensuing parameter	2004/58	txt					
B2.08	Name parameter set 2	2004/59	txt					
	Ensuing parameter	2004/5A	txt					
	Ensuing parameter	2004/5B	txt					
	Ensuing parameter	2004/5C	txt					
	Ensuing parameter	2004/5D	txt					
	Ensuing parameter	2004/5E	txt					
	Ensuing parameter	2004/5F	txt					
B2.13	P15 activation	2004/51						
B3	**Inverter data**							
Mains voltage								
B3.01	Mains voltage	2004/60						
Motor control								
B3.02	Control mode	2004/61						
B3.03	Starting voltage	2004/62			10	0	100	V
B3.04	V/f - V1	2004/63			1	0	1000	V
B3.05	V/f - f1	2004/64			10	0	300	Hz

Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
B3.06	V/f - V2	2005/01			1	0	1000	V
B3.07	V/f - f2	2005/02			10	0	300	Hz
B3.08	V/f - V3	2005/03			1	0	1000	V
B3.09	V/f - f3	2005/04			10	0	300	Hz
B3.10	V/f - V4	2005/05			1	0	1000	V
B3.11	V/f - f4	2005/06			10	0	300	Hz
B3.12	V/f - V5	2005/07			1	0	1000	V
B3.13	V/f - f5	2005/08			10	0	300	Hz
B3.17	R1 Compensation	2005/09			1	50	100	%
B3.18	Slip compensation	2005/0A			1	0	300	%
B3.19	Vmax field weakening	2005/0B			1	100	200	%
B3.20	Dynamic 1	2005/0C			100	0	25	
B3.21	Dynamic 2	2005/0D			100	0	10	
General settings								
B3.24	Stop mode	2005/0E						
B3.25	decel. persistant freq.	2005/10			10	0	50	Hz
B3.26	decel. persistant time	2005/11			1	0	3600	s
B3.27	Motor fluxing	2005/0F						
B3.30	Switch. frequency	2005/12			10	2	16	kHz
B3.31	**Noise reduction**	2005/13						
B3.32	Min. length of pulses	2005/14						
B3.35	Catch on the fly	2005/15						
B3.36	Allowed catch direction	2005/16						
B3.37	Remanence level	2005/17			10	0.4	12	
B3.40	Output filter	2005/18						
B3.41	Fan control	2005/19						
B3.42	Auto tune at power on	2005/1A						
B3.43	Automatic SC test	2005/1B						
B3.44	Operation with IR	2005/1C						
B4	**Motor data**							
Motor selection								
B4.01	Motor type	2005/1D						
B4.02	Motor selection	2005/1E						
B4.03	Start auto tune	2012/05						
Motor data M1								
B4.05	Nominal power M1	2005/20			see table	0.2	3500	kW
B4.06	Nominal current M1	2005/21			see table	0	4000	A
B4.07	Nominal voltage M1	2005/22			1	0	1000	V
B4.08	Nominal frequency M1	2005/23			10	0	300	Hz
B4.09	Nominal speed M1	2005/24			1	0	65000	rpm
B4.10	Nominal slip M1	2001/45			100			Hz
B4.11	No. of pole pairs M1	2001/46			1			
B4.12	Stator resistor M1	2005/25			see table	0	65000	mOhm
B4.13	Rotortime constant M1	2005/26			1	0	10000	ms
B4.14	Fluxing current M1	2005/27			10	0	4000	A
B4.15	Stray reactance M1	2005/28			100	0	655.35	mH
Motor data M2								
B4.17	Nominal power M2	2005/2A			see table	0.2	3500	kW
B4.18	Nominal current M2	2005/2B			see table	0	4000	A
B4.19	Nominal voltage M2	2005/2C			1	0	1000	V
B4.20	Nominal frequency M2	2005/2D			10	0	300	Hz

Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
B4.21	Nominal speed M2	2005/2E			1	0	65000	rpm
B4.22	Nominal slip M2	2001/47			100			Hz
B4.23	No. of pole pairs M2	2001/48			1			
B4.24	Stator resistor M2	2005/2F			see table	0	65000	mOhm
B4.25	Rotortime constant M2	2005/30			1	0	10000	ms
B4.26	Fluxing current M2	2005/31			10	0	4000	A
B4.27	Stray reactance M2	2005/32			100	0	655.35	mH
Motor data M0								
B4.29	Nominal power M0	2001/49			see table			kW
B4.30	Nominal current M0	2001/4A			see table			A
B4.31	Nominal voltage M0	2001/4B			1			V
B4.32	Nominal frequency M0	2001/4C			10			Hz
B4.33	Nominal speed M0	2001/4D			1			rpm
B4.34	Nominal slip M0	2001/4E			100			Hz
B4.35	No. of pole pairs M0	2001/4F			1			
B4.36	Stator resistor M0	2001/50			see table			mOhm
B4.37	Rotortime constant M0	2001/51			1			ms
B4.38	Fluxing current M0	2001/52			10			A
B4.39	Stray reactance M0	2001/53			100			mH
B4.40	Load default motor	2003/62						

B5	Brake function							
Brake mode								
B5.01	Brake mode	2005/47						
DC-Holdingbrake								
B5.20	DC-holdingbrake	2005/4C						
B5.21	DC-holdingbrake I-start	2005/4D			1	0	100	%
B5.22	DC-holdingbrake t-start	2005/4E			10	0	100	s
B5.23	DC-holdingbrake I-cont.	2005/4F			1	0	100	%
B5.24	DC-holdingbrake t-cont.	2005/50			10	0	100	s

C1	Int. reference							
Preset reference values								
C1.01	Pre-set ref. selection	2005/59						
C1.02	Pre-set reference 1	2005/5A			100	-300	300	% / Hz
C1.03	Pre-set reference 2	2005/5B			100	-300	300	% / Hz
C1.04	Pre-set reference 3	2005/5C			100	-300	300	% / Hz
C1.05	Pre-set reference 4	2005/5D			100	-300	300	% / Hz
C1.06	Pre-set reference 5	2005/5E			100	-300	300	% / Hz
C1.07	Pre-set reference 6	2005/5F			100	-300	300	% / Hz
C1.08	Pre-set reference 7	2005/60			100	-300	300	% / Hz
C1.09	Pre-set reference 8	2005/61			100	-300	300	% / Hz
C1.10	Pre-set reference 9	2005/62			100	-300	300	% / Hz
C1.11	Pre-set reference 10	2005/63			100	-300	300	% / Hz
C1.12	Pre-set reference 11	2005/64			100	-300	300	% / Hz
C1.13	Pre-set reference 12	2006/01			100	-300	300	% / Hz
C1.14	Pre-set reference 13	2006/02			100	-300	300	% / Hz
C1.15	Pre-set reference 14	2006/03			100	-300	300	% / Hz
C1.16	Pre-set reference 15	2006/04			100	-300	300	% / Hz
C1.17	Pre-set reference 16	2006/05			100	-300	300	% / Hz

Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
Motor potentiometer								
C1.18	Motor pot. selection	2006/06						
C1.19	Motor pot. control	2006/07						
C1.20	Motor pot. min. value	2006/08			100	-300	300	% / Hz
C1.21	Motor pot. max. value	2006/09			100	-300	300	% / Hz
C1.22	Motor pot. accel. time	2006/0A			10	0	6500	s
C1.23	Motor pot. decel. time	2006/0B			10	0	6500	s
C1.24	Motor pot. ref. storage	2006/0C						
C1.25	Motor pot. tracking	2006/0D						
Panel reference sources								
C1.29	MX-wheel selection	2006/0E						
C1.30	MX-wheel f min. value	2006/0F			10	0	300	Hz
C1.31	MX-wheel f max. value	2006/10			10	0	300	Hz
C1.34	MX-wheel single step	2006/13			100	0	50	
C1.35	Store MX-wheel ref.	2006/14						
Calculator								
C1.38	Calculator selection	2006/15						
C1.39	Calculator input A	2006/16						
C1.40	Calculator input B	2006/17						
C1.41	Calculator function	2006/18						
C1.42	Reference value	2006/19			100	-300	300	
C1.43	Multiplier	2006/1A			1	1	30000	
C1.44	Divisor	2006/1B			1	1	1000	
C1.45	Calculator min. value	2006/1C			100	-300	300	% / Hz
C1.46	Calculator max. value	2006/1D			100	-300	300	% / Hz
Actual value selection								
C1.49	Actual value usage	2006/1E						
C1.50	Actual value selection	2006/1F						
C1.51	Actual value filter time	2006/20			100	0	20	s
C1.52	Value at 0 Hz/%	2006/21			100	-300	300	% / Hz
C1.53	Value at 100 Hz/%	2006/22			100	-300	300	% / Hz
Reference value switch								
C1.54	Ref. val. switch usage	2006/23						
C1.55	Ref. val. switch selec.	2006/24						
C1.56	Ref. val. switch input A	2006/25						
C1.57	Ref. val. switch input B	2006/26						
Curve generator								
C1.61	Curve generator selec.	2006/28						
C1.63	Ref. value 0	2006/2A			100	-300	300	% / Hz
C1.64	Time - Δt1	2006/2B			100	0	650	s
C1.65	Ref. value 1	2006/2C			100	-300	300	% / Hz
C1.66	Time - Δt2	2006/2D			100	0	650	s
C1.67	Ref. value 2	2006/2E			100	-300	300	% / Hz
C1.68	Time - Δt3	2006/2F			100	0	650	s
C1.69	Ref. value 3	2006/30			100	-300	300	% / Hz
C1.70	Time - Δt4	2006/31			100	0	650	s
C1.71	Ref. value 4	2006/32			100	-300	300	% / Hz
C1.72	Time - Δt5	2006/33			100	0	650	s
C1.73	Ref. value 5	2006/34			100	-300	300	% / Hz
C1.74	Time - Δt6	2006/35			100	0	650	s
C1.75	Ref. value 6	2006/36			100	-300	300	% / Hz
C1.76	Time - Δt7	2006/37			100	0	650	s
XY Graph								
C1.90	XY graph selection	200B/3A						
C1.91	XY graph input selection	200B/3B						

Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
C1.92	No. of value pairs	200B/3C			1	2	6	
C1.93	XY Graph min	200B/3D			100	-300	300	% / Hz
C1.94	XY Graph max	200B/3E			100	-300	300	% / Hz
C1.95	XY Graph - IN 1	200B/3F			100	-300	300	% / Hz
C1.96	XY Graph - OUT 1	200B/40			100	-300	300	% / Hz
C1.97	XY Graph - IN 2	200B/41			100	-300	300	% / Hz
C1.98	XY Graph - OUT 2	200B/42			100	-300	300	% / Hz
C1.99	XY Graph - IN 3	200B/43			100	-300	300	% / Hz
C1.100	XY Graph - OUT 3	200B/44			100	-300	300	% / Hz
C1.101	XY Graph - IN 4	200B/45			100	-300	300	% / Hz
C1.102	XY Graph - OUT 4	200B/46			100	-300	300	% / Hz
C1.103	XY Graph - IN 5	200B/47			100	-300	300	% / Hz
C1.104	XY Graph - OUT 5	200B/48			100	-300	300	% / Hz
C1.105	XY Graph - IN 6	200B/49			100	-300	300	% / Hz
C1.106	XY Graph - OUT 6	200B/4A			100	-300	300	% / Hz
C2	**Ramp / frequency**							
Frequency range								
C2.01	Minimum frequency	2006/38			10	0	300	Hz
C2.02	Maximum frequency	2006/39			10	10	300	Hz
Direction of rotation								
C2.03	Direction enable	2006/3A						
C2.04	Phase rotation	2006/3B						
Acceleration/deceleration ramps								
C2.05	Acceleration ramp 1	2006/3C			10	0	6000	s
C2.06	Deceleration ramp 1	2006/3D			10	0	6000	s
C2.07	Acceleration ramp 2	2006/3E			10	0	6000	s
C2.08	Deceleration ramp 2	2006/3F			10	0	6000	s
C2.09	Switch 1st/2nd accel.	2006/40			10	0	300	Hz
C2.10	Switch 2nd/1st decel.	2006/41			10	0	300	Hz
C2.11	Start ramp	2006/42			10	0	6000	s
C2.12	S-ramp mode	2006/43						
C2.13	S-ramp	2006/44			1	1	100	%
C2.14	Limitation	200B/4B						
C3	**Cascade control**							
Cascade control - activation								
C3.01	Cascade mode	2006/45						
Cascade state								
C3.02	Cascade state	2001/5C	0110					
C3.03	Oper. hours C.Mot1	2001/5D			1			h
C3.04	Oper. hours C.Mot2	2001/5E			1			h
C3.05	Oper. hours C.Mot3	2001/5F			1			h
C3.06	Oper. hours C.Mot4	2001/60			1			h
Basic settings								
C3.09	No. of cascade pumps	2006/46			1	1	4	
C3.10	Manual / auto switch	2006/47						
C3.11	Oper. mode C.Mot1	2006/48						
C3.12	Oper. mode C.Mot2	2006/49						
C3.13	Oper. mode C.Mot3	2006/4A						
C3.14	Oper. mode C.Mot4	2006/4B						
C3.15	Switching mode	2006/4C						

Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
Switching points pressure evaluation								
C3.18	Max. PID-deviation	2006/4D			10	0	100	%
C3.19	Overdrive limit	2006/4E			10	0	100	%
Switching points efficiency-optimized								
C3.22	Frequency C.Mot1 on	2006/4F			10	0	300	Hz
C3.23	Frequency C.Mot1 off	2006/50			10	0	300	Hz
C3.24	Frequency C.Mot2 on	2006/51			10	0	300	Hz
C3.25	Frequency C.Mot2 off	2006/52			10	0	300	Hz
C3.26	Frequency C.Mot3 on	2006/53			10	0	300	Hz
C3.27	Frequency C.Mot3 off	2006/54			10	0	300	Hz
C3.28	Frequency C.Mot4 on	2006/55			10	0	300	Hz
C3.29	Frequency C.Mot4 off	2006/56			10	0	300	Hz
Switching dynamic								
C3.32	Switch on delay	2006/57			10	0	500	s
C3.33	Turn-off delay	2006/58			10	0	500	s
C3.34	Overdrive time	2006/59			10	0	500	s
C3.35	Min. switch-over time	2006/5A			10	0	500	s
Change of motor								
C3.38	Motor change	2006/5B						
C3.39	Change master drive	2006/5C						
C3.40	Time-frame	2006/5D			10	0	1000	h
C3.41	Time master drive	2006/5E			1	0	10000	h
C3.42	C.mot at trip	201B/29						
C4	**PID configuration**							
Monitoring of PID values								
C4.01	PID reference value	2001/61			10			%
C4.02	PID actual value	2001/62			10			%
C4.03	PID deviation	2001/63			1			%
C4.04	PID output	2001/64			100			
Basic setting								
C4.07	Control mode	2006/5F						
C4.08	Control sense	2006/60						
C4.09	Proportional gain	2006/61			1000	0	30	
C4.10	Integration time	2006/62			100	0	600	s
C4.11	Derive time	2006/63			100	0	600	s
C4.12	Max. D-part	2006/64			100	0	300	
C4.13	Output level min.	2007/01			100	-300	300	
C4.14	Output level max.	2007/02			100	-300	300	
C4.15	Limitation	200B/61						
C4.17	Frequency tracking	2007/03						
C4.18	Ref. value acceleration	2007/04			10	0	6000	s
C4.19	Ref. value deceleration	2007/05			10	0	6000	s
Compensation of pressure drop								
C4.22	Pressure drop	2007/06			10	0	300	%
C4.23	Start compensation	2007/07			10	0	300	Hz
C4.24	Compensation dynamic	2007/08			10	0	300	s
Advanced functions								
C4.32	PID-lock	2007/0C						
C4.33	Wind-up behaviour	2007/0D						
C4.34	PID multiplier	2007/0E			1	-1000	1000	
C4.35	PID divisor	2007/0F			1	1	1000	
C4.36	PID offset	2007/10			100	-100	100	
C4.37	Process unit	2007/11	txt					

Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
C6	**Special functions**							
Economy mode								
C6.01	Economy mode	2007/14						
C6.02	Max. fluxing reduction	2007/15			1	25	100	%
C6.03	V/f level	2007/16			1	0	100	%
Motor heating								
C6.05	Motor heating	2007/17						
C6.06	Heating current	2007/18			1	0	50	%
Line contactor control								
C6.07	Line contactor control	2007/19						
Motor contactor control								
C6.08	Motor contactor control	2007/1A						
Standby Mode								
C6.11	Standby mode	2007/1B						
C6.12	Off delay time	2007/1C			10	1	3000	s
C6.13	On delay time	2007/1D			10	1	100	s
C6.14	Max. level	2007/1E			10	0	300	%
C6.15	Min. level	2007/1F			10	0	300	%
Pulse counter								
C6.18	Pulse counter	2007/20						
C6.19	Total counter	2002/01			10			
C6.20	Counter (average)	2002/02			10			
C6.21	Scaling	2007/21			1000	0	65	
C6.22	Time base pulse counter	2007/22			1	0	3600	s
C6.23	Pulse type	2007/23						
C6.24	Symbol pulse counter	2007/24	txt					
C6.25	Pulse counter unit	2007/26	txt					
Correction reference value								
C6.26	f-correction	2007/29						
DC-supply								
C6.65	DC - charging	201B/36						
C6.66	DC - charging time	201B/37			100	0	15	s

D1	**Analog inputs**							
Analog input AI1								
D1.01	AI1 selection	2007/2A						
D1.02	AI1 level	2007/2B						
D1.03	AI1 min. value	2007/2C			100	-300	300	% / Hz
D1.04	AI1 max. value	2007/2D			100	-300	300	% / Hz
D1.05	AI1 filter-time	2007/2E			100	0	30	s
Analog input AI2								
D1.08	AI2 selection	2007/2F						
D1.09	AI2 level	2007/30						
D1.10	AI2 min. value	2007/31			100	-300	300	% / Hz
D1.11	AI2 max. value	2007/32			100	-300	300	% / Hz
D1.12	AI2 filter-time	2007/33			100	0	30	s
Analog input AI3								
D1.15	AI3 selection	2007/34						
D1.16	AI3 level	2007/35						
D1.17	AI3 min. value	2007/36			100	-300	300	% / Hz
D1.18	AI3 max. value	2007/37			100	-300	300	% / Hz
D1.19	AI3 filter-time	2007/38			100	0	30	s
Analog input AI4								
D1.22	AI4 selection	2007/39						

Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
D1.23	AI4 level	2007/3A						
D1.24	AI4 min. value	2007/3B			100	-300	300	% / Hz
D1.25	AI4 max. value	2007/3C			100	-300	300	% / Hz
D1.26	AI4 filter-time	2007/3D			100	0	30	s
Frequency input FP								
D1.29	FP selection	2007/3E						
D1.30	FP min.	2007/3F			100	0	30	kHz
D1.31	FP max.	2007/40			100	0	30	kHz
D1.32	FP min. value	2007/41			100	-300	300	% / Hz
D1.33	FP max. value	2007/42			100	-300	300	% / Hz
D1.34	FP filter-time	2007/43			100	0	30	s
Frequency input LFP								
D1.37	LFP selection	201D/17						
D1.38	LFP min.	201D/18			100	10	60	Hz
D1.39	LFP max	201D/19			100	10	60	Hz
D1.40	LFP min. value	201D/1A			100	-300	300	% / Hz
D1.41	LFP max. value	201D/1B			100	-300	300	% / Hz
D1.42	LFP filter-time	201D/1C			100	0	30	s

D2 Digital inputs

Digital Inputs								
D2.01	DI1 selection	2007/44						
D2.02	DI2 selection	2007/45						
D2.03	DI3 selection	2007/46						
D2.04	DI4 selection	2007/47						
D2.05	DI5 selection	2007/48						
D2.06	DI6 selection	2007/49						
D2.07	DI7 selection	2007/4A						
D2.08	DI8 selection	2007/4B						
D2.09	DI9 selection	2007/4C						
D2.10	DI10 selection	2007/4D						
D2.11	DI11 selection	2007/4E						
D2.12	DI12 selection	2007/4F						
D2.13	DI13 selection	2007/50						
D2.14	DI14 selection	2007/51						
D2.15	DI at bus mode active	2007/52	0110					
D2.18	DI invertation	201B/04	0110					

D3 Analog outputs

Analog output AO1								
D3.01	AO1 selection	2007/53						
D3.02	AO1 level	2007/54						
D3.03	AO1 min. value	2007/55			100	-300	300	% / Hz
D3.04	AO1 max. value	2007/56			100	-300	300	% / Hz
D3.05	AO1 filter-time	2007/57			100	0	30	s
D3.06	AO1 value	2000/41			100			V / mA
Analog output AO2								
D3.08	AO2 selection	2007/58						
D3.09	AO2 level	2007/59						
D3.10	AO2 min. value	2007/5A			100	-300	300	% / Hz
D3.11	AO2 max. value	2007/5B			100	-300	300	% / Hz
D3.12	AO2 filter-time	2007/5C			100	0	30	s
D3.13	AO2 value	2000/42			100			V / mA
Analog output AO3								
D3.15	AO3 selection	2007/5D						

Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
D3.16	AO3 level	2007/5E						
D3.17	AO3 min. value	2007/5F			100	-300	300	% / Hz
D3.18	AO3 max. value	2007/60			100	-300	300	% / Hz
D3.19	AO3 filter-time	2007/61			100	0	30	s
D3.20	AO3 value	2000/43			100			V / mA
Pulse generator								
D3.22	PG selection	201C/53						
D3.23	PG error correction	201C/52						
D3.24	PG const. value MUL	201C/54			1	1	10000	
D3.25	PG const. value DIV	201C/55			1	1	10000	
D3.26	PG output min.	201C/57			1	0	100	Hz
D3.27	PG output max.	201C/58			1	0	100	Hz
D3.28	PG input min.	201C/59			100	-300	300	
D3.29	PG input max.	201C/5A			100	-300	300	

D4 Digital outputs

Digital outputs								
D4.01	R1 selection	2007/62						
D4.02	R2 selection	2007/63						
D4.03	R3 selection	2007/64						
D4.04	DO1 selection	2008/01						
D4.05	DO2 selection	2008/02						
D4.06	R4 selection	2008/03						
D4.07	DO3 selection	2008/04						
D4.08	DO4 selection	2008/05						
D4.11	DO invertation	2008/06	0110					

D6 Fieldbus

Fieldbus configuration								
D6.01	Bus selection	200D/02						
D6.02	Control requested	200D/03						
D6.03	Bus error behaviour	200D/04						
D6.04	Bus error delay time	200D/05			10	0	3200	s
D6.06	Mode tracking	201B/3B						
D6.10	Modbus address	200D/06			1	0	247	
D6.11	Modbus baud rate	200D/07						
D6.12	Modbus format	200D/08						
D6.15	Modbus time-out	200D/09			10	0	300	s
D6.20	CANopen address	200D/14			1	0	127	
D6.21	CANopen baud rate	200D/15						
D6.22	CANopen status	2002/07						
D6.23	CANopen error register	2002/08	0110					
D6.24	CANopen Rx errorcount	2002/05			1			
D6.25	CANopen Tx errorcount	2002/06			1			
D6.30	DP slave address	200D/16			1			
D6.31	DP baud rate	2002/09						
D6.32	Slave state	2002/0A						
D6.33	On after off 1	200D/17						
D6.34	Master settings	2002/0B	0110					
D6.35	DP master address	2002/0C			1			
D6.36	Config buffer 1	2002/0D			1	0	250	hex
D6.37	Config buffer 2	2002/0E			1	0	250	hex
D6.38	Config buffer 3	2002/0F			1	0	250	hex
D6.39	DP diagnostic buffer 1	2002/10			1			hex

Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
D6.40	DP diagnostic buffer 2	2002/11			1			hex
D6.41	Group number	2002/12			1			
D6.42	Global command	2002/13			1			
Fieldbus references								
D6.100	No. of Bus-ref. values	200D/18						
D6.101	Ref. value1 selection	200D/19						
D6.102	Ref. value1 min. value	200D/1A			100	-300	300	% / Hz
D6.103	Ref. value1 max. value	200D/1B			100	-300	300	% / Hz
D6.104	Ref. value1 emergency	200D/1C			1	0	FFFF	hex
D6.105	Ref. value2 selection	200D/1D						
D6.106	Ref. value2 min. value	200D/1E			100	-300	300	% / Hz
D6.107	Ref. value2 max. value	200D/1F			100	-300	300	% / Hz
D6.108	Ref. value2 emergency	200D/20			1	0	FFFF	hex
D6.109	Ref. value3 selection	200D/21						
D6.110	Ref. value3 min. value	200D/22			100	-300	300	% / Hz
D6.111	Ref. value3 max. value	200D/23			100	-300	300	% / Hz
D6.112	Ref. value3 emergency	200D/24			1	0	FFFF	hex
D6.113	Ref. value4 selection	200D/25						
D6.114	Ref. value4 min. value	200D/26			100	-300	300	% / Hz
D6.115	Ref. value4 max. value	200D/27			100	-300	300	% / Hz
D6.116	Ref. value4 emergency	200D/28			1	0	FFFF	hex
D6.117	Ref. value5 selection	200D/29						
D6.118	Ref. value5 min. value	200D/2A			100	-300	300	% / Hz
D6.119	Ref. value5 max. value	200D/2B			100	-300	300	% / Hz
D6.120	Ref. value5 emergency	200D/2C			1	0	FFFF	hex
D6.121	Ref. value6 selection	200D/2D						
D6.122	Ref. value6 min. value	200D/2E			100	-300	300	% / Hz
D6.123	Ref. value6 max. value	200D/2F			100	-300	300	% / Hz
D6.124	Ref. value6 emergency	200D/30			1	0	FFFF	hex
D6.125	Ref. value7 selection	200D/31						
D6.126	Ref. value7 min. value	200D/32			100	-300	300	% / Hz
D6.127	Ref. value7 max. value	200D/33			100	-300	300	% / Hz
D6.128	Ref. value7 emergency	200D/34			1	0	FFFF	hex
D6.129	Ref. value8 selection	200D/35						
D6.130	Ref. value8 min. value	200D/36			100	-300	300	% / Hz
D6.131	Ref. value8 max. value	200D/37			100	-300	300	% / Hz
D6.132	Ref. value8 emergency	200D/38			1	0	FFFF	hex
D6.133	Ref. value9 selection	200D/39						
D6.134	Ref. value9 min. value	200D/3A			100	-300	300	% / Hz
D6.135	Ref. value9 max. value	200D/3B			100	-300	300	% / Hz
D6.136	Ref. value9 emergency	200D/3C			1	0	FFFF	hex
Fieldbus actual values								
D6.137	Number actual values	200D/3D						
D6.138	Act. value1 selection	200D/3E						
D6.139	Act. value1 min. value	200D/3F			100	-300	300	% / Hz
D6.140	Act. value1 max. value	200D/40			100	-300	300	% / Hz
D6.141	Act. value1 filter-time	200D/41			100	0	30	s
D6.142	Act. value2 selection	200D/42						
D6.143	Act. value2 min. value	200D/43			100	-300	300	% / Hz
D6.144	Act. value2 max. value	200D/44			100	-300	300	% / Hz
D6.145	Act. value2 filter-time	200D/45			100	0	30	s
D6.146	Act. value3 selection	200D/46						
D6.147	Act. value3 min. value	200D/47			100	-300	300	% / Hz
D6.148	Act. value3 max. value	200D/48			100	-300	300	% / Hz
D6.149	Act. value3 filter-time	200D/49			100	0	30	s

Parameter name	Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
D6.150 Act. value4 selection	200D/4A						
D6.151 Act. value4 min. value	200D/4B			100	-300	300	% / Hz
D6.152 Act. value4 max. value	200D/4C			100	-300	300	% / Hz
D6.153 Act. value4 filter-time	200D/4D			100	0	30	s
D6.154 Act. value5 selection	200D/4E						
D6.155 Act. value5 min. value	200D/4F			100	-300	300	% / Hz
D6.156 Act. value5 max. value	200D/50			100	-300	300	% / Hz
D6.157 Act. value5 filter-time	200D/51			100	0	30	s
D6.158 Act. value6 selection	200D/52						
D6.159 Act. value6 min. value	200D/53			100	-300	300	% / Hz
D6.160 Act. value6 max. value	200D/54			100	-300	300	% / Hz
D6.161 Act. value6 filter-time	200D/55			100	0	30	s
D6.162 Act. value7 selection	200D/56						
D6.163 Act. value7 min. value	200D/57			100	-300	300	% / Hz
D6.164 Act. value7 max. value	200D/58			100	-300	300	% / Hz
D6.165 Act. value7 filter-time	200D/59			100	0	30	s
D6.166 Act. value8 selection	200D/5A						
D6.167 Act. value8 min. value	200D/5B			100	-300	300	% / Hz
D6.168 Act. value8 max. value	200D/5C			100	-300	300	% / Hz
D6.169 Act. value8 filter-time	200D/5D			100	0	30	s
D6.170 Act. value9 selection	200D/5E						
D6.171 Act. value9 min. value	200D/5F			100	-300	300	% / Hz
D6.172 Act. value9 max. value	200D/60			100	-300	300	% / Hz
D6.173 Act. value9 filter-time	200D/61			100	0	30	s
Assignment free bits STW							
D6.174 Bit 11 STW1 selection	200D/62						
D6.175 Bit 12 STW1 selection	200D/63						
D6.176 Bit 13 STW1 selection	200D/64						
D6.177 Bit 14 STW1 selection	200E/01						
D6.178 Bit 15 STW1 selection	200E/02						
D6.179 STW1 at term.-mode act	200E/03	0110					
Assignment free bits ZTW							
D6.197 Bit 11 ZTW1 selection	200E/15						
D6.198 Bit 12 ZTW1 selection	200E/16						
D6.199 Bit 13 ZTW1 selection	200E/17						
D6.200 Bit 14 ZTW1 selection	200E/18						
D6.201 Bit 15 ZTW1 selection	200E/19						
Diagnosis STW (BUS -> VSD)							
D6.218 Bus STW hex	2002/14			1			hex
D6.219 Bus STW bin	2002/15	0110					
Diagnosis ZTW (VSD -> BUS)							
D6.222 Bus ZTW hex	2002/18			1			hex
D6.223 Bus ZTW bin	2002/19	0110					
Diagnosis of the operating state							
D6.226 Internal control word	2002/1C			1			hex
D6.227 Internal state	2002/1D	0110					
Diagnosis BUS -> VSD							
D6.228 PRx 01	2002/1F			1			hex
D6.229 PRx 02	2002/20			1			hex
D6.230 PRx 03	2002/21			1			hex
D6.231 PRx 04	2002/22			1			hex
D6.232 PRx 05	2002/23			1			hex
D6.233 PRx 06	2002/24			1			hex
D6.234 PRx 07	2002/25			1			hex
D6.235 PRx 08	2002/26			1			hex

Parameter name	Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
D6.236 PRx 09	2002/27			1			hex
D6.237 PRx 10	2002/28			1			hex
Diagnosis VSD -> BUS							
D6.242 PTx 01	2002/33			1			hex
D6.243 PTx 02	2002/34			1			hex
D6.244 PTx 03	2002/35			1			hex
D6.245 PTx 04	2002/36			1			hex
D6.246 PTx 05	2002/37			1			hex
D6.247 PTx 06	2002/38			1			hex
D6.248 PTx 07	2002/39			1			hex
D6.249 PTx 08	2002/3A			1			hex
D6.250 PTx 09	2002/3B			1			hex
D6.251 PTx 10	2002/3C			1			hex
Modbus Master							
D6.260 Master activation	2017/01						
D6.261 Master TaskIndex	2017/02			1	0	15	
D6.262 Master TaskState	2017/03			1	0	0	hex
D6.263 Master TaskSlaveAdr.	2017/04			1	0	247	
D6.264 Master ZTW Bit 11	2017/14						
D6.265 Master ZTW Bit 12	2017/15						
D6.266 Master ZTW Bit 13	2017/16						
D6.267 Master ZTW Bit 14	2017/17						
D6.268 Master ZTW Bit 15	2017/18						
D6.269 Master act. 1 selection	2017/05						
D6.270 Master act. 1 min	2017/06			100	-300	300	
D6.271 Master act. 1 max	2017/07			100	-300	300	
D6.272 Master act. 1 filtertime	2017/08			100	0	30	s
D6.273 Master act. 2 selection	2017/09						
D6.274 Master act. 2 min	2017/0A			100	-300	300	
D6.275 Master act. 2 max	2017/0B			100	-300	300	
D6.276 Master act. 2 filtertime	2017/0C			100	0	30	s
D6.277 Master act. 3 selection	2017/0D						
D6.278 Master act. 3 min	2017/0E			100	-300	300	
D6.279 Master act. 3 max	2017/0F			100	-300	300	
D6.280 Master act. 3 filtertime	2017/10			100	0	30	s
D6.281 Master STW mask	2017/19			1	0	FFFF	hex
D6.282 Master ref. 1 selection	2017/11						
D6.283 Master ref. 2 selection	2017/12						
D6.284 Master ref. 3 selection	2017/13						

E1 Process protection

Limitations							
E1.01 I max 1	2008/07			1	10	165	%
E1.03 Inverter temp. model	200C/23						
E1.05 T limit motor	2008/09			1	10	300	%
E1.13 P max. motor	2008/0F			1	10	300	%
Behaviour at limitations							
E1.17 Reaction at limitation	2008/11						
E1.18 Time Δt	2008/12			100	0	300	s
E1.19 Ref. after acc. extension	2008/13						
E1.21 Reaction at deceleration	2008/14						
E1.22 Time Δt	2008/15			100	0	300	s
E1.23 Ref. after dec. extension	2008/16						

Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	max	Unit
Skip frequencies								
E1.25	Skip frequency 1	2008/17			10	-300	300	Hz
E1.26	Hysteresis 1	2008/18			100	0	10	Hz
E1.27	Skip frequency 2	2008/19			10	-300	300	Hz
E1.28	Hysteresis 2	2008/1A			100	0	10	Hz
E1.29	Skip frequency 3	2008/1B			10	-300	300	Hz
E1.30	Hysteresis 3	2008/1C			100	0	10	Hz
E1.31	Skip frequency 4	2008/1D			10	-300	300	Hz
E1.32	Hysteresis 4	2008/1E			100	0	10	Hz
Speed monitoring								
E1.38	n-monitoring	2008/1F						
E1.39	Pulse / rotation	2008/20			1	0	100	
E1.40	Filter-time	2008/21			10	0	300	s
E1.41	Detected speed	2002/47			10			rpm
E1.42	Ratio factor	2008/22			100	0	10	
E1.43	Calculated slip	2002/48			10			rpm
E1.44	Tolerance	2008/23			10	0	500	rpm
E1.45	n-monitoring response	2008/24						
E1.46	Time Δt	2008/25			10	0	300	s
Feed-in monitoring								
E1.49	Feed-in monitoring	2008/26						
E1.50	Feed in mon. reaction	2008/27						
E1.51	Time Δt	2008/28			10	0	300	s

E2 Motor protection

Thermistor control								
E2.01	TH1 motor allocation	2008/29						
E2.02	TH1 activation	2008/2A						
E2.03	TH1 response	2008/2B						
E2.04	TH1 Time Δt	2008/2C			1	0	300	s
E2.05	TH1 verification	2008/2D						
E2.06	TH2 motor allocation	2008/2E						
E2.07	TH2 activation	2008/2F						
E2.08	TH2 response	2008/30						
E2.09	TH2 Time Δt	2008/31			1	0	300	s
E2.10	TH2 verification	2008/32						
E2.11	TH3 motor allocation	2008/33						
E2.12	TH3 activation	2008/34						
E2.13	TH3 response	2008/35						
E2.14	TH3 Time Δt	2008/36			1	0	300	s
E2.15	TH3 verification	2008/37						
Thermal mathematical motor model								
E2.18	M1 - overl. monitoring	2008/38						
E2.19	M1 - response	2008/39						
E2.20	M1 - Imax at 0Hz	2008/3A			1	0	300	%
E2.21	M1 - Imax at f nom.	2008/3B			1	0	150	%
E2.22	M1 - therm. f-limitation	2008/3C			10	0	300	Hz
E2.23	M1 - motor-time	2008/3D			1	0	500	min
E2.24	M1 - cooling temp.	2008/3E			1	-10	80	°C
E2.25	M1 - alarm level	2008/3F			1	0	300	%
E2.26	M1 - trigger level	2008/40			1	0	300	%
E2.27	Thermal load M1	2002/49			1			%
E2.30	M2 - overl. monitoring	2008/41						
E2.31	M2 - response	2008/42						
E2.32	M2 - Imax at 0Hz	2008/43			1	0	300	%

Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
E2.33	M2 - Imax at f nom.	2008/44			1	0	150	%
E2.34	M2 - therm. f-limitation	2008/45			10	0	300	Hz
E2.35	M2 - motor-time	2008/46			1	0	500	min
E2.36	M2 - cooling temp.	2008/47			1	-10	80	°C
E2.37	M2 - alarm level	2008/48			1	0	300	%
E2.38	M2 - trigger level	2008/49			1	0	300	%
E2.39	Thermal load M2	2002/4A			1			%
Stall protection								
E2.42	Stall protection	2008/4A						
E2.43	Stalling time	2008/4B			10	0	200	s
E2.44	Stalling frequency	2008/4C			10	0	20	Hz
E2.45	Stalling current	2008/4D			1	0	150	%
Overspeed protection								
E2.48	Overspeed monitoring	2008/4E						
E2.49	Overspeed response	2008/4F						
E2.50	Overspeed level	2008/50			1	0	20000	rpm
E2.51	Time Δt	2008/51			10	0	300	s
Loss of motor phase								
E2.54	Motor phase monitor	2008/52						
Underload protection								
E2.61	Underload monitor	2008/53						
E2.62	Underload response	2008/54						
E2.63	Underload level n²	2008/55			1	0	100	%
E2.64	Underload level ½ fn	2008/56			1	0	100	%
E2.65	Underload level fn	2008/57			1	0	100	%
E2.66	Underload start time	2008/58			10	0	300	s
E2.67	Time Δt	2008/59			10	0	300	s
E2.68	Filter-time	2008/5A			10	0	300	s

E3 Fault configuration

Behaviour in case of faults								
E3.01	Reaction at a trip	2008/5B						
E3.03	Auto reset	2008/5C						
E3.04	Autoreset selection	2008/5D	0110					
E3.05	Autoreset selection 2	201C/20	0110					
E3.06	Auto reset trials	2008/5E			1	1	20	
E3.07	Period	2002/4C			1	60	600	s
Emergency operation								
E3.09	Enable emergency op.	2008/5F						
E3.10	Emergency op. active	2002/4D						
Loss of reference value								
E3.13	AI2 - 4mA monitor	2008/60						
E3.14	AI2 - 4mA response	2008/61						
E3.15	AI2 - emergency val.	2008/62			10	4	20	mA
E3.16	AI3 - 4mA monitor	2008/63						
E3.17	AI3 - 4mA response	2008/64						
E3.18	AI3- emergency val.	2009/01			10	4	20	mA
E3.19	AI4 - 4mA monitor	2009/02						
E3.20	AI4 - 4mA response	2009/03						
E3.21	AI4 - emergency val.	2009/04			10	4	20	mA
E3.22	FP - f monitoring	2009/05						
E3.23	FP - monitoring resp.	2009/06						
E3.24	FP - emergency val.	2009/07			100	0	30	kHz
Loss of line phase								
E3.27	Mains phase monitoring	2009/08						

Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
Behaviour at undervoltage								
E3.29	V< response	2009/09						
E3.30	Allowed V< time	2009/0A			10	0	300	s
E3.31	Max. V< time	2009/0B			10	0	3000	s
External fault								
E3.34	Ext. fault 1 monitor	2009/0C						
E3.35	Ext. fault 1 response	2009/0D						
E3.36	Start delay time	2009/0E			10	0	600	s
E3.37	Time Δt	2009/0F			10	0	300	s
E3.38	Ext. fault 1 name	2009/10	txt					
	Ensuing parameter	2009/11	txt					
	Ensuing parameter	2009/12	txt					
	Ensuing parameter	2009/13	txt					
	Ensuing parameter	2009/14	txt					
	Ensuing parameter	2009/15	txt					
	Ensuing parameter	2009/16	txt					
	Ensuing parameter	2009/17	txt					
E3.41	Ext. fault 2 monitor	2009/18						
E3.42	Ext. fault 2 response	2009/19						
E3.43	Start delay time	2009/1A			10	0	600	s
E3.44	Time Δt	2009/1B			10	0	300	s
E3.45	Ext. fault 2 name	2009/1C	txt					
	Ensuing parameter	2009/1D	txt					
	Ensuing parameter	2009/1E	txt					
	Ensuing parameter	2009/1F	txt					
	Ensuing parameter	2009/20	txt					
	Ensuing parameter	2009/21	txt					
	Ensuing parameter	2009/22	txt					
	Ensuing parameter	2009/23	txt					
ON lock								
E3.48	ON lock activation	2009/24						
E3.49	ON lock response	2009/25						
E3.50	Time Δt	2009/26			10	0	300	s
Alarm categories								
E3.51	Alarm category 1	2009/27	0110					
E3.52	Alarm category 1.2	2009/28	0110					
E3.54	Alarm category 2	2009/29	0110					
E3.55	Alarm category 2.2	2009/2A	0110					
E3.57	Alarm category 3	2009/2B	0110					
E3.58	Alarm category 3.2	2009/2C	0110					
Loss of reference value								
E3.60	LFP - f monitoring	201C/60						
E3.61	LFP - monitoring resp.	201C/61						
E3.62	LFP - emergency val.	201C/62			100	0	30	Hz
Process fault								
E3.65	Process fault 1 monitor	201C/0D						
E3.66	Process fault 1 response	201C/0E						
E3.67	Start delay time	201C/0F			10	0	600	s
E3.68	Time Δt	201C/10			10	0	300	s
E3.69	Process fault 1 name	200E/33	txt					
E3.72	Process fault 2 monitor	201C/14						
E3.73	Process fault 2 response	201C/15						
E3.74	Start delay time	201C/16			10	0	600	s
E3.75	Time Δt	201C/17			10	0	300	s
E3.76	Process fault 2 name	200E/3D	txt					
E3.79	Process fault 3 monitor	201C/1B						

Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
E3.80	Process fault 3 response	201C/1C						
E3.81	Start delay time	201C/1D			10	0	600	s
E3.82	Time Δt	201C/1E			10	0	300	s
E3.83	Process fault 3 name	200E/47	txt					
E4	**Control configuration**							
Control logic								
E4.01	Control source 1	2009/2D						
E4.02	Control source 2	2009/2E						
E4.03	3-wire-control	2009/2F						
E5	**Keypad**							
Panel operation								
E5.01	Local mode	2009/30						
E5.02	Local reset	2009/31						
E5.03	Keypad stop button	2009/32						
Parametertransfer with keypad								
E5.04	Copy: MX -> Keypad	2012/06						
E5.05	Copy: Keypad -> MX	2012/07						
BE11 monitoring								
E5.12	BE11 monitoring	201D/3F						
E5.13	BE11 monitor. response	201D/40						
E5.14	Time Δt	201D/41			10	0	3200	s
E6	**Function blocks**							
Comparator C1 - C4								
E6.01	Comparator C1	2009/33						
E6.02	C1 signal A selection	2009/34						
E6.03	C1 signal A filter-time	2009/35			100	0	300	s
E6.04	C1 signal B selection	2009/36						
E6.05	C1 ref. value	2009/37			100	-300	300	
E6.06	C1 signal B filter-time	2009/38			100	0	300	s
E6.07	C1 function	2009/39						
E6.08	C1 hysteresis/band	2009/3A			100	0	650	
E6.09	C1 output	2002/4E						
E6.10	Comparator C2	2009/3B						
E6.11	C2 signal A selection	2009/3C						
E6.12	C2 signal A filter-time	2009/3D			100	0	300	s
E6.13	C2 signal B selection	2009/3E						
E6.14	C2 ref. value	2009/3F			100	-300	300	
E6.15	C2 signal B filter-time	2009/40			100	0	300	s
E6.16	C2 function	2009/41						
E6.17	C2 hysteresis/band	2009/42			100	0	650	
E6.18	C2 output	2002/4F						
E6.19	Comparator C3	2009/43						
E6.20	C3 signal A selection	2009/44						
E6.21	C3 signal A filter-time	2009/45			100	0	300	s
E6.22	C3 signal B selection	2009/46						
E6.23	C3 ref. value	2009/47			100	-300	300	
E6.24	C3 signal B filter-time	2009/48			100	0	300	s
E6.25	C3 function	2009/49						
E6.26	C3 hysteresis/band	2009/4A			100	0	650	
E6.27	C3 output	2002/50						
E6.28	Comparator C4	2009/4B						

Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
E6.29	C4 signal A selection	2009/4C						
E6.30	C4 signal A filter-time	2009/4D			100	0	300	s
E6.31	C4 signal B selection	2009/4E						
E6.32	C4 ref. value	2009/4F			100	-300	300	
E6.33	C4 signal B filter-time	2009/50			100	0	300	s
E6.34	C4 function	2009/51						
E6.35	C4 hysteresis/band	2009/52			100	0	650	
E6.36	C4 output	2002/51						
Logic module L1 - L6								
E6.46	Logic 1	2009/53						
E6.47	LM1 signal A selection	2009/54						
E6.48	LM1 signal B selection	2009/55						
E6.49	LM1 signal C selection	2009/56						
E6.50	LM1 function	2009/57						
E6.51	LM1 output reverse	2009/58						
E6.52	LM1 output	2002/52						
E6.53	Logic 2	2009/59						
E6.54	LM2 signal A selection	2009/5A						
E6.55	LM2 signal B selection	2009/5B						
E6.56	LM2 signal C selection	2009/5C						
E6.57	LM2 function	2009/5D						
E6.58	LM2 output reverse	2009/5E						
E6.59	LM2 output	2002/53						
E6.60	Logic 3	2009/5F						
E6.61	LM3 signal A selection	2009/60						
E6.62	LM3 signal B selection	2009/61						
E6.63	LM3 signal C selection	2009/62						
E6.64	LM3 function	2009/63						
E6.65	LM3 output reverse	2009/64						
E6.66	LM3 output	2002/54						
E6.67	Logic 4	200A/01						
E6.68	LM4 signal A selection	200A/02						
E6.69	LM4 signal B selection	200A/03						
E6.70	LM4 signal C selection	200A/04						
E6.71	LM4 function	200A/05						
E6.72	LM4 output reverse	200A/06						
E6.73	LM4 output	2002/55						
E6.74	Logic 5	200A/07						
E6.75	LM5 signal A selection	200A/08						
E6.76	LM5 signal B selection	200A/09						
E6.77	LM5 signal C selection	200A/0A						
E6.78	LM5 function	200A/0B						
E6.79	LM5 output reverse	200A/0C						
E6.80	LM5 output	2002/56						
E6.81	Logic 6	200A/0D						
E6.82	LM6 signal A selection	200A/0E						
E6.83	LM6 signal B selection	200A/0F						
E6.84	LM6 signal C selection	200A/10						
E6.85	LM6 function	200A/11						
E6.86	LM6 output reverse	200A/12						
E6.87	LM6 output	2002/57						
Flip Flop								
E6.94	SR module 1	200A/13						
E6.95	SR1 signal S selection	200A/14						
E6.96	SR1 signal R selection	200A/15						

Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
E6.97	SR1 function	200A/16						
E6.98	SR1 output	2002/58						
E6.99	SR module 2	200A/17						
E6.100	SR2 signal S selection	200A/18						
E6.101	SR2 signal R selection	200A/19						
E6.102	SR2 function	200A/1A						
E6.103	SR2 output	2002/59						
Time device								
E6.109	Time module 1	200A/1B						
E6.110	T1 signal A selection	200A/1C						
E6.111	T1 function	200A/1D						
E6.112	T1 Time Δt	200A/1E			10	0	6500	s
E6.113	T1 output	2002/5A						
E6.114	T1 selection	200A/1F						
E6.115	Time module 2	200A/20						
E6.116	T2 signal A selection	200A/21						
E6.117	T2 function	200A/22						
E6.118	T2 Time Δt	200A/23			10	0	6500	s
E6.119	T2 output	2002/5B						
E6.120	T2 selection	200A/24						
E6.121	Time module 3	200A/25						
E6.122	T3 signal A selection	200A/26						
E6.123	T3 function	200A/27						
E6.124	T3 Time Δt	200A/28			10	0	6500	s
E6.125	T3 output	2002/5C						
E6.126	T3 selection	200A/29						
E6.127	Time module 4	200A/2A						
E6.128	T4 signal A selection	200A/2B						
E6.129	T4 function	200A/2C						
E6.130	T4 Time Δt	200A/2D			10	0	6500	s
E6.131	T4 output	2002/5D						
E6.132	T4 selection	200A/2E						
E6.133	Time module 5	200A/2F						
E6.134	T5 signal A selection	200A/30						
E6.135	T5 function	200A/31						
E6.136	T5 Time Δt	200A/32			10	0	6500	s
E6.137	T5 output	2002/5E						
E6.138	T5 selection	200A/33						
E6.139	Time module 6	200A/34						
E6.140	T6 signal A selection	200A/35						
E6.141	T6 function	200A/36						
E6.142	T6 Time Δt	200A/37			10	0	6500	s
E6.143	T6 output	2002/5F						
E6.144	T6 selection	200A/38						
Alarm logic module								
E6.151	Alarm Logic module	201B/0B						
E6.152	Alarm 1 AND	201B/0C						
E6.153	Alarm 2 AND	201B/0D						
E6.154	Alarm 3 AND	201B/0E						
E6.155	Alarm 4 OR	201B/0F						
E6.156	Alarm 5 OR	201B/10						
E6.157	Alarm 6 OR	201B/11						
E6.160	Output alarm module	201B/12						

Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
Trip logic module								
E6.161	Trip logic module	201B/15						
E6.162	Trip 1 AND	201B/16						
E6.163	Trip 2 AND	201B/17						
E6.164	Trip 3 OR	201B/18						
E6.165	Trip 4 OR	201B/19						
E6.166	Trip 5 OR	201B/1A						
E6.167	Trip 6 OR	201B/1B						
E6.170	Output trip logic module	201B/1C						
F1	**Info**							
Identification of the device								
F1.01	Inverter type	2000/0C	txt					
	Ensuing parameter	2000/0D	txt					
	Ensuing parameter	2000/0E	txt					
	Ensuing parameter	2000/0F	txt					
	Ensuing parameter	2000/10	txt					
	Ensuing parameter	2000/11	txt					
	Ensuing parameter	2000/12	txt					
	Ensuing parameter	2000/13	txt					
F1.02	Nominal power	2017/2A			1			W
F1.03	Nominal current	2002/61			10			A
F1.04	Nominal voltage	2002/62						
F1.05	Drive serial number	2000/14			1			
F1.06	Facility description	2000/18	txt					
	Ensuing parameter	2000/19	txt					
	Ensuing parameter	2000/1A	txt					
	Ensuing parameter	2000/1B	txt					
	Ensuing parameter	2000/1C	txt					
	Ensuing parameter	2000/1D	txt					
	Ensuing parameter	2000/1E	txt					
	Ensuing parameter	2000/1F	txt					
F1.07	APP software	2000/20	txt					
	Ensuing parameter	2000/21	txt					
	Ensuing parameter	2000/22	txt					
	Ensuing parameter	2000/23	txt					
	Ensuing parameter	2000/24	txt					
	Ensuing parameter	2000/25	txt					
	Ensuing parameter	2000/26	txt					
	Ensuing parameter	2000/27	txt					
F1.08	Service notice	2013/5E	txt					
	Ensuing parameter	2013/5F	txt					
	Ensuing parameter	2013/60	txt					
	Ensuing parameter	2013/61	txt					
	Ensuing parameter	2013/62	txt					
	Ensuing parameter	2013/63	txt					
	Ensuing parameter	2013/64	txt					
	Ensuing parameter	2014/01	txt					
	Ensuing parameter	2014/02	txt					
	Ensuing parameter	2014/03	txt					
	Ensuing parameter	2014/04	txt					
	Ensuing parameter	2014/05	txt					
F2	**Test routines**							
Force operation								
F2.01	Force operation	2012/08						

Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
F2.02	Force DI1	200A/39						
F2.03	Force DI2	200A/3A						
F2.04	Force DI3	200A/3B						
F2.05	Force DI4	200A/3C						
F2.06	Force DI5	200A/3D						
F2.07	Force DI6	200A/3E						
F2.08	Force DI7	200A/3F						
F2.09	Force DI8	200A/40						
F2.10	Force DI9	200A/41						
F2.11	Force DI10	200A/42						
F2.12	Force DI11	200A/43						
F2.13	Force DI12	200A/44						
F2.14	Force DI13	200A/45						
F2.15	Force DI14	200A/46						
F2.16	Force R1	200A/47						
F2.17	Force R2	200A/48						
F2.18	Force R3	200A/49						
F2.19	Force DO1	200A/4A						
F2.20	Force DO2	200A/4B						
F2.21	Force R4	200A/4C						
F2.22	Force DO3	200A/4D						
F2.23	Force DO4	200A/4E						
F2.24	Force AI1	200A/4F						
F2.25	Force value AI1	200A/50			100	-10	10	V
F2.26	Force AI2	200A/51						
F2.27	Force value AI2	200A/52			100	0	20	V / mA
F2.28	Force AI3	200A/53						
F2.29	Force value AI3	200A/54			100	0	20	mA
F2.30	Force AI4	200A/55						
F2.31	Force value AI4	200A/56			100	0	20	V / mA
F2.32	Force FP	200A/57						
F2.33	Force value FP	200A/58			100	0	30	kHz
F2.34	Force AO1	200A/59						
F2.35	Force value AO1	200A/5A			100	0	20	V / mA
F2.36	Force AO2	200A/5B						
F2.37	Force value AO2	200A/5C			100	-20	20	V / mA
F2.38	Force AO3	200A/5D						
F2.39	Force value AO3	200A/5E			100	-20	20	V / mA
Test routines								
F2.40	Start IGBT test	2012/09						
F2.41	Test charging circuit	2012/0A						
F2.45	Simulation mode	200A/5F						
F2.46	Software reset	200A/60						
F2.49	Test mode	2017/1F						
Force operation								
F2.52	Force FP	201C/5E						
F2.53	Force value LFP	201C/5F			100	0	60	Hz

F3 Fault memory

Fault memory								
F3.01	Number of faults	2002/63			1			
F3.02	Review	200A/61						
F3.03	Fault number	2002/64			1			
F3.04	Fault cause	2003/01						
F3.05	Operating hours	2003/02			1			h

Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
F3.06	Min / sec	2003/03			100			m:s
F3.07	Reference value [Hz]	2003/04			10			Hz
F3.08	Actual value [Hz]	2003/05			10			Hz
F3.09	Output current	2003/06			see table			A
F3.10	DC voltage	2003/07			1			V
F3.11	Thermal load VSD	2003/08			1			%
F3.12	Control mode	2003/09						
F3.13	Operating status	2003/0A						
F3.14	Alarm message	2003/0B						
F3.15	Drive state	2003/0D						
F3.16	Bus STW	2003/0C	0110					
F3.17	Bus ZTW	2003/0E	0110					
F4	**Diagnosis**							
Data-Logger								
F4.01	Data logger channel 1	200A/62						
F4.02	Data logger channel 2	200A/63						
F4.03	Data logger channel 3	200A/64						
F4.04	Time base	200B/01			1	0	1500	min
F4.05	Rating channel 1	200B/02						
F4.06	Rating channel 2	200B/03						
F4.07	Rating channel 3	200B/04						
State digital inputs								
F4.10	DI state basic device	2003/0F	0110					
F4.11	DI state IO11	2003/10	0110					
F4.12	DI state IO12	2003/11	0110					
State digital outputs								
F4.13	DO state basic device	2003/12	0110					
F4.14	DO state IO11	2003/13	0110					
F4.15	DO state IO12	2003/14	0110					
Analog checkpoints								
F4.16	f-reference 1 [Hz]	2003/15			10			Hz
F4.17	f-reference 2 [Hz]	2003/16			10			Hz
F4.18	f-reference after sel.	2003/17			10			Hz
F4.19	f-ref. after FW/REV	2003/18			10			Hz
F4.20	f-correction	2003/19			10			Hz
F4.21	f-ref. before ramp	2003/1A			10			Hz
F4.22	f-ref. after ramp	2003/1B			10			Hz
F4.23	f-ref. after PID act.	2003/1C			10			Hz
F4.24	f-ref. after loc/rem	2003/1D			10			Hz
F4.25	f-ref. after f-corr.	2003/1E			10			Hz
F4.26	PID reference value	2003/1F			10			%
F4.27	PID actual value	2003/20			10			%
F4.28	PID deviation	2003/21			1			%
F4.29	PID-output	2003/22			100			
F4.38	I limit	2003/2B			10			A
Power part								
F4.44	DC voltage	2003/2D			1			V
F4.45	IGBT overload time	2001/18			1	0	65535	s
F4.46	Thermal load VSD	2003/2E			1			%
F4.47	Thermal load M1	2003/2F			1			%
F4.48	Thermal load M2	2003/30			1			%
F4.50	Fan status	2003/32						

Parameter name		Index / Subindex	Type	Adjust-ability	Factor	Setting range min	Setting range max	Unit
State option cards								
F4.56	Option 1 type	2003/33						
F4.57	Option 2 type	2003/34						
F4.60	Status APP	2003/37						
F4.61	Status MC	2003/38						
F4.62	Status LCD-keypad	2003/39						
Reference value linkage								
F4.65	Source f-reference 1	2003/64						
F4.66	Source f-reference 2	2004/01						
F4.67	Source f-correction	2004/02						
F4.68	Source PID-reference	2004/03						
F4.69	Source PID-actual	2004/04						
F4.70	Source T-reference	2004/05						
F4.71	Source T-limit	2004/06						
Analog checkpoints								
F4.72	f-ref before MC	201D/4E			10			Hz
Reference value linkage								
F4.78	Source STW1	201C/26						
F6	**Code**							
Security settings								
F6.01	Code	200B/2D			1	0	9999	
F6.02	Code value	200B/2E			1	0	9999	
F6.03	Parametrising station	200B/2F						
F6.04	Impulse inhibit	200B/30						
F6.05	Service code	200B/31			1	0	59999	
System parameters								
	Store parameter values	2000/29						

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.
External fault 1 (or free editable text E3.38)	03	An external fault is signalized via a digital input command (see E3.34 to E3.38). It is processed as an alarm message corresponding to the setting of E3.35 Ext. fault 1 response.
External fault 2 (or free editable text E3.45)	04	An external fault is signalized via a digital input command (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 2 mA. This leads to an alarm message corresponding to the setting of E3.13 AI2 - 4mA monitor and E3.14 AI2 - 4mA response. If the reference value exceeds 2.5 mA again, the alarm message will be reset.
Reference fault AI3	07	At the analog input AI3 the reference value fell below 2 mA. This leads to an alarm message corresponding to the setting of E3.16 AI3 - 4mA monitor and E3.17 AI3 - 4mA response. If the reference value exceeds 2.5 mA again, the alarm message will be reset.
Reference fault AI4	08	At the analog input AI4 the reference value fell below 2 mA. This leads to an alarm message corresponding to the setting of E3.19 AI4 - 4mA monitor and E3.20 AI4 - 4mA response. If the reference value exceeds 2.5 mA again, the alarm message will be reset.
Bus fault	09	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.

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Matrix operating panel	Alarm index (dec.)	Description
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.
TH - ϑ M1 >	18	At least one of the thermistors (PTC) or thermal switches assigned to motor M1 (see motor assignment E2.01, E2.06, E2.11) has detected an overtemperature. An alarm message is as a result activated corresponding to the reaction setting for the respective thermistor.
TH - ϑ M2 >	19	At least one of the thermistors (PTC) or thermal switches assigned to motor M2 (see motor assignment E2.01, E2.06, E2.11) has detected an overtemperature. An alarm message is as a result activated corresponding to the reaction setting for the respective thermistor.
TH ϑ Ext >	20	At least one of the thermistors (PTC) or thermal switches, which are planned for the general use (see assignment E2.01, E2.06, E2.11) 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.
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 (A5.07) for the power part of the device (device is supplied with mains voltage) has exceeded the set time interval (A5.08).
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. After transmission it is necessary to confirm the parameterization on the LED keypad with shortcut "Digit + (or shortcut "Digit + ↓" to deny parameterization) in order to return to the regular operating state. Alternatively confirmation is possibly by means of the service code F6.05 = 33. (When using the matrix operating panel BE11 the function keys F1/F3 are provided for confirmation.)
E6 incomplete	30	*Parameterization alarm* One or several function modules in parameter group E6 are parameterized incompletely or faulty.
XY Graph set faulty	31	*Parameterization alarm* The reference source XY graph is parameterized incompletely or faulty.
Change control mode !	32	*Parameterization alarm* The selected function cannot be combined with the actual control mode.

Matrix operating panel	Alarm index (dec.)	Description
Param.set 1 fault	36	Faulty Eprom-zone for parameter set 1
Param.set 2 fault	37	Faulty Eprom-zone for parameter set 2
IGBT ϑ >	38	IGBT overtemperature, determined by the thermal mathematical inverter model
V/f 7 point set faulty	40	*Parameterization alarm* Incomplete or faulty parameterization of the V/f characteristic.
BE11 loss	45	The connection between matrix operating panel BE11 and inverter is cut off during active panel operation and a loss of BE11 control is detected (see parameter E5.12).
Control requ. missing	46	Control bit (b10) of the bus control word is low.
Parameter set 1	47	Displays the active parameter set when switch-over of parameter sets is selected (see parameter B2.03).
Parameter set 2	48	Displays the active parameter set when switch-over of parameter sets is selected (see parameter B2.03).
Test mode active	49	The drive operates in test mode (see parameter F2.49).
I-limit active	51	The actual motor current is higher than the actual allowed operating current. Current-limiting protective mechanisms are I_{max1} (E1.01), the thermal motor model (E2.18...E2.39) and the thermal mathematical inverter model (E1.03).
T-limitation active	52	The actual motor torque is higher than an effective limitation value. Torque-limiting protective mechanism are the internal torque limitation (E1.05) and the power limitation (E1.13).
Process fault 1	53	A process fault is signalized via a digital input command (see E3.65...E3.69). It is processed as an alarm message corresponding to the setting of E3.66 Process fault 1 response.
Process fault 2	54	A process fault is signalized via a digital input command (see E3.72...E3.76). It is processed as an alarm message corresponding to the setting of E3.73 Process fault 2 response.
Process fault 3	55	A process fault is signalized via a digital input command (see E3.79...E3.83). It is processed as an alarm message corresponding to the setting of E3.80 Process fault 3 response.
Motorparam. wrong	57	There is a fault at the motor data entered in parameter group B4.
SW2 position faulty	58	Sliding switch SW2 (PTC/LI) is in the wrong position (in limitation to E2.01)

These alarm/info messages can be read out under index 2000, subindex 2C.

Matrix operating panel	Fault code		Description
	EMCY (hex)	Index 2000/49 (dec.)	
No fault	0000	00	
Undervoltage	3120	01	There is an undervoltage situation. See parameter E3.29 V< response.
V>> at deceleration	3310	02	The DC link voltage has exceeded the hardware protection level of 825 V due to a deceleration. Extend deceleration ramps or activate motor brake B5.01 Brake mode.
Line overvoltage	3110	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 !
MC not ready	3230	04	The motor control is not ready after the charging process.
DC missing	3200	05	The frequency inverter is operated at the intelligent rectifier >*pDRIVE< LX*. The DC link voltage, made available by this rectifier, has shut down.
Precharging fault	FF01	06	Fault of the soft charge device (half controlled thyristor bridge). Only for devices larger than >*pDRIVE< MX eco* 4V18.
Line fault 1p	3130	08	Loss of one mains phase
Line fault 2-3p	3130	09	Loss of two or three mains phases
Overcurrent	2320	10	Overcurrent at the output
Motor earth fault	2320	11	Earth fault at the output Registration by means of the software (only with devices up to and including >*pDRIVE< MX eco* 4V75)
Insulation fault	2330	12	The differential current determined from the three motor phases is larger than 25 % of the nominal current of the inverter.
Overcurrent	2310	13	Overcurrent at the output Registration by means of the software (only with devices up to and including >*pDRIVE< MX eco* 4V75)
IGBT ϑ >>	4210	14	IGBT overtemperature, determined by the thermal mathematical inverter model
Motor phase fault 3p	3310	15	Loss of the three motor phases
Motor phase U lost	3311	16	Loss of motor phase U
Motor phase V lost	3312	17	Loss of motor phase V
Motor phase W lost	3313	18	Loss of motor phase W
Inverter overtemp.	4210	19	Inverter overtemperature (overload, cooling problem)
Unknown MC	6100	20	Unknown power part
PTC short circuit	7300	21	Short-circuit at a thermistor (PTC) sensor (TH1, TH2, TH3, TH heat sink)
PTC open circuit	7300	22	A thermistor (PTC) sensor is open (TH1, TH2, TH3, TH heat sink)
ASIC Init fault	5000	23	Asic on the motor control cannot be initialised.

Matrix operating panel	Fault code		Description
	EMCY (hex)	Index 2000/49 (dec.)	
IGBT fault	5000	25	The desaturation protection of an IGBT has triggered. The registration of this fault occurs only with devices larger than >*pDRIVE*< *MX eco* 4V75.
IGBT short circuit	2320	27	Electronically determined short circuit at one of the IGBTs.
Motor short circuit	2320	28	The automatically running test routine B3.43 Automatic SC test has detected a short circuit at the output.
Current measure fault	5210	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 E^2 zones invalid	6100	32	Motor control EEProm defect
CPU fault	7400	33	Internal electronic fault
ISL fault	7500	34	Communication fault on the internal serial link
MTHA fault	FF08	35	Asic for time measurement defect (undervoltage time determination)
Overspeed	8400	36	The motor has exceeded the maximum allowed Overspeed level (E2.50).
Safe Standstill	FF04	37	There is a fault in the area of the internal monitoring for function "Safe Standstill" (PWR).
IO12 comm. fault	7510	38	Communication fault at option card >*pDRIVE*< *IO12*
Opt. comm. fault	8200	39	Communication fault at an option card
Wrong option board	FF03	40	Defect or unknown option card used
Bus fault	8100	41	A bus fault occurred due to exceeded run time or loss of control.
Param. config. fault	6320	42	Parameter settings invalid
Reference fault AI2	6310	43	At the analog input AI2 the reference value fell below 2 mA.
Reference fault AI3	6310	44	At the analog input AI3 the reference value fell below 2 mA.
Reference fault AI4	6310	45	At the analog input AI4 the reference value fell below 2 mA.
Reference fault FP	6310	46	At the frequency input FP the reference value fell short by 50 % of the setting f_{min}.
TH ϑ M1 >>	FF05	47	At least one of the thermistors (PTC) or thermal switches assigned to motor M1 (see motor assignment E2.01, E2.06, E2.11) has detected an overtemperature.
TH ϑ M2 >>	FF06	48	At least one of the thermistors (PTC) or thermal switches assigned to motor M2 (see motor assignment E2.01, E2.06, E2.11) has detected an overtemperature.
TH ϑ Ext >>	FF07	49	At least one of the thermistors (PTC) or thermal switches, which are planned for the general use (see assignment E2.01, E2.06, E2.11) has detected an overtemperature.
ϑ M1 >>	4300	50	The thermal mathematical motor model has reached the set trigger level for motor M1.
ϑ M2 >>	4300	51	The thermal mathematical motor model has reached the set trigger level for motor M2.
Stall protection	FF13	52	The stall protection has triggered due to a rotor blockade or a highly overloaded starting. See parameter E2.42 to E2.45.

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Matrix operating panel	Fault code		Description
	EMCY (hex)	Index 2000/49 (dec.)	
Underload	FF14	53	The underload function (E2.61) has recognized a motor underload.
Speed check fault	FF15	54	The function n-monitoring (E1.38) has recognized an overspeed.
Feed in <<	FF16	55	The function Feed-in monitoring (E1.49) has triggered.
AT-fault 1	FF09	56	Fault at the execution of the autotuning routine
Config. fault	FF10	57	EEProm application software incompatible or changed power part
External fault 1	9001	58	An external fault is signalized via a digital input function (see E3.34 to E3.38).
External fault 2	9002	59	An external fault is signalized via a digital input function (see E3.41 to E3.45).
Line contactor fault	1000	60	Line contactor control defect (response monitoring)
Motor contactor error	5000	61	Feedback for motor contactor control faulty
ON lock	F011	63	The digital input function "ON lock" (E3.48) caused a protective shut-down.
Internal SW error	6100	64	Internal software bug
Power rating fault	1000	65	Unclear power part assignment
Incompatible MC	1000	66	Motor control is not compatible to the application software
Flash fault APP	5500	67	Flash Eprom on the applicative defect
Indus zone fault	6100	68	Value for calibration on the applicative defect
Eprom fault APP	7600	69	EEProm on the applicative defect
Limitation active	8612	71	A limitation function of the motor control (current or torque) was active and according to the setting of E1.17 Reaction at limitation a protective shut-down takes place.
Ramp adaption	FF12	72	The set acceleration or deceleration ramp cannot be maintained and is automatically extended.
24V fault	5112	73	Problem with the external 24 V buffer voltage
BE11 loss	FF18	80	The connection between matrix operating panel BE11 and inverter is cut off during active panel operation and a loss of BE11 control is detected (see parameter E5.12).
VSD overload	FF19	81	Protective shut-down due to exceeding the maximum current/time specification.
I-limit active	FF1A	82	The actual motor current was higher than the actual allowed maximum current (E1.01 I_{max1}, thermal mathematical motor model E2.18...E2.39, thermal mathematical inverter model E1.03). This leads to a protective shut-down corresponding to the setting of E1.17 Reaction at limitation.
T-limitation active	FF1B	83	The actual motor torque was higher than an effective limitation value. Torque-limiting protective mechanisms are the internal torque limitation (E1.05) and the power limitation (E1.13). This leads to a protective shut-down corresponding to the setting of E1.17 Reaction at limitation.

Matrix operating panel	Fault code		Description
	EMCY (hex)	Index 2000/49 (dec.)	
Process fault 1	FF1F	87	A process fault is signalized via a digital input command (see E3.65...E3.69).
Process fault 2	FF20	88	A process fault is signalized via a digital input command (see E3.72...E3.76).
Process fault 3	FF21	89	A process fault is signalized via a digital input command (see E3.79...Undervoltage).
–	0081	–	General communication fault CANopen
–	0061	–	Internal fault CANopen

These trip messages can be read out under index 2000, subindex 49.

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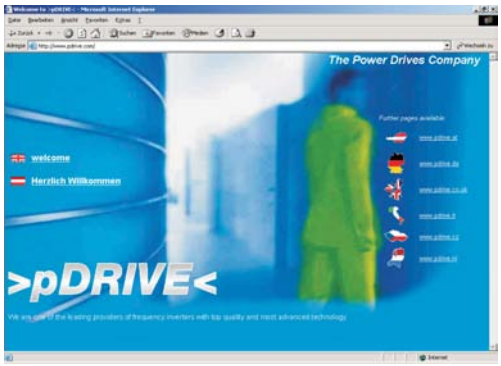
>*pDRIVE*< stands for intelligent high-performance.

As one of the leading providers of inverters and motors, we know from experience that quality without compromising, consolidated advice and more flexible service lead to longstanding research and expertise.
Therefore we dedicate an essential part of our activities to permanently optimising processes and developing solutions for target groups which will meet even the highest demands.



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