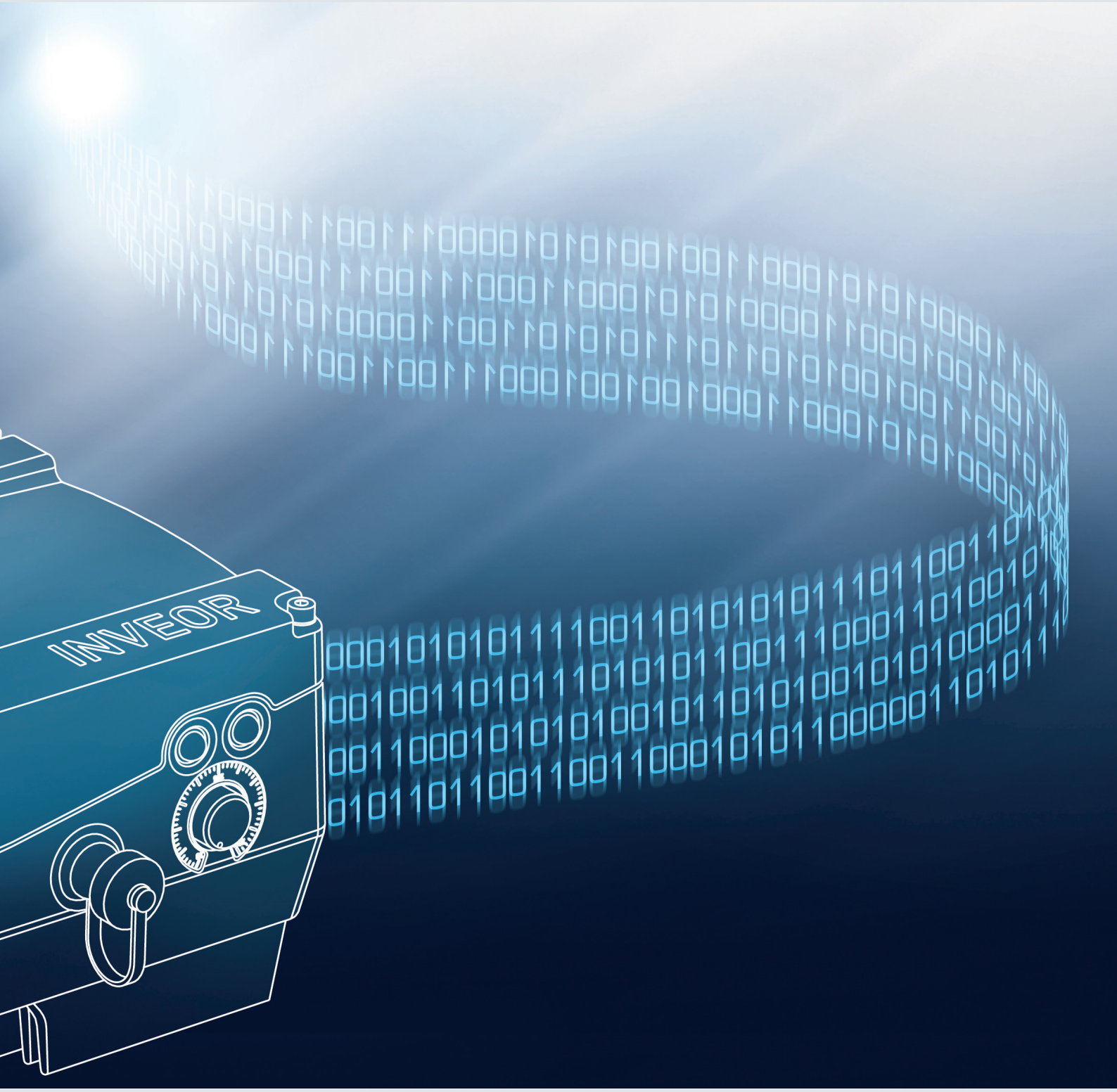
INDUSTRIE ELEKTRIK

KOSTAL



Smart connections.

Operating manual

EtherNet/IP fieldbus

Legal notice

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General note on gender equality

KOSTAL is aware of how language impacts on gender equality and always makes an effort to reflect this in documentation. Nevertheless, for the sake of readability we are unable to use non-gender-specific terms throughout and use the masculine form instead.

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Contents

1. General information

Thank you for choosing an INVEOR drive controller with EtherNet/IP from KOSTAL Industrie Elektrik GmbH & Co KG! Our INVEOR line of drive controllers is designed to be universally usable with all common motor types and bus systems.

If you have any technical questions, please call our central service hotline:

Tel.: +49 (0)2331 80 40-848

Monday to Friday: 7 am to 5 pm (UTC/GMT +1)

Fax: +49 (0)2331 80 40-602

E-mail: INVEOR-service@kostal.com

Website

www.kostal-industrie-elektrik.com

1.1 Information about documentation

This documentation is a supplementary operating manual for the INVEOR drive controller with the EtherNet/IP bus system.
It contains all the important information you need to install and operate the bus system.
Please read the operating manuals for the drive controller and bus system through carefully. They contain important information for operating the INVEOR with fieldbus.
We assume no liability for any damage resulting from non-observance of this manual.
This manual is an integral part of the product and applies exclusively to the INVEOR with EtherNet/IP from KOSTAL Industrie Elektrik GmbH & Co KG.
Provide the operator of the system with this manual so it is available when needed.

1.1.1 Other applicable documents

This refers to all manuals that describe how to operate the drive controller system and any other manuals for the equipment used. Download the 3D files (.stp) for INVEOR and adapter plates from **www.kostal-industrie-elektrik.com**.
A description of parameters is available for download (www.kostal-industrie-elektrik.com) for parametrising the drive controller system. In the download, you will find all the information required for correct parameterisation.

1.1.2 Storing the documentation

Store this operating manual and all other applicable documents carefully so they are available when needed.

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1.2 Notes in this manual

1.2.1 Warnings

The warnings refer to life-threatening dangers. Serious injuries possibly resulting in death may occur.

Each warning consists of the following elements:

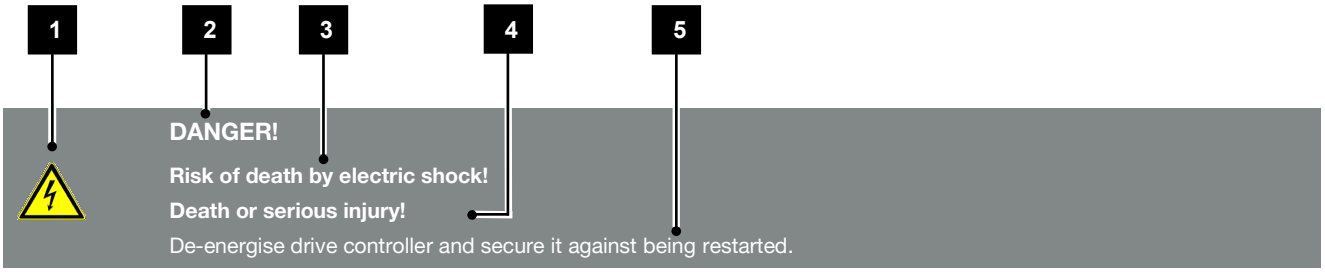


Fig.: 1 Structure of warnings

1	Warning symbol
2	Signal word
3	Type of danger and its source
4	Possible consequence(s) of failure to comply
5	Corrective actions

1.2.2 Warning symbols used


Danger


Danger due to electrical shock and discharge


Danger due to burns


Danger due to electromagnetic fields

1.2.3 Signal words

Signal words are used to identify the severity of the danger.

DANGER

Indicates a direct hazard with a high level of risk, which, if not avoided, will result in death or serious injury.

WARNING

Indicates a hazard with a moderate level of risk, which, if not avoided, will result in death or serious injury.

CAUTION

Indicates a hazard with a low level of risk, which, if not avoided, may result in minor or slight injury or property damage.

1.2.4 Information notes

Information notes contain important instructions for the installation and problem-free operation of the drive controller. These must be followed at all times. The information notes also point out that failure to observe instructions may result in damage to property or financial damages.

IMPORTANT INFORMATION

The drive controller may only be assembled, operated, maintained and installed by trained and qualified staff.

Fig.: 2 Example of an information note

Symbols within the information notes


Important information


Damage to property possible

Other notes


INFORMATION


Enlarged view

1.3 Symbols used in this manual

Symbol	Meaning
1., 1., 3. …	Consecutive steps in a handling instruction
➔	Effect of a handling instruction
✓	Final result of a handling instruction
■	List

Fig.: 3 Symbols and icons used

Abbreviations used

Abbreviation	Explanation
Tab.	Table
Fig.	Figure
It.	Item
Ch.	Chapter

1.4 Qualified staff

You will find the "Qualified staff" chapter in the operating manual for the INVEOR.

1.5 Proper use

You will find the "Proper use" chapter in the operating manual for the INVEOR.

1.6 Responsibility

You will find the "Responsibility" chapter in the operating manual for the INVEOR.

1.7 Contacts for information

More information is available from:

Central service hotline

Tel.: +49 2331 8040-848
Monday to Friday: 7 am to 5 pm (UTC/GMT +1)
Fax: +49 2331 8040-602
E-mail: **INVEOR-service@kostal.com**
Drives@Kostal.com

Website address

Customers can find technical and general information on the following website:

www.kostal-industrie-elektrik.com

1.8 Safety instructions

You will find the "Safety instructions" chapter in the operating manual for the INVEOR.

2. Device and system description

This chapter contains information on the scope of delivery for the drive controller and the function description.

2.1 EtherNet/IP

The EtherNet/IP bus system is part of the fieldbus family. The network is generally linear in structure. The maximum data transfer rate to an EtherNet/IP bus may be up to 100 Mbit/s.
The fieldbus cable is only connected via the two M12 connector sockets on the front of the device. Ensure that the incoming bus cable is connected to the "In" socket and the outgoing one to the "Out" socket. If connecting the last participant, the "Out" socket should be left free – there is no need for a terminal resistor.

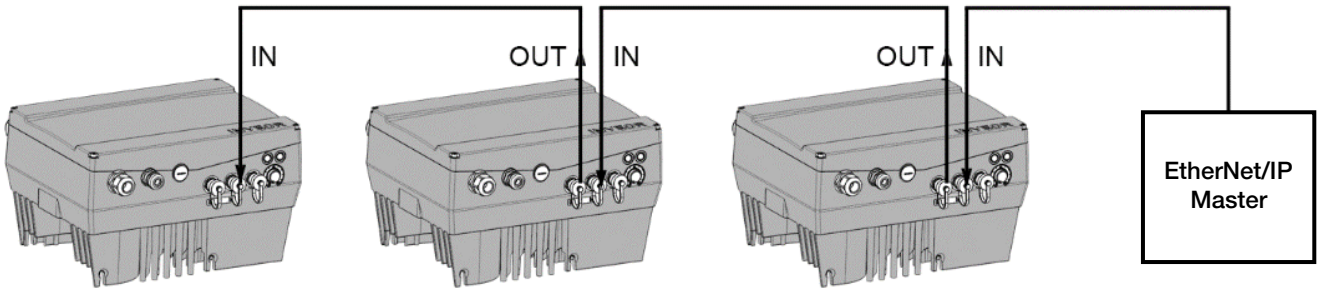


Fig.: 4 Wiring and bus connection (Example connection INVEOR M size C)

INFORMATION
A repeater must be used when more than 32 devices (e.g. INVEOR) are operated on one EtherNet/IP string.

2.1.1 Master / slave operation

The INVEOR should only be operated as an EtherNet/IP slave.

2.2 Scope of delivery

The scope of delivery is described in the INVEOR basic documentation.
The interface card is part of the INVEOR.

2.3 Item description for INVEOR

2.3.1 EtherNet/IP type code

Type code EtherNet/IP: For information see operating manual

2.3.2 Features code

AP17 - Standard + EtherNet/IP
AP47 - Standard + EtherNet/IP +
AP26 - Functional safety + EtherNet/IP
AP56 - Functional safety + EtherNet/IP +

IO23 - Standard + EtherNet/IP
IO24 - Standard + EtherNet/IP +
IO33 - Functional safety + EtherNet/IP
IO34 - Functional safety + EtherNet/IP +

2.4 Hardware components

The following hardware components are required for connecting the INVEOR to an EtherNet/IP bus system:

■ EtherNet/IP connecting cable M12 plug/RJ45 plug/4-pin/2 m/ D-coded/colour: green * INVZUB/-/LCL/IE/M12M/RJ45/2 m/D/-	Order no.: 10138814
■ EtherNet/IP connecting cable M12 plug/RJ45 plug/4-pin/5 m/ D-coded/colour: green * INVZUP/-/L/CL/IE/M12M/RJ45/5 m/D/-	Order no.: 10138847
■ EtherNet/IP connecting cable M12 plug/M12 plug/4-pin/2 m/ D-coded/colour: green * INVZUP/-/L/CL/IE/M12M/M12M/2 m/D/-	Order no.: 10138848
■ EtherNet/IP connecting cable M12 plug/M12 plug/4-pin/5 m/ D-coded/colour: green * INVZUP/-/L/CL/IE/M12M/M12M/5 m/D/-	Order no.: 10138849

*** Not part of the scope of delivery**

INFORMATION
The INVEOR is fitted in the factory with the appropriate communication card.
The INVEOR cannot be retrofitted or converted at a later date.

2.4.1 Connecting the fieldbus cable (INVEOR MP)

Size A/B/C/D

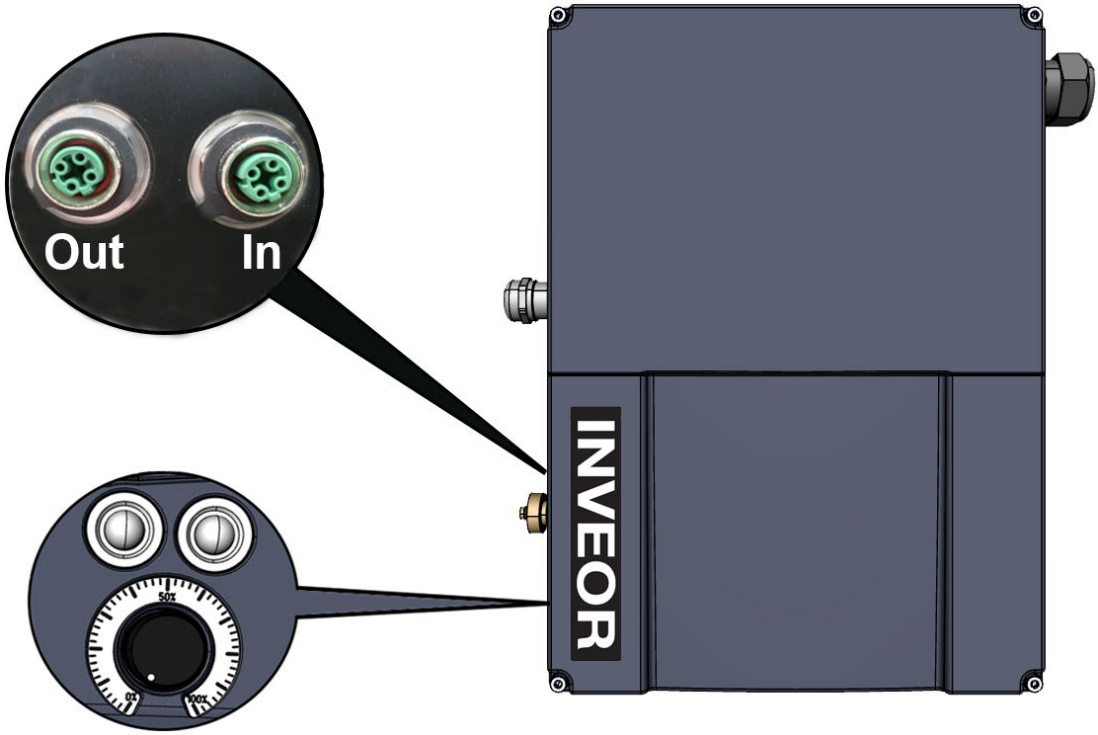


Fig. 5: Fieldbus cable connection Size A/B/C/D

2.4.2 Connecting the fieldbus cable (INVEOR MPM/MPP)

Size A/B/C/D

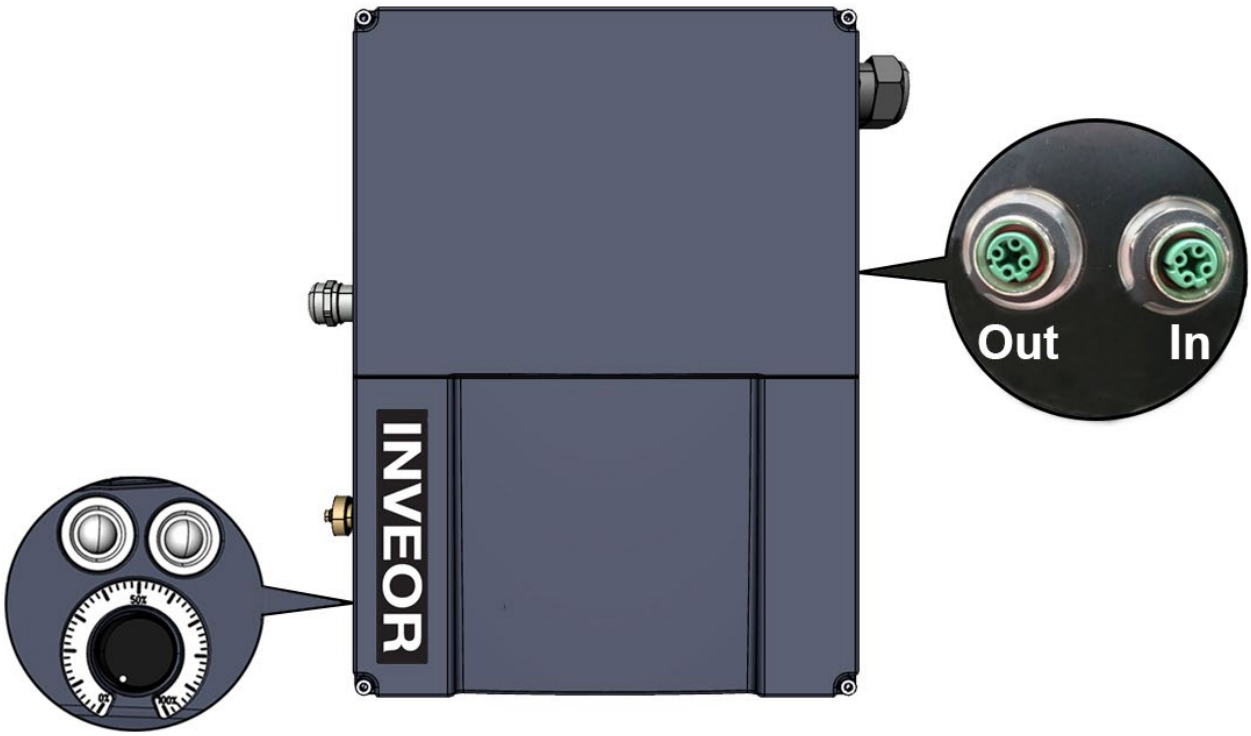
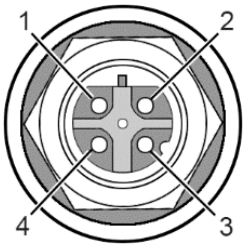


Fig. 6: Fieldbus cable connection Size A/B/C/D

1	2	3	4	5

2.4.3 Pin assignment for interfaces

Pin assignment on device side of M12 socket for EtherNet/IP:



PIN no.	Signal
1	TD +
2	RD +
3	TD -
4	RD -
Housing	Shielding

Fig. 7: Round plug connector, 4-pin, M12, D-coded for EtherNet/IP fieldbus

2.4.4 Cable

The following points should be observed when wiring:

- Lay bus and power cables as far apart as possible (min. 30 cm),
- If cables do cross, an angle of 90° should be observed if possible.

2.5 Software components

What software do I require to operate and configure the drive controller with EtherNet/IP?

The INVEOR drive controller can be parameterised using the INVEORpc tool and MMI (see operating manual) as well as the EtherNet/IP master.

3. Installation

3.1 Configuring the drive controller for EtherNet/IP

To enable the drive controller to be controlled by the fieldbus, the following basic parameters must be set using the INVEORpc tool, MMI or EtherNet/IP master:

- Set parameter 1.130 (target value source) to fieldbus "9"
- Set parameter 1.131 (target value approval) to fieldbus "6"
- Set parameter 6.010 (EtherNet fieldbus) to EtherNet/IP “3”

It is also possible to configure the basic parameters using the master via the EtherNet/IP. However, this can only be done once the communication has been installed.

The user must choose the set of parameters appropriate to him.

3.2 INVEOR bus address

DANGER!

Risk of death due to electrical shock!

Death or serious injury!

De-energise the drive controller, determine that it is voltage-free and secure it against being restarted.

The vendor ID for KOSTAL devices is 1676.

The IP address can be assigned and the network can be configured both automatically (DHCP / BOOTP) and manually.

Select the corresponding option in the master.

Parameters 6.067 (IP number), 6.068 (netmask) and 6.069 (gateway) can be set to suit the network environment.

If parameters are not set, the following default values apply:	IP:	192,168.0.31
	Netmask:	255,255,255.0
	Gateway:	0.0.0.0

3.3 Installing the INVEOR EDS file

A “Device-specific information file” is provided to simplify use of the INVEOR drive controller with EtherNet/IP. (Currently: INVEOR_28_02_22.eds)

Download the "EtherNet/IP fieldbus for INVEOR" ZIP file from the download area on our website at the following link:

www.kostal-industrie-elektrik.com

Embed the EDS file as required by the EtherNet/IP master you are using.

4. Data access via EtherNet/IP

Data can be accessed via EtherNet/IP both cyclically and non-cyclically (see chapter 4.2 / 0).

Cyclic data is known as a process image. It is made up of data sent by the EtherNet/IP master to the drive controller and from the drive controller to the EtherNet/IP master.

The cyclic data sent from the EtherNet/IP master to the drive controller is known as "Process data In".

The cyclic data sent from the drive controller to the EtherNet/IP master is known as "Process data Out".

4.1 Configuring the EtherNet interface, DHCP

The INVEOR supports the EtherNet/IP classes 0xF5 and 0xF6 for configuring the Ethernet interface.

The fieldbus address, netmask, gateway and 2 DNS addresses are contained in class 0xF5, instance 0x01 and attribute 0x05 where they can be read out or even set. What's more, the fieldbus address and netmask can also be set via the InverterPC tool.

The EtherNet/IP device supports DHCP.

The attribute 0x03 in class 0xF5 in instance 0x01 must be used for this purpose.
The permitted values are:

0 Auto Negotiate, IP Address, Netmask, Gateway
(the IP configuration has a static specification, baud rate is negotiated)

1 Auto Negotiate, Bootp , Gateway
(the Bootp protocol is supported, the baud rate is negotiated, the gateway is specified)

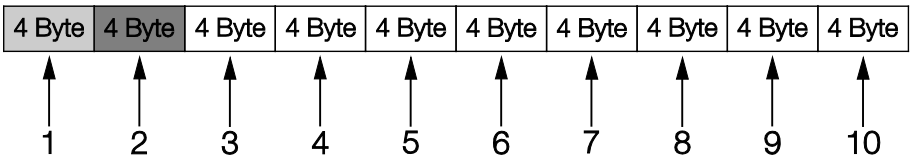
2 Auto Negotiate, DHCP, Gateway
(the DHCP protocol is supported, the baud rate is negotiated, the gateway is specified)

Should an incorrect configuration have resulted in failure and the device can no longer be contacted by fieldbus, the EtherNet/IP configuration can be deleted using the InverterPC tool (as of version 3.40) and reset back to the default setting.

4.2 Cyclic data access – Process data Out

4.2.1 Structure of Process data Out

The process data stated below is sent from the drive controller to the EtherNet/IP master. The process data Out consist of 40 bytes. The data is made up of 10 process variables.



The first two process variables (status word and actual frequency) cannot be parameterised and are always sent. The remaining 8 process variables can be configured using parameters 6.080 to 6.087.
The "Process data Out" available can be found in chapter 4.2.3 "Process data Out".
Use the INVEORpc application, MMI or EtherNet/IP master for parameterisation.

1	2	3	4	5

The structure of the "Process data Out" set in the factory is shown in the following table.

Frame No.	Address	Data type	Designation	Unit	Description
1	0x0000	WORD*	Status word	-	cannot be parameterised
2	0x0004	REAL***	Actual frequency	Hz	cannot be parameterised
3	0x0008	REAL	Process data Out 3 (Motor voltage)	V	can be parameterised using INVEORpc tool (parameter 6.080)
4	0x000C	REAL	Process data Out 4 (Motor current)	A	can be parameterised using INVEORpc tool (parameter 6.081)
5	0x0010	REAL	Process data Out 5 (Grid voltage)	V	can be parameterised using INVEORpc tool (parameter 6.082)
6	0x0014	REAL	Process data Out 6 (Target frequency value)	Hz	can be parameterised using INVEORpc tool (parameter 6.083)
7	0x0018	DWORD**	Process data Out 7 (Digital inputs with bit coding)	-	can be parameterised using INVEORpc tool (parameter 6.084)
8	0x001C	REAL	Process data Out 8 (Analogue input 1)	V	can be parameterised using INVEORpc tool (parameter 6.085)
9	0x0020	DWORD*	Process data Out 9 (Error word 1)	-	can be parameterised using INVEORpc tool (parameter 6.086)
10	0x0024	DWORD*	Process data Out 10 (Error word 2)	-	can be parameterised using INVEORpc tool (parameter 6.087)

Tab.: 1 Default structure for "Process data Out"

* WORD data type corresponds to UINT16 = 2 bytes
** DWORD data type corresponds to UINT32 = 4 bytes
*** REAL data type corresponds to = 4 bytes

IMPORTANT INFORMATION

The 32-bit data (error status, DigOuts, DigIns) has been broken down into 16-bit data because the data width of the fieldbuses is limited to 16-bit in some places.

If 32-bit data access is possible, the 32-bit word is used regardless of whether the low or high word is being accessed!

IMPORTANT INFORMATION

The REAL depiction is the standard IEEE format (help: 50 % target value = 0X42480000)

The endianness of the fieldbus should be observed for all data types.

1	2	3	4	5

4.2.2 Structure of INVEOR status word

The meanings of the individual bits of the INVEOR status word are described in the following table.

Bit	Value	Meaning	Description
0	**1**	Ready for engagement	Grid voltage present, no fault
	0	Not ready for engagement	
1	1	Ready for operation	No fault / HW enable set
	0	Not ready for operation	
2	1	Operation	Motor is energised
	0	Operation blocked	
3	1	Error active	A fault is present
	0	Free from faults	
4	1	No OFF 2	On 2 off / STW bit 1 set [3](logic can be inverted with parameter 6.066.)
	0	Electr. stop active (OFF 2)	
5	1	No OFF 3	On 3 off / STW bit 2 set [3](logic can be inverted with parameter 6.066)
	0	Rapid stop active (OFF 3)	
6	1	Engagement inhibit active	[1] PWM blocked
	0	No engagement inhibit	[1] PWM enabled
7	1	Warning active	[2] A warning is present
	0	No warning	
8	1	Nominal/actual value deviation in tolerance range	Actual value within a tolerance band Parameter 6.070 / 6.071
	0	Nominal/actual value deviation outside tolerance range	
9	1	Control from AG	INVEOR is parameterised for activation via fieldbus
	0	No control from AG	
10	1	Target frequency reached	Actual frequency > = reference value (Parameter 6.072)
	0	Target frequency fallen below	Actual frequency < reference value
11	1	Device-specific	Meaning not specified
	0	-	
12	1	Device-specific	Meaning not specified
	0	-	

Continues on next page

1	2	3	4	5

Continuation

Bit	Value	Meaning	Description
13	1	Device-specific	Meaning not specified
	0	-	
14	1	Device-specific	Meaning not specified
	0	-	
15	1	Device-specific	Meaning not specified
	0	-	

Tab.: 2 INVEOR status word

AG: Automation device
1 Deviation from standard
2 As of software version 03.61
3 As of software version 03.74

4.2.3 Process data Out which can be parameterised

The remaining 8 process variables can be selected using the INVEORpc tool, MMI or EtherNet/IP master by configuring parameters 6.080 to 6.087.

The process data available can be found in the following table.

Consec. no.	Data type	Available in SW version	Designation	Unit	Description
0	REAL		Actual frequency	Hz	
1	REAL		Output voltage	V	Motor voltage
2	REAL		Motor current	A	
3	REAL		IGBT temperature	° C	
4	REAL		Intermediate circuit voltage	V	
5	REAL		Target frequency value	Hz	
6	REAL		Supply voltage	V	Input voltage
7	REAL		Intermediate circuit current	A	
8	REAL		Inner temperature	° C	FC inner temperature
9	REAL		Incremental encoder speed	Hz	only with encoder option
10	t.b.d.		Incremental encoder position		only with encoder option
11	DWORD*		Application error	1	Bit-coded
13	DWORD		Power error	1	Bit-coded
15	DWORD		Digital inputs	1	Bit 0 = Dig. In 1 Bit 1 = Dig. In 2 Bit 2 = Dig. In 3 Bit 3 = Dig. In 4 Bit 4 = EN-HW / STO
16	REAL		Analogue In 1	V	Analogue input 1 application
17	REAL		Analogue In 2	V	Analogue input 2 application
18	REAL		F_target ramp	Hz	Frequency target value behind ramp

Continues on next page

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Continuation

Consec. no.	Data type	Available in SW version	Designation	Unit	Description
19	REAL		F_target	Hz	Frequency target value of target value source
20	REAL		PID actual value	%	Actual value of PID process controller
21	REAL		PID target value	%	Target value of PID process controller
22	REAL		Analogue Out 1	V	Analogue Out 1
23	REAL		Intermediate circuit power	W	Intermediate circuit power
24	REAL		Reserved	-	Reserved
25	REAL		Reserved	-	Reserved
26	REAL		Reserved	-	Reserved
27	REAL		Reserved	-	Reserved
28	REAL		Reserved	-	Reserved
29	DWORD		BUS/Soft PLC status word	1	BUS/Soft PLC status word
30	REAL	03.02	Speed	rpm	Motor shaft speed
31	REAL	03.02	Torque	Nm	Torque
32	REAL	03.02	Shaft power	W	Mechanical shaft power
33	DWORD	03.04	Virtual DigOuts (lowWord)	1	Virtual DigOuts of the soft PLC
35	REAL	03.04	Customer-specific output variable 1	1	Customer-specific soft PLC output variable
36	REAL	03.04	Customer-specific output variable 2	1	Customer-specific soft PLC output variable
37	REAL	03.04	Customer-specific output variable 3	1	Customer-specific soft PLC output variable
38	DWORD	03.05	Operating time in seconds	1	Operating time in seconds
39	DWORD	03.05	Power On cycles	1	Power On cycles
40	REAL	03.05	Electric energy Wh	Wh	Total electric energy
41	DWORD	03.05	Digital relay outputs		Control of outputs: Bit 0 = Dig Out 1 (Parameter 4.150 = 25) Bit 1 = Dig Out 2 (Parameter 4.170 = 25) Bit 2 = Relay 1 (Parameter 4.190 = 25) Bit 3 = Relay 2 (Parameter 4.210 = 25) Bit 4 = Virt Out 1 (Parameter 4.230 = 25)
42	DWORD*		Application error (at present)	1	Bit-coded
44	DWORD		Application error (at present)	1	Bit-coded

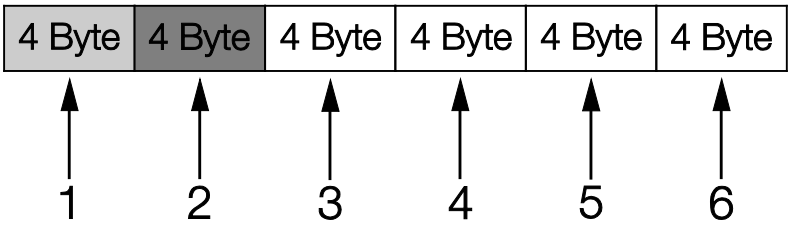
Tab.: 3 Process data Out which can be parameterised

*Data type DWORD corresponds to UINT32

1	2	3	4	5

4.3 Cyclic data access – Process data In

The process data stated below are sent from the EtherNet/IP master to the drive controller. The process data In consist of 24 bytes. The data is made up of 6 process variables.



The first two process variables (control word and target value) cannot be parameterised and are always expected. The remaining 4 process variables can be configured using parameters 6.110 to 6.113.

The "Process data In" available can be found in chapter 4.3.2 "Process data In".
Use the INVEORpc application, MMI or EtherNet/IP master for parameterisation.

The structure of the "Process data In" set in the factory is shown in the following table.

Frame no.	Address	Data type	Designation	Unit	Description
1	0x0000	WORD*	Control word (see 0)		cannot be parameterised
2	0x0004	REAL***	Target value	%	cannot be parameterised
3	0x0008	DWORD**	Process data In 3 (Digital output 1 – relay)		can be parameterised using INVEORpc tool (parameter 6.110)
4	0x000C	REAL	Process data In 4 (Analogue output 1)	V	can be parameterised using INVEORpc tool (parameter 6.111)
5	0x0010		Process data In 5 (Reserved)		can be parameterised using INVEORpc tool (parameter 6.112)
6	0x0014		Process data In 6 (Reserved)		can be parameterised using INVEORpc tool (parameter 6.113)

Tab.: 4 Process data In

* WORD data type corresponds to UINT16 = 2 bytes
** DWORD data type corresponds to UINT32 = 4 bytes
*** REAL data type corresponds to = 4 bytes

4.3.1 Structure of INVEOR control word

The meanings of the individual bits of the INVEOR control word are described in the following table.

IMPORTANT INFORMATION

The control word is only accepted if bit 10 (control from AG) is set, otherwise the sent control word is rejected.

IMPORTANT INFORMATION

The target value is only accepted if bit 6 (target value enabled) is set. Otherwise the target value is rejected.

Bit	Value	Meaning	Description
0	1*	ON 1	Engagement condition 1
	0	OFF 1	Shut down via ramp
1	1*	ON 2	Engagement condition 2
	0	Electr. stop (OFF 2)	Switch off PWM, free shutdown
2	1*	EIN 3	Engagement condition 3
	0	Rapid stop (OFF 3)	Shut down via fastest possible ramp
3	1*	Operating condition 1	Operating condition 1
	0		Switch off PWM, free shutdown
4	1*	Operating condition 2	Operating condition 2
	0		Shut down via fastest possible ramp
5	1	Block HLG	[1] Not implemented
	0	Stop HLG	[1] Not implemented
6	1*	Enable target value	Adopt target value
	0	Block target value	Reject target value
7	1	Error acknowledgement (0-> 1)	Collective acknowledgement on pos. flank
	0*	---	---
8	1	JOG (right)	[1] Not implemented
	0		[1] Not implemented
9	1	JOG (left)	[1] Not implemented
	0		[1] Not implemented
10	1*	Control from AG	Management via interface, control word valid
	0		Control word is rejected
11	1	Device-specific	-
	0		
12	1	Device-specific	-
	0		

Continues on next page

1	2	3	4	5

Continuation

Bit	Value	Meaning	Description
13	1	Device-specific	-
	0		
14	1	Device-specific	-
	0		
15	1	Device-specific	-
	0		

Tab.: 5 Control word

HLG: Ramp function generator
*** Operating condition**
[1] Deviation from standard

IMPORTANT INFORMATION
An example of a control word with which the start-up works is 0x45F.
The endianness of the fieldbus should be observed for all data types.

4.3.2 Process data In which can be parameterised

The remaining 4 process variables (2 – 6) can be parameterised with the help of the INVEORpc tool using parameters 6.110 to 6.113. The available process variables of the parameter settings can be found in the following table.

Serial no.	Data type	SW vers.	Designation	Unit	Description
0	DWORD*	03.02	Digital relay outputs	1	Control of outputs: Bit 0 = Dig Out 1 (Parameter 4.150 = 25) Bit 1 = Dig Out 2 (Parameter 4.170 = 25) Bit 2 = Relay 1 (Parameter 4.190 = 25) Bit 3 = Relay 2 (Parameter 4.210 = 25) Bit 4 = Virt Out 1 (Parameter 4.230 = 25)
1	REAL	03.02	Analogue Out 1	V	Control of analogue output
2	DWORD	03.04	Customised input variable 1	1	Customised input variable soft PLC (32 bit)
4	REAL	03.04	Customised input variable 2 / PID actual value	-	Customised input variable soft PLC
5	REAL	03.04	Customised input variable 3	-	Customised input variable soft PLC
6	REAL	03.04	Customised input variable 4	-	Customised input variable soft PLC

Tab.: 6Process data In which can be parameterised

* DWORD data type corresponds to UINT32 = 4 bytes

4.4 Non-cyclic data access / parameters

IMPORTANT INFORMATION
Only parameters with an access level of 2 or less can be accessed (see list of parameters in operating manual).
Access for both reading and writing is possible.

IMPORTANT INFORMATION
You will find detailed information about the parameters in the "Parameters" chapter of the "INVEOR drive controller" operating manual.

4.4.1 Non-cyclic data

Class 100 (0x64) is available in the EtherNet/IP implementation of the INVEOR for access to non-cyclic data. Instance ID 0 of class 100 is read-only.

Instance ID 1 of class 100 is intended for read and write access. The parameter's index is stated as the attribute ID.

The "Set Attribute Single" (service code 16) and "Get Attribute Single" (service code 14) services are supported.

Example:
In order to write the "Deceleration time 2" parameter (index = 48) for example, the instance ID 1 must be selected in class 100 where attribute ID 48 must then selected. A new value can then be set there with the "Set Attribute Single" (16) service. This value should be transferred as 4 bytes real. (e. g. 50.0 = 0x42480000)

The maximum number of parameters in the INVEOR is 511. The attribute ID can therefore not be any greater than 511.

4.4.2 Parameter

The following parameters can be accessed non-cyclically for reading and writing.

IMPORTANT INFORMATION
Changing a parameter value via the fieldbus includes direct EEPROM write access.

INFORMATION
- All parameters are of the data type "REAL"
- The data below are listed in ascending order by "Number*". The index (!!!) must be taken as the EtherNet/IP attribute number for read/write access!

EtherNet/IP		INVEOR parameter						
Slot	Index	Parameter	Number*	Accepted	Name in German	Minimum	Maximum	Unit
1	0	0	1.020	2: Always	Minimum frequency	0	400	Hz
1	1	1	1.021	2: Always	Maximum frequency	5	400	Hz
1	3	3	1.050	2: Always	Deceleration time 1	0.1	1000	s
1	4	4	1.051	2: Always	Run up time 1	0.1	1000	s
1	48	48	1.052	2: Always	Deceleration time 2	0.1	1000	s
1	49	49	1.053	2: Always	Run up time 2	0.1	1000	s
1	50	50	1.054	2: Always	Ramp selection	0	9	

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Continuation

EtherNet/IP		INVEOR parameter						
Slot	Index	Parameter	Number*	Accepted	Name in German	Minimum	Maximum	Unit
1	172	172	1.088	2: Always	Deceleration time 3	0.1	1000	s
1	8	8	1.100	2: Always	Operating mode	0	3	
1	5	5	1.130	2: Always	Target value source	0	10	
1	7	7	1.131	2: Always	Target value approval	0	16	
1	81	81	1.132	2: Always	Start protection	0	8	
1	41	41	1.150	2: Always	Rotation direction	0	16	
1	53	53	1.180	2: Always	Acknowledge function	0	7	
1	54	54	1.181	2: Always	Auto acknowledgement	0	1000	s
1	109	109	1.182	2: Always	Auto ackn. no.	0	500	
1	55	55	2.050	2: Always	Fixed frequency mode	0	4	
1	9	9	2.051	2: Always	Fixed frequency 1	-400	400	Hz
1	10	10	2.052	2: Always	Fixed frequency 2	-400	400	Hz
1	11	11	2.053	2: Always	Fixed frequency 3	-400	400	Hz
1	12	12	2.054	2: Always	Fixed frequency 4	-400	400	Hz
1	13	13	2.055	2: Always	Fixed frequency 5	-400	400	Hz
1	14	14	2.056	2: Always	Fixed frequency 6	-400	400	Hz
1	15	15	2.057	2: Always	Fixed frequency 7	-400	400	Hz
1	139	139	2.150	2: Always	MOP digital in.	0	8	
1	51	51	2.151	2: Always	MOP step range	0	100	%
1	141	141	2.152	2: Always	MOP step time	0.02	1000	s
1	140	140	2.153	2: Always	MOP react. Time	0.02	1000	s
1	142	142	2.154	2: Always	MOP reference memory	0	1	
1	37	37	3.050	2: Always	PID-P proportional gain	0	100	
1	38	38	3.051	2: Always	PID-I proportional gain	0	100	1/s
1	39	39	3.052	2: Always	PID-D proportional gain	0	100	s
1	6	6	3.060	2: Always	PID actual value	0	3	
1	82	82	3.061	2: Always	PID inverted	0	1	
1	83	83	3.062	2: Always	PID fixed nominal value 1	0	100	%
1	127	127	3.063	2: Always	PID fixed nominal value 2	0	100	%
1	128	128	3.064	2: Always	PID fixed nominal value 3	0	100	%
1	129	129	3.065	2: Always	PID fixed nominal value 4	0	100	%
1	130	130	3.066	2: Always	PID fixed nominal value 5	0	100	%
1	131	131	3.067	2: Always	PID fixed nominal value 6	0	100	%
1	132	132	3.068	2: Always	PID fixed nominal value 7	0	100	%
1	133	133	3.069	2: Always	PID fixed nominal mod	0	2	

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Continuation

EtherNet/IP		INVEOR parameter						
Slot	Index	Parameter	Number*	Accepted	Name in German	Minimum	Maximum	Unit
1	84	84	3.070	2: Always	PID standby time	0	1000	s
1	85	85	3.071	2: Always	PID std.by hyst.	0	50	%
1	166	166	3.072	2: Always	PID dry. Time	0	32767	s
1	169	169	3.073	2: Always	PID target value min	0	100	%
1	170	170	3.074	2: Always	PID target value max	0	100	%
1	25	25	4.020	2: Always	AI1 input type	1	2	
1	26	26	4.021	2: Always	AI1 standard. Low	0	100	%
1	27	27	4.022	2: Always	AI1 standard. High	0	100	%
1	23	23	4.023	2: Always	AI1 dead time	0	100	%
1	22	22	4.024	2: Always	AI1 filter time	0.02	1	s
1	19	19	4.030	2: Always	AI1 function	0	1	
1	103	103	4.033	2: Always	AI1-phys unit	0	10	
1	104	104	4.034	2: Always	AI1 phys min	-10000	10000	%
1	105	105	4.035	2: Always	AI1 phys max	-10000	10000	%
1	167	167	4.036	2: Always	AI1 wire break time	0	32767	s
1	34	34	4.050	2: Always	AI2 input type	1	2	
1	35	35	4.051	2: Always	AI2 standard Low	0	100	%
1	36	36	4.052	2: Always	AI2 standard High	0	100	%
1	32	32	4.053	2: Always	AI2 dead time	0	100	%
1	31	31	4.054	2: Always	AI2 filter time	0.02	1	s
1	28	28	4.060	2: Always	AI2 function	0	1	
1	106	106	4.063	2: Always	AI2-phys unit	0	10	
1	107	107	4.064	2: Always	AI2 phys min	-10000	10000	%
1	108	108	4.065	2: Always	AI2 phys max	-10000	10000	%
1	168	168	4.066	2: Always	AI2 wire break time	0	32767	s
1	42	42	4.100	2: Always	AO1 function	0	40	
1	43	43	4.101	2: Always	AO1 standard Low	-32767	32767	
1	80	80	4.102	2: Always	AO1 standard high	-32767	32767	
1	120	120	4.110	2: Always	DI1 inverted	0	1	
1	121	121	4.111	2: Always	DI2 inverted	0	1	
1	122	122	4.112	2: Always	DI3 inverted	0	1	
1	123	123	4.113	2: Always	DI4 inverted	0	1	
1	56	56	4.150	2: Always	DO1 function	0	60	
1	57	57	4.151	2: Always	DO1 on	-32767	32767	
1	58	58	4.152	2: Always	DO1 off	-32767	32767	

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Continuation

EtherNet/IP		INVEOR parameter						
Slot	Index	Parameter	Number*	Accepted	Name in German	Minimum	Maximum	Unit
1	59	59	4.170	2: Always	DO2 function	0	60	
1	60	60	4.171	2: Always	DO2 on	-32767	32767	
1	61	61	4.172	2: Always	DO2 off	-32767	32767	
1	62	62	4.190	2: Always	Rel.1 function	0	60	
1	63	63	4.191	2: Always	Relay 1 on	-32767	32767	
1	64	64	4.192	2: Always	Relay 1 off	-32767	32767	
1	94	94	4.193	2: Always	Relay 1 on delay	0	10000	s
1	95	95	4.194	2: Always	Relay 1 off delay	0	10000	s
1	65	65	4.210	2: Always	Relay 2 function	0	60	
1	66	66	4.211	2: Always	Relay 2 on	-32767	32767	
1	67	67	4.212	2: Always	Relay 2 off	-32767	32767	
1	96	96	4.213	2: Always	Relay 2 on delay	0	10000	s
1	97	97	4.214	2: Always	Relay 2 off delay	0	10000	s
1	160	160	4.230	2: Always	VO function	0	60	
1	161	161	4.231	2: Always	VO on	-10000	10000	
1	162	162	4.232	2: Always	VO off	-10000	10000	
1	163	163	4.233	2: Always	VO on delay	0	32767	s
1	164	164	4.234	2: Always	VO off delay	0	32767	s
1	124	124	5.010	2: Always	External fault 1	0	7	
1	125	125	5.011	2: Always	External fault 2	0	7	
1	86	86	5.070	2: Always	Motor current limit %	0	250	%
1	87	87	5.071	2: Always	Motor current limit s	0	100	s
1	156	156	5.075	2: Always	Gearbox factor	0	1000	
1	111	111	5.080	2: Always	Blocking detection	0	1	
1	154	154	5.081	2: Always	Block.time	1	50	s
1	171	171	5.082	2: Always	Start-up error_current	0	1	
1	138	138	5.090	2: Always	Par.set change	0	12	
1	70	70	5.100	2: Always	Techn.param.1	-9999999	9999999	
1	71	71	5.101	2: Always	Techn.param.2	-9999999	9999999	
1	72	72	5.102	2: Always	Techn.param.3	-9999999	9999999	
1	73	73	5.103	2: Always	Techn.param.4	-9999999	9999999	
1	74	74	5.104	2: Always	Techn.param.5	-9999999	9999999	
1	75	75	5.105	2: Always	Techn.param.6	-9999999	9999999	
1	76	76	5.106	2: Always	Techn.param.7	-9999999	9999999	
1	77	77	5.107	2: Always	Techn.param.8	-9999999	9999999	

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Continuation

EtherNet/IP		INVEOR parameter						
Slot	Index	Parameter	Number*	Accepted	Name in German	Minimum	Maximum	Unit
1	78	78	5.108	2: Always	Techn.param.9	-9999999	9999999	
1	79	79	5.109	2: Always	Techn.param.10	-9999999	9999999	
1	144	144	5.110	2: Always	Techn.param.11	-32768	32767	
1	145	145	5.111	2: Always	Techn.param.12	-32768	32767	
1	146	146	5.112	2: Always	Techn.param.13	-32768	32767	
1	147	147	5.113	2: Always	Techn.param.14	-32768	32767	
1	148	148	5.114	2: Always	Techn.param.15	-32768	32767	
1	149	149	5.115	2: Always	Techn.param.16	-32768	32767	
1	150	150	5.116	2: Always	Techn.param.17	-32768	32767	
1	151	151	5.117	2: Always	Techn.param.18	-32768	32767	
1	152	152	5.118	2: Always	Techn.param.19	-32768	32767	
1	153	153	5.119	2: Always	Techn.param.20	-32768	32767	
1	98	98	6.050	2: Always	SAS/ SPF adr	0	31	
1	110	110	6.051	2: Always	SAS baud rate	0	3	
1	99	99	6.060	0: Commissioning	Fieldbus address	0	127	
1	100	100	6.061	0: Commissioning	Fieldbus baud rate	0	8	
1	102	102	6.062	2: Always	Bus time-out	0	100	s
1	176	176	6.066	2: Always	Status word Bits 4/5	0	1	
1	157	157	6.070	2: Always	Target/actual value dev.	0	100	%
1	158	158	6.071	2: Always	Tolerance range	0	32767	s
1	159	159	6.072	2: Always	Target comp. value	0	400	Hz
1	112	112	6.080	2: Always	Process data Out 3	0	49	
1	113	113	6.081	2: Always	Process data Out 4	0	49	
1	114	114	6.082	2: Always	Process data Out 5	0	49	
1	115	115	6.083	2: Always	Process data Out 6	0	49	
1	116	116	6.084	2: Always	Process data Out 7	0	49	
1	117	117	6.085	2: Always	Process data Out 8	0	49	
1	118	118	6.086	2: Always	Process data Out 9	0	49	
1	119	119	6.087	2: Always	Process data Out 10	0	49	
1	134	134	6.110	2: Always	Process data In 3	0	10	
1	135	135	6.111	2: Always	Process data In 4	0	10	
1	136	136	6.112	2: Always	Process data In 5	0	10	
1	137	137	6.113	2: Always	Process data In 6	0	10	
2	102	358	32.100	0: Commissioning	Output power PM	0	1100	W
2	112	368	33.001	1: Ready	Type of motor	1	2	
2	100	356	33.010	2: Always	I2T fact. motor	0	1000	%

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Continuation

EtherNet/IP		INVEOR parameter						
Slot	**Index**	**Parameter**	**Number***	**Accepted**	**Name in German**	**Minimum**	**Maximum**	**Unit**
2	84	340	33.011	2: Always	I2T time	0	1200	s
2	132	388	33.015	1: Ready	R optimisation	0	200	%
2	147	403	33.016	1: Ready	Motor phase monitoring	0	1	
2	70	326	33.031	1: Ready	Motor current	0	150	A
2	71	327	33.032	1: Ready	Motor rating	50	55000	W
2	73	329	33.034	1: Ready	Motor speed	0	80000	rpm
2	74	330	33.035	1: Ready	Motor frequency	10	400	Hz
2	115	371	33.050	1: Ready	Stator resistance	0	100	Ohm
2	117	373	33.105	1: Ready	Scatter inductivity	0	1	H
2	68	324	33.110	1: Ready	Motor voltage	0	1500	V
2	72	328	33.111	1: Ready	Motor cos phi	0.5	1	
2	125	381	33.138	2: Always	Holding current time	0	3600	s
2	116	372	33.200	1: Ready	Stator induc.	0	1	H
2	129	385	33.201	1: Ready	Nominal flux	0	10000	mVs
2	111	367	34.010	1: Ready	Control method	100	299	
2	85	341	34.011	1: Ready	Type of encoder	0	2	1
2	86	342	34.012	1: Ready	Encoder line count	0	10000	1
2	87	343	34.013	2: Always	Encoder offset	-360	360	°
2	131	387	34.020	2: Always	Flying restart	0	1	
2	130	386	34.021	2: Always	Catch time	0	10000	ms
2	8	264	34.030	2: Always	Switching frequency	1	4	
2	121	377	34.090	2: Always	Speed controller Kp	1	10000	mA/rad/s
2	122	378	34.091	2: Always	Speed controller Tn	0	10	s
2	113	369	34.110	2: Always	Slip trimmer	0	1.5	
2	138	394	34.120	2: Always	Quadr. characteristic curve	0	1	
2	139	395	34.121	2: Always	Flux adjustment	10	100	%
2	114	370	34.130	2: Always	Control reserve voltage	0	3	
2	137	393	34.225	1: Ready	Field weaken.PMSM	0	1	
2	136	392	34.226	2: Always	PMSM startup current	5	1000	%
2	143	399	34.227	1: Ready	Init.time PMSM	0	100	s
2	140	396	34.228	1: Ready	PMSM start-up procedure	0	1	
2	141	397	34.229	1: Ready	Start.ramp PMSM	0.1	1000	s
2	142	398	34.230	1: Ready	Start-up frequency P	5	400	Hz
2	120	376	35.080	2: Always	Brake chopper	0	1	

5. Error detection and troubleshooting

The errors from the application and power side can be issued in the Process data Out (see Chapter 4.2.3 "Process data Out which can be parameterised" / serial no. 11, 13).

5.1 Error word of application side

The following section contains a list of possible error messages of the application.

Bit.	Error number	Description
0	1	Undervoltage 24 V application
1	2	Overvoltage 24 V application
5	6	Customer PLC version error
7	8	Communication application<>power
9	10	Parameter distributor
10	11	Power time out
12	13	Cable break at analogue in 1 (4–20 mA / 2– 10 V)
13	14	Cable break at analogue in 2 (4–20 mA / 2– 10 V)
14	15	Blocking detection
15	16	PID dry run
16	17	Start-up error
17	18	Excess temperature for frequency converter application
20	21	Bus time-out
21	22	Acknowledgement error
22	23	External error 1
23	24	External error 2
24	25	Motor detection
25	26	STO inputs plausibility

Tab.: 7 Application error word

1	2	3	4	5

5.2 Error word of power side

The following section contains a list of possible power side error messages.

Bit.	Error number	Description
0	32	Trip IGBT
1	33	Overvoltage of intermediate circuit
2	34	Undervoltage of intermediate circuit
3	35	Excess motor temperature
4	36	Power failure
6	38	Excess IGBT module temperature
7	39	Overcurrent
8	40	Excess frequency converter temperature
10	42	I^2T motor protection shut-off
11	43	Ground leak
13	45	Motor connection disrupted
14	46	Motor parameters
15	47	Drive controller parameters
16	48	Type plate data
17	49	Power class restriction
21	53	Motor tipped

Tab.: 8 Power error word

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