INVEOR

Modbus fieldbus

Operating manual

Distributor for:

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Legal notice

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General note on gender equality

KOSTAL is aware of how language impacts on gender equality and always make 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.

Contents

1. General information

Thank you for choosing an INVEOR drive controller with Modbus from KOSTAL Industrie Elektrik GmbH! 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 Modbus 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 Modbus from KOSTAL Industrie Elektrik GmbH.
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/downloads/downloadmanager#Antriebstechnik A description of parameters is available for download (www.kostal-industrie-elektrik.com) for parameterising the drive control 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.

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:

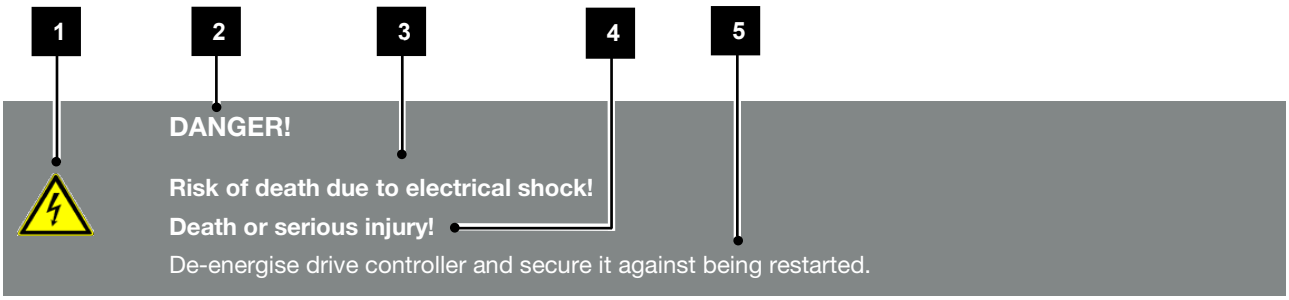


Fig. 1: Structure of the warnings

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

Symbol	Meaning
	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 can 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

Symbol	Meaning
	Important information
	Damage to property possible

Other notes

Symbol	Meaning
	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 Safety notice

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

1.8 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

Website address

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

www.kostal-industrie-elektrik.com

2. Device and system description

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

2.1 Modbus

The Modbus bus system is part of the fieldbus family.
The network is generally linear in structure. The maximum data transfer rate to a Modbus bus may be up to 115.2 kbit/s.
The fieldbus cable is only connected via the M12 connector socket on the front of the device.
If the fieldbus cable is to be routed to another participant, an M12 T-splitter (order no. 10272829) should be used. The bus must be terminated with a terminating resistor (order no. 10343387).

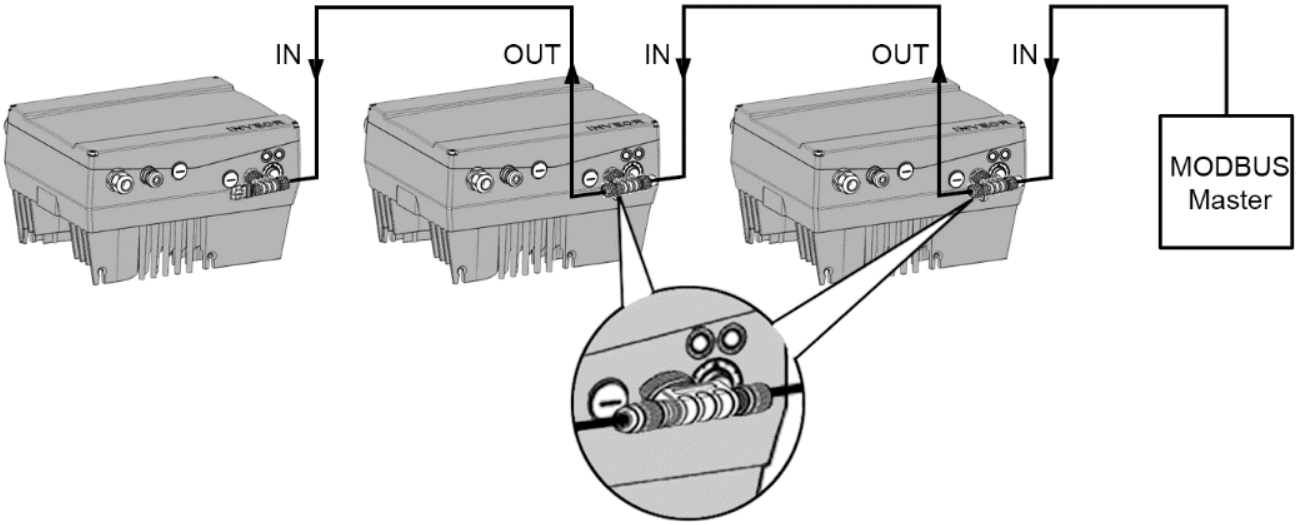


Fig.: 1 Wiring and bus connection

INFORMATION

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

2.1.1 Master/slave operation

The INVEOR should only be operated as a Modbus slave.

2.2 Scope of delivery

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

2.3 Item description

As of software V 03.80, every INVEOR drive controller supports the Modbus protocol.

INFORMATION

Exceptions to this are INVEOR drive controllers with the MMI option (DK05)

2.4 Hardware components

The following hardware components are available for connecting the INVEOR to a Modbus bus system:

Description	Article number
M12 connecting cable 2 m M12 plug on M12 coupling / RS485 / 4-pin / 2 m / A-coded P AL-WAK4-m-AL_8044041	10272382
M12 connecting cable 5 m M12 plug on M12 coupling / RS485 / 4-pin / 5 m / A-coded P AL-WAK4-m-AL-WAS4/S37080	10272793
M12 connection cable open 2 m M12 plug / open / RS485 / 4-pin / 2 m / A-coded P AL-WAS4-m / S370 8043817	10272795
M12 connection cable open 10 m M12 plug / open / RS485 / 4-pin / 10 m / A-coded P AL-WAS4-m / S370 8043819	10272794
M12 T-splitter M12 plug on plug and socket / RS485 / 4-pin / A-coded J FKM4-FSM4-FSM4, 8008139	10272829
M12 plug can be self-assembled M12 plug / RS485 / 4-pin / A-coded INVZUB – L/CF/RS/M12M/-/-/A/	10137294
M12 coupling can be self-assembled M12 coupling / RS485 / 4-pin / A-coded P WAKC4K 8004811	10272796
M12 terminating resistor 120 Ohm M12 plug / RS485 / 5-pin / A-coded INVZUB – L/TE/RS/M12M/-/-/A/-/-	10343387

2.4.1 Interfaces on the drive controller

The following connections can be found on the INVEOR with Modbus interface card:

Size Alpha:

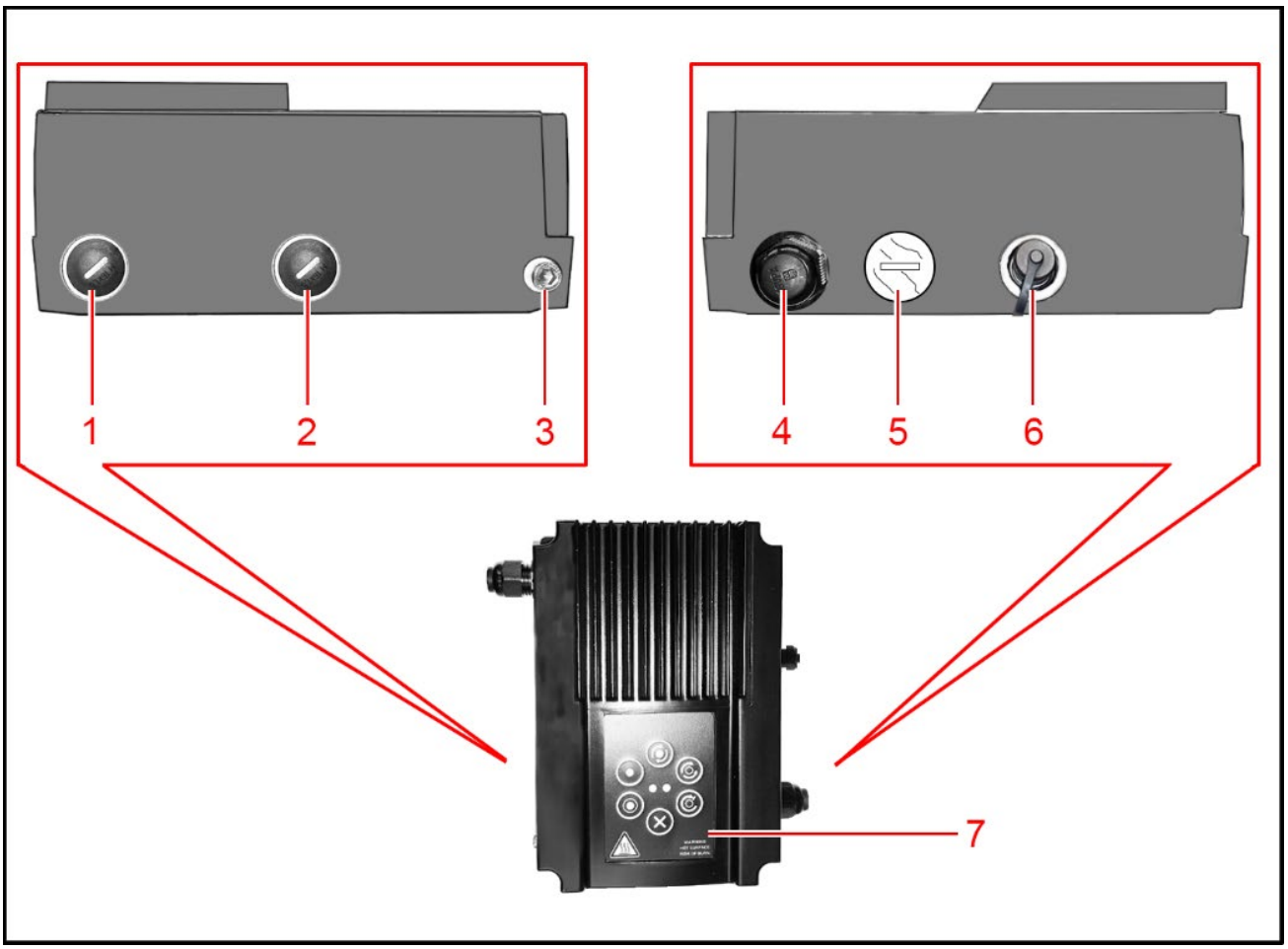


Fig.: 2 Size Alpha "Modbus" connections

Size Alpha "Modbus" connections	
1	Blind plug (optional motor connection with wall mounting)
2	Control cable blind plug
3	Ground screw
4	Grid connection
5	Transparent plug
6	MMI / Modbus
7	Foil keypad (optional)

Size A:

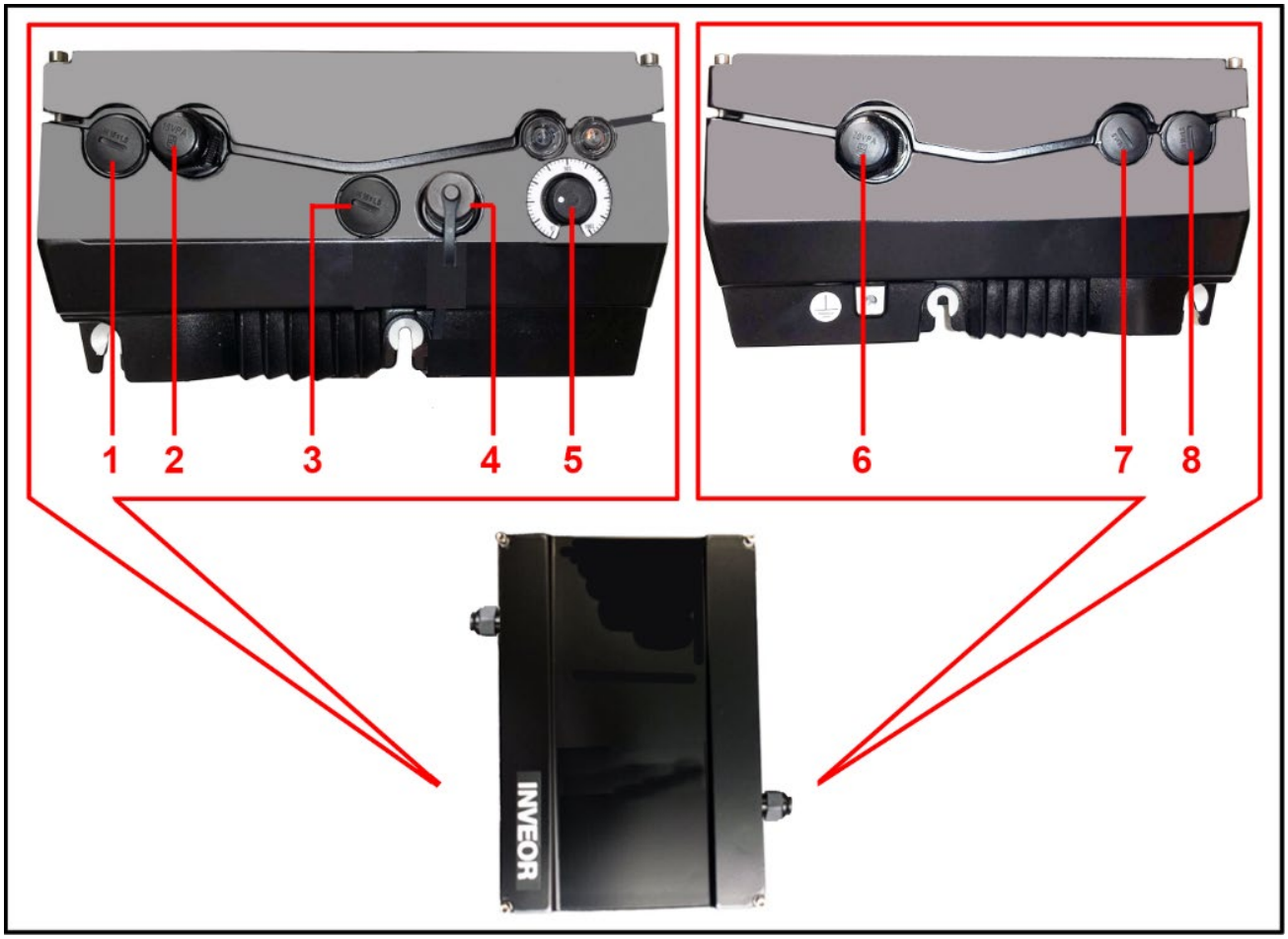


Fig.: 3 Size A "Modbus" connections

Size A "Modbus" connections	
1	Blind plug
2	Control line
3	Blind plug
4	MMI / Modbus
5	Potentiometer
6	Grid connection
7	Blind plug STO (install EMC screw connection supplied in the package)
8	Blind plug STO (install EMC screw connection supplied in the package)

Sizes B - C

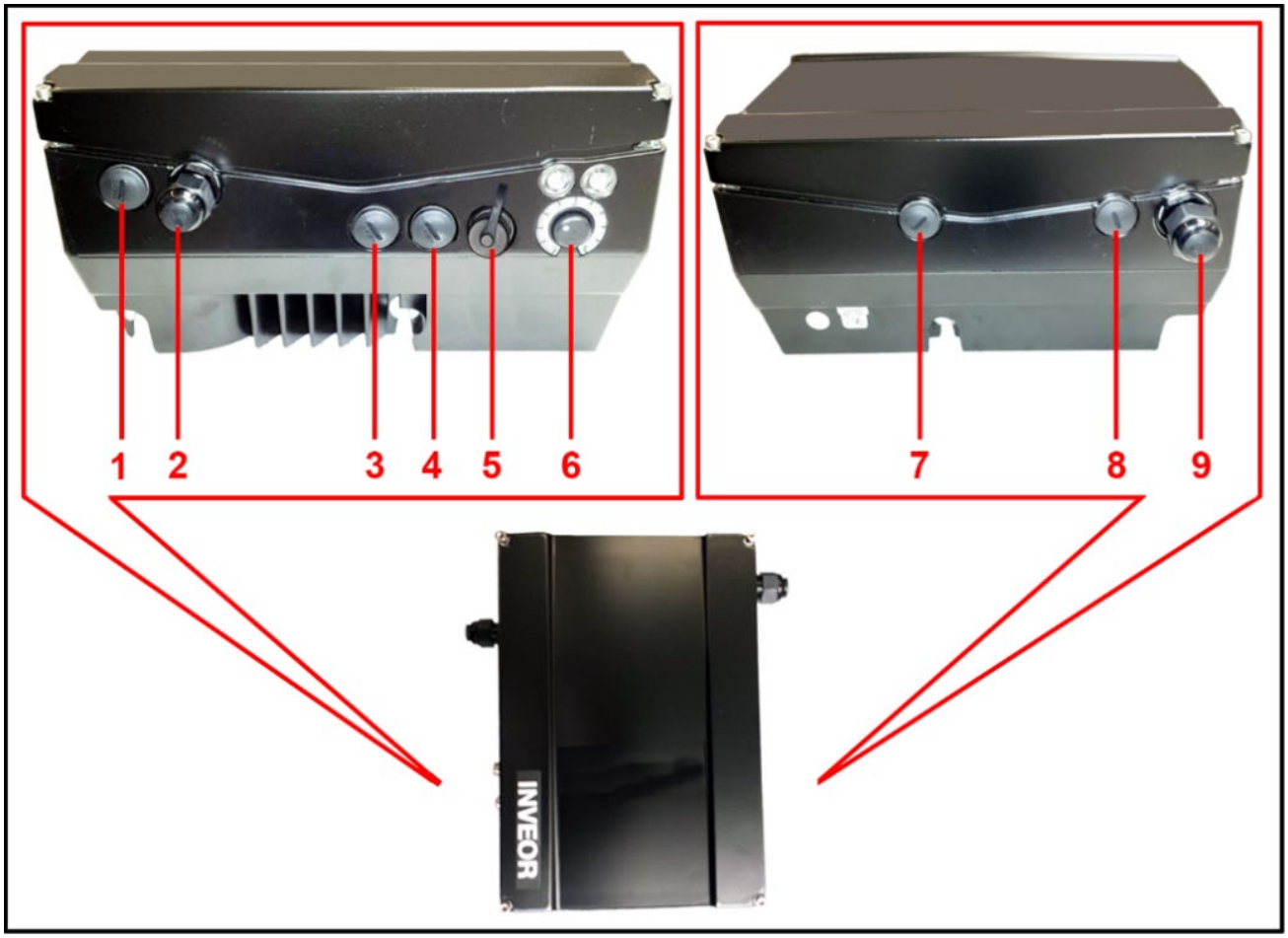


Fig.: 4 Sizes B - C "Modbus" connections

Sizes B - C "Modbus" connections	
1	Blind plug STO (install EMC screw connection supplied in the package)
2	Control line
3	Blind plug
4	Blind plug
5	MMI / Modbus
6	Potentiometer
7	Blind plug STO (install EMC screw connection supplied in the package)
8	Blind plug STO (install EMC screw connection supplied in the package)
9	Grid connection

Size D

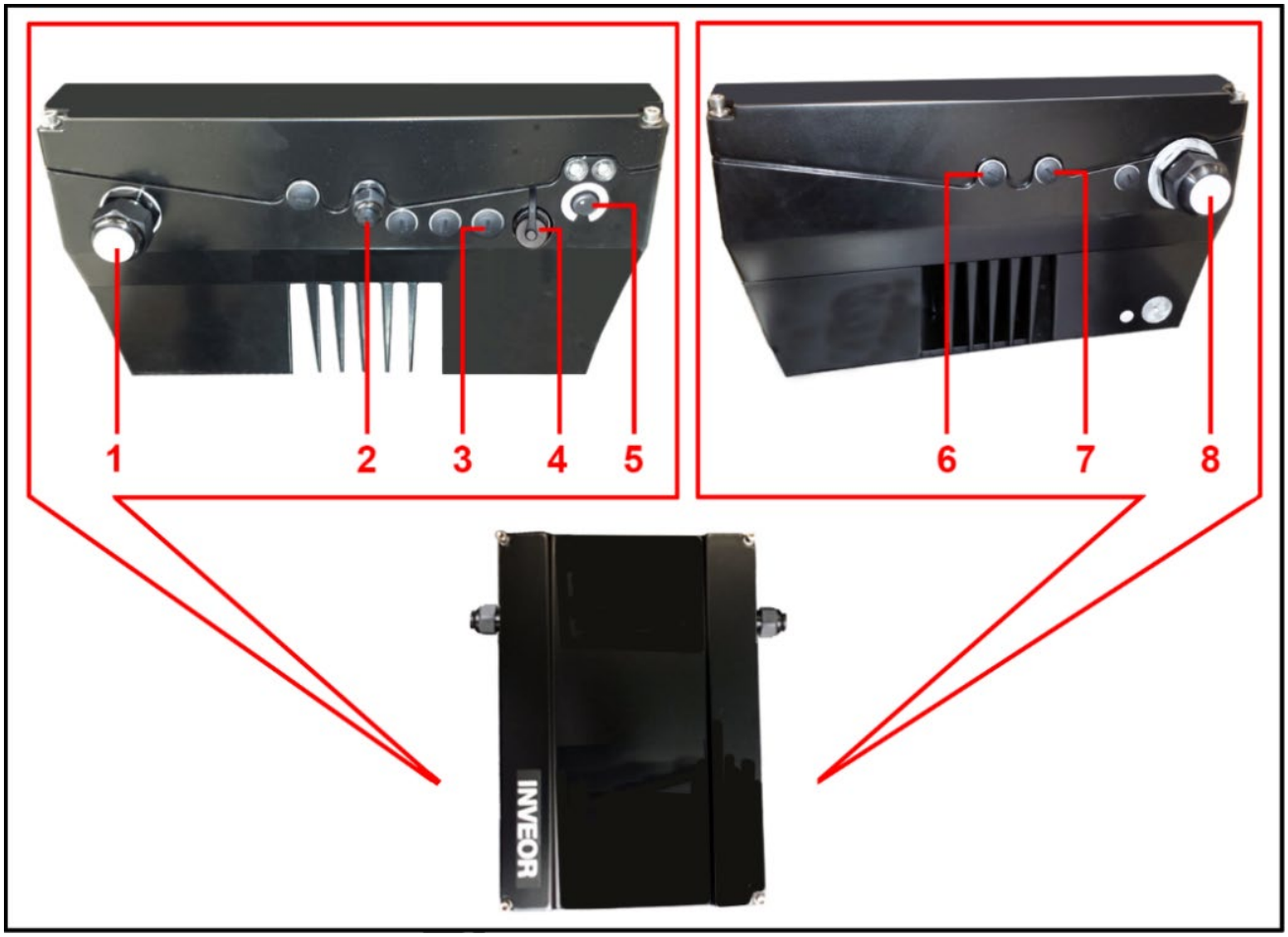


Fig.: 5 Size D "Modbus" connections

Size D "Modbus" connections	
1	Cable screw connection with blind plug
2	Control line
3	Blind plug
4	MMI / Modbus
5	Potentiometer
6	Blind plug STO (install EMC screw connection supplied in the package)
7	Blind plug STO (install EMC screw connection supplied in the package)
8	Grid connection

2.4.2 Pin assignment for interfaces

Pin assignment on device side of M12 socket for Modbus:

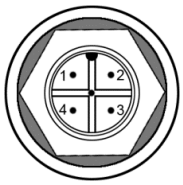
Pin no.	Assignment	Socket
1	24 V	
2	RS 485 - A	
3	GND	
4	RS 485 - B	
Housing	Shielding	

Fig. 6: Round plug connector, 4-pin, M12, A-coded for Modbus fieldbus

> **IMPORTANT INFORMATION**
>
> The 24 V on pin 1 is output by the INVEOR, to supply the MMI handheld controller, for example.
>
> The 24 V must not be connected to the other 24 V bus participants in a Modbus network.

2.4.3 Cable

The following points should be observed when wiring:

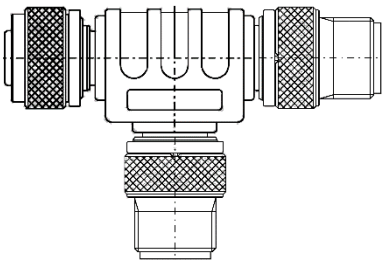
- Lay bus and power cables as far apart as possible (min. 30 cm),
- If cables do cross, an angle of 90° should be observed if possible.
- Depending on how cables are laid, cable length, set baud rate and ambient conditions, shielded cables may have to be used.

2.5 Software components

The INVEOR drive controller can be parameterised using the INVERTERpc tool and MMI (see operating manual) as well as using the Modbus master.

3. Installation

The fieldbus line is exclusively connected via an M12 T-splitter found on the front of the M12 connection socket.



M12 T-splitter

Article no.
10272829

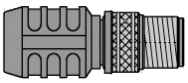
The following Modbus M12 T-splitter can be used:

- M12 T-splitter

  M12 plug on plug and socket / RS485 / 4-pin / A-coded
  J FKM4-FSM4-FSM4, 8008139

> **IMPORTANT INFORMATION**
>
> The 24 V on pin 1 is output by the INVEOR, to supply the MMI handheld controller, for example.
>
> The 24 V must not be connected to the other 24 V bus participants in a Modbus network.

A terminating resistor must be installed at both ends of the Modbus.



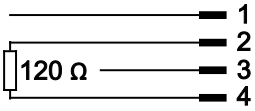
Terminating resistor

Article no.
10343387

The following Modbus M12 terminating resistor can be used:

- M12 terminating resistor 120 Ohm

  M12 plug / RS485 / 5-pin / A-coded
  INVZUB – L/TE/RS/M12M/-/-/A/-/-



Terminating resistor plug assignment

3.1 Configuration of the drive controller for Modbus

In order for the drive controller to be controlled by Modbus, the following basic parameters must be set using the INVERTERpc tool:

- Set parameter 6.064 RS485 type (RS485 bus type) to Modbus "1"
- Set parameter 1.130 (target value source) to Modbus "4"
- Set parameter 1.131 (target value approval) to Modbus "7"

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

6,051	SAS / Modbus baud rate		Unit:	
Relationship to parameter	Parameter manual: P. xy	Transfer status: 2	min. 0 max.: 8 def.: 2	own value (to be entered)
	Configuration of the Modbus baud rate: 0 = 9600 1 = 19200 2 = 38400 3 = 57600 4 = 115200 5 = 600 6 = 1200 7 = 2400 8 = 4800			

6,065	Modbus configuration		Unit:	
Relationship to parameter	Parameter manual: P. xy	Transfer status: 2	min. 0 max.: 7 def.: 0	own value (to be entered)
	Configuration of the Modbus bus: 0 = 8 Bits, Even Parity, 1 Stop Bit, 16 Bit, Big Endian 1 = 8 Bits, No Parity, 2 Stop Bit, 16 Bit, Big Endian 2 = 8 Bits, No Parity, 1 Stop Bit, 16 Bit, Big Endian 3 = 8 Bits, Odd Parity, 1 Stop Bit, 16 Bit, Big Endian 4 = 8 Bits, Even Parity, 1 Stop Bit, 32 Bit, Big Endian 5 = 8 Bits, No Parity, 2 Stop Bit, 32 Bit, Big Endian 6 = 8 Bits, No Parity, 1 Stop Bit, 32 Bit, Big Endian 7 = 8 Bits, Odd Parity, 1 Stop Bit 32 Bit, Big Endian			

3.2 INVEOR bus address

In order for an INVEOR to be clearly recognised in a Modbus system, it must be assigned an address.
The assignment can take place by setting parameter 6.050 "SAS/ Modbus address".
Use INVERTERpc for the parameterisation.

6,050	SAS / Modbus address		Unit:	
Relationship to parameter	Parameter manual: P. xy	Transfer status: 0	min. 0 max.: 247 def.: 0	own value (to be entered)
	Selection of the Modbus address			

IMPORTANT INFORMATION

The address of an INVEOR must lie within the range from 1 to 247.

4. Accessing data via Modbus

Accessing data via Modbus is purely acyclic and can be undertaken with 16-bit / 32-bit access.

The 16-bit or 32-bit data width can be set via parameter 6.065 "Modbus configuration".

In the INVEOR a distinction is made between In/Out process data and parameters.

The process data sent from the Modbus master to the INVEOR drive controller is known as "Process data In".

The process data sent from the INVEOR drive controller to the Modbus master is known as "Process data Out".

4.1 Process data

4.1.1 Process data Out: Status word / actual frequency

The status word and actual frequency can be read by the Modbus master.
Both values can be read individually and together.

Example 1:

16-bit data width, read the actual frequency:
Read at address 2000, 1 register (1 x 16-bit)

Example 2:

16-bit data width, read the status word and actual frequency:
Read at address 1999, 2 register (2 x 16-bit)

Example 3:

32-bit data width, read the status word and actual frequency:
Read at address 3999, 4 register (4 x 16-bit)

16-bit access:

Address	Data type	Designation	Unit	Description
1999	WORD*	Status word	-	See structure of status word 4.1.2
2000	WORD	Actual frequency	Hz	Signed 16-bit standardised to 0.1 Hz/digit

Tab.: 1 Addresses of process values Out 16-bit

32-bit access:

Address	Data type	Designation	Unit	Description
3999	DWORD*	Status word	-	See structure of status word 4.1.2
4001	REAL***	Actual frequency	Hz	

Tab.: 2 Addresses of process values Out 32-bit

* WORD data type corresponds to INT16 = 2 bytes
** DWORD data type corresponds to UINT32 = 4 bytes
***REAL data type corresponds to = 4 bytes

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.

4.1.2 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	-	-
	0	-	
12	1	-	-
	0	-	
13	1	-	-
	0	-	
14	1	-	
	0	-	-
15	1	-	
	0		

Tab.: 3 INVEOR status word

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

4.1.3 Further process data Out

Further "Process data Out" is available as of start address 999 (16-bit access) and/or as of address 1999 (32-bit access).

The following tables contain the process data Out available.

Please note that 1 register must be read for the 16-bit data width and 2 registers for the 32-bit data width!

INFORMATION

With the 32-bit data width, all process data Out is of the "REAL" data type.

With the 16-bit data width, all process data Out is of the "INT16" data type (values standardised to the maximum value)

e.g. reading the supply voltage (address 1005)

Maximum 1000 V
Read 14261

$$\frac{14261}{2^{15}} \text{ x } 1000 \text{ V} = 435{,}2 \text{ V}$$

e.g. reading out a negative actual frequency (address 999)

Maximum 400 Hz
read -2458

$$\frac{-2458}{2^{15}} \text{ x } 400 \text{ Hz} = -30 \text{ Hz}$$

16-bit access:

Address	Data type	Designation	Unit	Maximum	Description
999	REAL	Actual frequency	Hz	400 Hz	
1000	REAL	Output voltage	V	1000 V	Motor voltage
1001	REAL	Motor current	A	100 A	
1002	REAL	IGBT temperature	° C	200 °C	
1003	REAL	Intermediate circuit voltage	V	1000 V	
1004	REAL	Target frequency value	Hz	400 Hz	
1005	WORD	Grid voltage	V	1000 V	Input voltage
1006	WORD	Intermediate circuit current	A	100 A	
1007	WORD	Inner temperature	° C	200 °C	FC inner temperature
1008	WORD	Incremental encoder speed	Hz	400 Hz	only with encoder option
1009	t.b.d.	Incremental encoder position			only with encoder option
1010	WORD	Application error, low word	1		Bit-coded
1011	WORD	Application error, high word	1		Bit-coded
1012	WORD	Power error, low word	1		Bit-coded
1013	WORD	Power error, high word	1		Bit-coded
1014	WORD	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
1015	WORD	Analogue In 1	V	10.0	Analogue input 1 application
1016	WORD	Analogue In 2	V	10.0	Analogue input 2 application
1017	WORD	F_target ramp	Hz		Frequency target value behind ramp
1018	WORD	F_target	Hz		Frequency target value of target value source
1019	WORD	PID actual value	%	100.0	Actual value of PID process controller
1020	WORD	PID target value	%	100.0	Target value of PID process controller
1021	WORD	Analogue Out 1	V	10.0	Analogue Out 1
1022	WORD	Intermediate circuit power	W	50000.0	Intermediate circuit power
1023	WORD	Reserved	-		Reserved
1024	WORD	Reserved	-		Reserved
1025	WORD	Reserved	-		Reserved

Address	Data type	Designation	Unit	Maximum	Description
1026	WORD	Reserved	-		Reserved
1027	WORD	Reserved	-		Reserved
1028	WORD	BUS/Soft PLC status word	1		BUS/Soft PLC status word
1029	WORD	Speed	rpm	20000	Motor shaft speed
1030	WORD	Torque	Nm	200.0	Torque
1031	WORD	Electric motor rating	W	25000.0	Electric motor rating
1032	WORD	Customised output variable 1, low word	1		Virtual DigOuts of the soft PLC
1033	WORD	Customised output variable 1, high word	1		Virtual DigOuts of the soft PLC
1034	WORD	Customised output variable 2	1	10000	Customised soft PLC output variable
1035	WORD	Customised output variable 3	1	10000	Customised soft PLC output variable
1036	WORD	Customised output variable 4	1	10000	Customised soft PLC output variable
1037	WORD	Operating time in hours	1		Operating time in hours
1038	WORD	Power On cycles	1		Power On cycles
1039	WORD	Electric energy kWh	kWh	32767	Total electric energy
1040	WORD	Status of outputs (DigOut 1 + 2, relays 1 + 2)			Status of outputs: Bit 0 = Dig Out 1 Bit 1 = Dig Out 2 Bit 2 = Relay 1 Bit 3 = Relay 2 Bit 4 = Virt Out 1
1041	WORD	Appl. (current) error, low word	1		Bit-coded
1042	WORD	Appl. (current) error, high word	1		Bit-coded
1043	WORD	Power (current) error, low word	1		Bit-coded
1044	WORD	Power (current) error, high word	1		Bit-coded

Tab.: 4 Process data Out 16-bit

*Data type WORD corresponds to INT16

32-bit access:

Address	Data type	Designation	Unit	Description
1999	REAL	Actual frequency	Hz	
2001	REAL	Output voltage	V	Motor voltage
2003	REAL	Motor current	A	
2005	REAL	IGBT temperature	° C	
2007	REAL	Intermediate circuit voltage	V	
2009	REAL	Target frequency value	Hz	
2011	REAL	Grid voltage	V	Input voltage
2013	REAL	Intermediate circuit current	A	
2015	REAL	Inner temperature	° C	FC inner temperature
2017	REAL	Incremental encoder speed	Hz	only with encoder option
2019	t.b.d.	Incremental encoder position		only with encoder option

Address	Data type	Designation	Unit	Description
2021	DWORD*	Application error	1	Bit-coded
2025	DWORD	Power error	1	Bit-coded
2029	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
2031	REAL	Analogue In 1	V	Analogue input 1 application
2033	REAL	Analogue In 2	V	Analogue input 2 application
2035	REAL	F_target ramp	Hz	Frequency target value behind ramp
2037	REAL	F_target	Hz	Frequency target value of target value source
2039	REAL	PID actual value	%	Actual value of PID process controller
2041	REAL	PID target value	%	Target value of PID process controller
2043	REAL	Analogue Out 1	V	Analogue Out 1
2045	REAL	Intermediate circuit power	W	Intermediate circuit power
2047	REAL	Reserved	-	Reserved
2049	REAL	Reserved	-	Reserved
2051	REAL	Reserved	-	Reserved
2053	REAL	Reserved	-	Reserved
2055	REAL	Reserved	-	Reserved
2057	DWORD	BUS/Soft PLC status word	1	BUS/Soft PLC status word
2059	REAL	Speed	rpm	Motor shaft speed
2061	REAL	Torque	Nm	Torque
2063	REAL	Electric motor rating	W	Electric motor rating
2067	WORD	Customised output variable 1	1	Customised soft PLC output variable
2069	REAL	Customised output variable 2	1	Customised soft PLC output variable
2071	REAL	Customised output variable 3	1	Customised soft PLC output variable
2073	REAL	Customised output variable 4	1	Customised soft PLC output variable
2075	DWORD	Operating time in seconds	1	Operating time in seconds
2077	DWORD	Power On cycles	1	Power On cycles
2079	REAL	Electric energy Wh	Wh	Total electric energy
2081	DWORD	Status of outputs (DigOut 1 + 2, relays 1 + 2)		Status of outputs: Bit 0 = Dig Out 1 Bit 1 = Dig Out 2 Bit 2 = Relay 1 Bit 3 = Relay 2 Bit 4 = Virt Out 1
2083	DWORD*	Application error (at present)	1	Bit-coded
2087	DWORD	Power error (at present)	1	Bit-coded

Tab.: 5 Process data Out 32-bit

4.2 Process data In control word / nominal frequency

The control word and nominal frequency can be transferred by the Modbus master.
The two values can be written individually and together.

Example 1:
16-bit data width, write the nominal frequency:
Write at address 2002, 1 register (1 x 16-bit)

Example 2:
16-bit data width, write the control word and nominal frequency:
Write at address 2001, 2 register (2 x 16-bit)

Example 3:
32-bit data width, write the control word and nominal frequency:
Write at address 4003, 4 register (4 x 16-bit)

16-bit access:

Address	Data type	Designation	Unit	Description
2001	WORD*	Control word	-	See structure of control word 4.2.1
2002	WORD	Nominal frequency	Hz	Signed 16-bit standardised to 0.1 Hz/digit e.g. 15 Hz = value 150

Tab.: 6 Addresses of process values In 16-bit

IMPORTANT INFORMATION

With PID control

PID target value % = $\frac{Value\ x\ F_{Max}}{10}$

IMPORTANT INFORMATION

The target value is only accepted if bit 6 (target value enabled) and bit 10 (control from automation device) is set. Otherwise the target value is rejected.

32-bit access:

Address	Data type	Designation	Unit	Description
4003	DWORD*	Control word	-	See structure of control word 4.2.1
4005	REAL***	Nominal frequency	%	100 % = maximum frequency

Tab.: 7 Addresses of process values In 32-bit

IMPORTANT INFORMATION

The target value is only accepted if bit 6 (target value enabled) and bit 10 (control from automation device) is set. Otherwise the target value is rejected.

* WORD data type corresponds to INT16 = 2 bytes
** DWORD data type corresponds to UINT32 = 4 bytes
***REAL data type corresponds to = 4 bytes

4.2.1 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) and bit 10 (control from automation device) 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*	ON 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	-	-
	0	-	-
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	-	-
	0	-	-
9	1	-	-
	0	-	-
10	1*	Control from AG	Management via interface, control word valid
	0		Control word is rejected
11	1	-	-
	0		
12	1	-	-
	0		
13	1	-	-
	0		
14	1	-	-
	0		
15	1	-	-
	0		

Tab.: 8 Control word

*** Operating condition**

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.

4.2.2 Further process data IN

Further process data In is available as of start address 1049 (16-bit access) and/or as of address 2099 (32-bit access).

The following tables contain the process data In available.

Please note that 1 register must be written for the 16-bit data width and 2 registers for the 32-bit data width!

INFORMATION

With the 32-bit data width, all process data In is of the "REAL" data type.

With the 16-bit data width, all process data In is of the "INT16" data type (values standardised to the maximum value)

e.g. adaptation of customised input variable 2 (address 1053) to 800

Maximum 10000 $\frac{800}{10000} x\ 2^{15}$ = 2621

16-bit access:

Address	Data type	Designation	Unit	Maximum	Description
1049	WORD*	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)
1050	WORD	Analogue Out 1	V	10.0	Control of analogue output
1051	WORD	Customised input variable 1, low word	1		Customised input variable soft PLC (32 bit)
1052	WORD	Customised input variable 1, high word	1		Customised input variable soft PLC (32 bit)
1053	WORD	Customised input variable 2 / PID actual value	-	10000	Customised input variable soft PLC
1054	WORD	Customised input variable 3	-	10000	Customised input variable soft PLC
1055	WORD	Customised input variable 4	-	10000	Customised input variable soft PLC

32-bit access:

Address	Data type	Designation	Unit	Maximum	Description
2099	DWORD*	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)
2101	REAL	Analogue Out 1	V	10.0	Control of analogue output
2103	DWORD	Customised input variable 1	1		Customised input variable soft PLC (32 bit)
2107	REAL	Customised input variable 2 / PID actual value	-	10000	Customised input variable soft PLC
2109	REAL	Customised input variable 3	-	10000	Customised input variable soft PLC
2111	REAL	Customised input variable 4	-	10000	Customised input variable soft PLC

Tab.: 9 Addresses of process data In 32-bit

* DWORD data type corresponds to UINT32 = 4 bytes

4.3 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.

4.3.1 Parameters

The following parameters can be accessed for reading and writing.

IMPORTANT INFORMATION

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

INFORMATION

With the 32-bit data width, all parameters are of the "REAL" data type.

With the 16-bit data width, all parameters In are of the "INT16" data type (values standardised to the maximum value)

e.g. adaptation of maximum frequency (address 3000) to 75 Hz

Maximum 400 Hz $\frac{75\ \mathrm{Hz}}{400\ Hz}\ x\ 2^{15}$ = 6144

IMPORTANT INFORMATION

The data below is listed sorted in ascending order by "Number*".

Modbus		INVEOR parameter					
16-bit	32-bit	Number*	Accepted	Name in German	Minimum	Maximum	Unit
2999	5999	1,020	2: Always	Minimum frequency	0	400	Hz
3000	6001	1,021	2: Always	Maximum frequency	5	400	Hz
3002	6005	1,050	2: Always	Deceleration time 1	0.1	1000	s
3003	6007	1,051	2: Always	Run up time 1	0.1	1000	s
3047	6095	1,052	2: Always	Deceleration time 2	0.1	1000	s
3048	6097	1,053	2: Always	Run up time 2	0.1	1000	s
3049	6099	1,054	2: Always	Ramp selection	0	9	
3171	6343	1,088	2: Always	Deceleration time 3	0.1	1000	s
3007	6015	1,100	2: Always	Operating mode	0	3	
3004	6009	1,130	2: Always	Target value source	0	10	
3006	6013	1,131	2: Always	Target value approval	0	16	
3080	6161	1,132	2: Always	Start protection	0	8	
3040	6081	1,150	2: Always	Rotation direction	0	16	
3052	6105	1,180	2: Always	Acknowledge function	0	7	
3053	6107	1,181	2: Always	Auto acknowledgement	0	1000	s
3108	6217	1,182	2: Always	Auto ackn. no.	0	500	
3054	6109	2.050	2: Always	Fixed frequency mode	0	4	
3008	6017	2,051	2: Always	Fixed frequency 1	-400	400	Hz
3009	6019	2,052	2: Always	Fixed frequency 2	-400	400	Hz
3010	6021	2,053	2: Always	Fixed frequency 3	-400	400	Hz
3011	6023	2,054	2: Always	Fixed frequency 4	-400	400	Hz
3012	6025	2,055	2: Always	Fixed frequency 5	-400	400	Hz
3013	6027	2,056	2: Always	Fixed frequency 6	-400	400	Hz
3014	6029	2,057	2: Always	Fixed frequency 7	-400	400	Hz
3138	6277	2,150	2: Always	MOP digital in.	0	8	
3050	6101	2,151	2: Always	MOP step range	0	100	%
3140	6281	2,152	2: Always	MOP step time	0.02	1000	s
3139	6279	2,153	2: Always	MOP react. Time	0.02	1000	s
3141	6283	2,154	2: Always	MOP reference memory	0	1	
3036	6073	3,050	2: Always	PID-P amplific.	0	100	
3037	6075	3,051	2: Always	PID-I amplific.	0	100	1/s
3038	6077	3,052	2: Always	PID-D amplific.	0	100	s
3005	6011	3,060	2: Always	PID actual value	0	3	
3081	6163	3,061	2: Always	PID inverted	0	1	
3082	6165	3,062	2: Always	PID fixed nominal value 1	0	100	%
3126	6253	3,063	2: Always	PID fixed nominal value 2	0	100	%
3127	6255	3,064	2: Always	PID fixed nominal value 3	0	100	%

Modbus		INVEOR parameter					
16-bit	32-bit	Number*	Accepted	Name in German	Minimum	Maximum	Unit
3128	6257	3,065	2: Always	PID fixed nominal value 4	0	100	%
3129	6259	3,066	2: Always	PID fixed nominal value 5	0	100	%
3130	6261	3,067	2: Always	PID fixed nominal value 6	0	100	%
3131	6263	3,068	2: Always	PID fixed nominal value 7	0	100	%
3132	6265	3,069	2: Always	PID fixed nominal mod	0	2	
3083	6167	3,070	2: Always	PID standby time	0	1000	s
3084	6169	3,071	2: Always	PID standby hyst.	0	50	%
3165	6331	3,072	2: Always	PID dry. Time	0	32767	s
3168	6337	3,073	2: Always	PID target value min	0	100	%
3169	6339	3,074	2: Always	PID target value max	0	100	%
3024	6049	4,020	2: Always	AI1 input type	1	2	
3025	6051	4,021	2: Always	AI1 standard. Low	0	100	%
3026	6053	4,022	2: Always	AI1 standard. High	0	100	%
3022	6045	4,023	2: Always	AI1 dead time	0	100	%
3021	6043	4,024	2: Always	AI1 filter time	0.02	1	s
3018	6037	4,030	2: Always	AI1 function	0	1	
3102	6205	4,033	2: Always	AI1-phys unit	0	10	
3103	6207	4,034	2: Always	AI1 phys min	-10000	10000	%
3104	6209	4,035	2: Always	AI1 phys max	-10000	10000	%
3166	6333	4,036	2: Always	AI1 wire break time	0	32767	s
3033	6067	4,050	2: Always	AI2 input type	1	2	
3034	6069	4,051	2: Always	AI2 standard Low	0	100	%
3035	6071	4,052	2: Always	AI2 standard High	0	100	%
3031	6063	4,053	2: Always	AI2 dead time	0	100	%
3030	6061	4,054	2: Always	AI2 filter time	0.02	1	s
3027	6055	4,060	2: Always	AI2 function	0	1	
3105	6211	4,063	2: Always	AI2-phys unit	0	10	
3106	6213	4,064	2: Always	AI2 phys min	-10000	10000	%
3107	6215	4,065	2: Always	AI2 phys max	-10000	10000	%
3167	6335	4,066	2: Always	AI2 wire break time	0	32767	s
3041	6083	4,100	2: Always	AO1 function	0	40	
3042	6085	4,101	2: Always	AO1 standard Low	-32767	32767	
3079	6159	4,102	2: Always	AO1 standard high	-32767	32767	
3119	6239	4,110	2: Always	DI1 inverted	0	1	

Modbus		INVEOR parameter					
16-bit	32-bit	Number*	Accepted	Name in German	Minimum	Maximum	Unit
3120	6241	4,111	2: Always	DI2 inverted	0	1	
3121	6243	4,112	2: Always	DI3 inverted	0	1	
3122	6245	4,113	2: Always	DI4 inverted	0	1	
3055	6111	4,150	2: Always	DO1 function	0	60	
3056	6113	4,151	2: Always	DO1 on	-32767	32767	
3057	6115	4,152	2: Always	DO1 off	-32767	32767	
3058	6117	4,170	2: Always	DO2 function	0	60	
3059	6119	4,171	2: Always	DO2 on	-32767	32767	
3060	6121	4,172	2: Always	DO2 off	-32767	32767	
3061	6123	4,190	2: Always	Rel.1 function	0	60	
3062	6125	4,191	2: Always	Relay 1 on	-32767	32767	
3063	6127	4,192	2: Always	Relay 1 off	-32767	32767	
3093	6187	4,193	2: Always	Relay 1 on delay	0	10000	s
3094	6189	4,194	2: Always	Relay 1 off delay	0	10000	s
3064	6129	4,210	2: Always	Relay 2 function	0	60	
3065	6131	4,211	2: Always	Relay 2 on	-32767	32767	
3066	6133	4,212	2: Always	Relay 2 off	-32767	32767	
3095	6161	4,213	2: Always	Relay 2 on delay	0	10000	s
3096	6193	4,214	2: Always	Relay 2 off delay	0	10000	s
3159	6319	4,230	2: Always	VO function	0	60	
3160	6321	4,231	2: Always	VO on	-10000	10000	
3161	6323	4,232	2: Always	VO off	-10000	10000	
3162	6325	4,233	2: Always	VO on delay	0	32767	s
3163	6327	4,234	2: Always	VO off delay	0	32767	s
3123	6247	5,010	2: Always	External fault 1	0	7	
3124	6249	5,011	2: Always	External fault 2	0	7	
3085	6171	5,070	2: Always	Motor current limit %	0	250	%
3086	6173	5,071	2: Always	Motor current limit s	0	100	s
3155	6311	5,075	2: Always	Gearbox factor	0	1000	
3110	6221	5,080	2: Always	Blocking detection	0	1	
3153	6307	5,081	2: Always	Block.time	1	50	s
3170	6341	5,082	2: Always	Start-up error_current	0	1	
3137	6275	5,090	2: Always	Par.set change	0	12	
3069	6139	5,100	2: Always	Techn.param.1	-9999999	9999999	
3070	6141	5,101	2: Always	Techn.param.2	-9999999	9999999	
3071	6143	5,102	2: Always	Techn.param.3	-9999999	9999999	
3072	6145	5,103	2: Always	Techn.param.4	-9999999	9999999	
3073	6147	5,104	2: Always	Techn.param.5	-9999999	9999999	
3074	6149	5,105	2: Always	Techn.param.6	-9999999	9999999	

Modbus		INVEOR parameter					
16-bit	32-bit	Number*	Accepted	Name in German	Minimum	Maximum	Unit
3075	6151	5,106	2: Always	Techn.param.7	-9999999	9999999	
3076	6153	5,107	2: Always	Techn.param.8	-9999999	9999999	
3077	6155	5,108	2: Always	Techn.param.9	-9999999	9999999	
3078	6157	5,109	2: Always	Techn.param.10	-9999999	9999999	
3143	6287	5,110	2: Always	Techn.param.11	-32768	32767	
3144	6289	5,111	2: Always	Techn.param.12	-32768	32767	
3145	6291	5,112	2: Always	Techn.param.13	-32768	32767	
3146	6293	5,113	2: Always	Techn.param.14	-32768	32767	
3147	6295	5,114	2: Always	Techn.param.15	-32768	32767	
3148	6297	5,115	2: Always	Techn.param.16	-32768	32767	
3149	6299	5,116	2: Always	Techn.param.17	-32768	32767	
3150	6301	5,117	2: Always	Techn.param.18	-32768	32767	
3151	6303	5,118	2: Always	Techn.param.19	-32768	32767	
3152	6305	5,119	2: Always	Techn.param.20	-32768	32767	
3097	6195	6,050	2: Always	SAS/ SPF adr	0	31	
3109	6219	6,051	2: Always	SAS baud rate	0	3	
3098	6197	6,060	0: Commissioning	Fieldbus address	0	127	
3099	6199	6,061	0: Commissioning	Fieldbus baud rate	0	8	
3101	6203	6,062	2: Always	Bus time-out	0	100	s
3175	6351	6,066	2: Always	Status word Bits 4/5	0	1	
3156	6313	6,070	2: Always	Target/actual value dev.	0	100	%
3157	6315	6,071	2: Always	Tolerance range	0	32767	s
3158	6317	6,072	2: Always	Target comp. value	0	400	Hz
3111	6223	6,080	2: Always	Process data Out 3	0	49	
3112	6225	6,081	2: Always	Process data Out 4	0	49	
3113	6227	6,082	2: Always	Process data Out 5	0	49	
3114	6229	6,083	2: Always	Process data Out 6	0	49	
3328	6657	33,034	1: Ready	Motor speed	0	80000	rpm
3329	6659	33,035	1: Ready	Motor frequency	10	400	Hz
3370	6741	33,050	1: Ready	Stator resistance	0	100	Ohm
3372	6745	33,105	1: Ready	Scatter inductivity	0	1	H
3115	6231	6,084	2: Always	Process data Out 7	0	49	
3116	6233	6,085	2: Always	Process data Out 8	0	49	
3117	6235	6,086	2: Always	Process data Out 9	0	49	
3118	6237	6,087	2: Always	Process data Out 10	0	49	
3133	6267	6,110	2: Always	Process data In 3	0	10	
3134	6269	6,111	2: Always	Process data In 4	0	10	

Modbus		INVEOR parameter					
16-bit	32-bit	Number*	Accepted	Name in German	Minimum	Maximum	Unit
3135	6271	6,112	2: Always	Process data In 5	0	10	
3136	6273	6,113	2: Always	Process data In 6	0	10	
3357	6715	32,100	0: Commissioning	Output power PM	0	1100	W
3367	6735	33,001	1: Ready	Type of motor	1	2	
3355	6711	33,010	2: Always	I2T fact. motor	0	1000	%
3339	6679	33,011	2: Always	I2T time	0	1200	s
3387	6775	33,015	1: Ready	R optimisation	0	200	%
3402	6805	33,016	1: Ready	Motor phase monitoring	0	1	
3325	6651	33,031	1: Ready	Motor current	0	150	A
3326	6653	33,032	1: Ready	Motor rating	50	55000	W
3323	6647	33,110	1: Ready	Motor voltage	0	1500	V
3327	6655	33,111	1: Ready	Motor cos phi	0.5	1	
3380	6761	33,138	2: Always	Holding current time	0	3600	s
3371	6743	33,200	1: Ready	Stator induc.	0	1	H
3384	6769	33,201	1: Ready	Nominal flux	0	10000	mVs
3366	6733	34,010	1: Ready	Control method	100	299	
3340	6681	34,011	1: Ready	Type of encoder	0	2	1
3341	6683	34,012	1: Ready	Encoder line count	0	10000	1
4442	8885	34,013	2: Always	Encoder offset	-360	360	°
3386	6773	34,020	2: Always	Flying restart	0	1	
3385	6771	34,021	2: Always	Catch time	0	10000	ms
3263	6527	34,030	2: Always	Switching frequency	1	4	
3376	6753	34,090	2: Always	Speed controller Kp	1	10000	mA/rad/s
3377	6755	34,091	2: Always	Speed controller Tn	0	10	s
3368	6737	34,110	2: Always	Slip trimmer	0	1.5	
3393	6787	34,120	2: Always	Quadr. characteristic curve	0	1	
3394	6789	34,121	2: Always	Flux adjustment	10	100	%
3369	6739	34,130	2: Always	Control reserve voltage	0	3	
3392	6785	34,225	1: Ready	Field weaken.PMSM	0	1	
3391	6783	34,226	2: Always	PMSM start-up current	5	1000	%
3398	6797	34,227	1: Ready	PMSM init. time	0	100	s
3395	6791	34,228	1: Ready	PMSM start-up procedure	0	1	
3396	6793	34,229	1: Ready	PMSM start-up ramp	0.1	1000	s
3397	6795	34,230	1: Ready	Start-up frequency P	5	400	Hz
3375	6751	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 Fehler! Verweisquelle konnte nicht gefunden werden. "Fehler! Verweisquelle konnte nicht gefunden werden.**").**

5.1 Application side error word

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.: 10 Application error word

5.2 Power side error word

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.: 11 Power error word

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