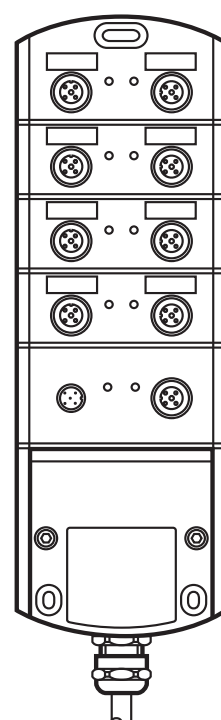




Device manual
Output module
CompactModule Metal
CR2031

UK



Contents

1 Preliminary note	3
2 Safety instructions	3
3 Function and features	4
4 Function	4
5 Mounting	5
6 Electrical connection	6
6.1 M12 sockets	6
6.2 Tightening torque of the cover screws (terminal chamber)	6
6.3 M16 cable gland	6
6.4 Definition of short-circuit and overload protection	6
6.5 CAGE CLAMP ® connection technology	7
6.6 Types of connection and fuses	7
6.7 Examples types of connection	8
7 Set-up	9
7.1 PLC configuration in CODESYS 2.3	9
7.2 PLC configuration in CODESYS 3.5	10
7.2.1 Heartbeat configuration	10
7.2.2 SyncMonitoring	11
7.3 Electronic Data Sheet	11
8 Parameter setting	12
8.1 Parameter list	12
9 Programming	14
9.1 General	14
9.2 Programming function	14
9.3 Data structures	15
9.3.1 Function CR2031	16
9.3.2 Data structure CR2031 ConfigStruct	17
9.3.3 Data structure: CR2031 InOutStruct	18
10 Technical data	20
11 Fault correction	24
11.1 EMCY Object	24
12 Object directory	25
12.1 Manufacturer Specific Profile Area; index 2000 to 5FFF	25
12.2 Communication Profile Area; index 1000 to 1FFF	27
13 Maintenance, repair and disposal	30
14 Declaration of conformity	31
15 Terms and abbreviations	31

1 Preliminary note

Technical data, approvals, accessories and further information at www.ifm.com.

► Instructions

→ Cross-reference



Important note

Non-compliance may result in malfunction or interference.



Information

Supplementary note.

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2 Safety instructions

This description is part of the unit. It contains texts and drawings concerning the correct handling of the module and must be read before installation or use.

Observe the information of the description. Non-observance of the notes, operation which is not in accordance with use as prescribed below, wrong installation or handling can result in serious harm concerning the safety of persons and plant.

The instructions are for authorised persons according to the EMC and low voltage guidelines. The unit must be installed and commissioned by a skilled electrician (programmer or service technician). The device may only be installed, connected and commissioned by qualified personnel.

Disconnect the device externally before doing any work on it. If necessary, also disconnect separately supplied output load circuits.

If the unit is not supplied by the mobile on-board system (12/24 V battery operation) it must be ensured that the external voltage is generated and supplied according to the criteria for safety extra-low voltage (SELV) as this is supplied without further measures to the connected controller, the sensors, and the actuators.

The wiring of all signals in connection with the SELV circuit of the unit must also comply with the SELV criteria (safe extra-low voltage, safe electrical separation from other electric circuits).

If the supplied SELV voltage has an external connection to ground (SELV becomes PELV) the responsibility lies with the user and the respective national regulations for installation must be complied with. All statements in these operating instructions refer to the unit the SELV voltage of which is not grounded.

The terminals may only be supplied with the signals indicated in the technical data or on the unit label and only the approved accessories of ifm electronic may be connected.

The unit can be operated within a wide temperature range according to the technical specification indicated below. Due to the additional self-heating the housing walls can have high perceptible temperatures when touched in hot environments.

In case of malfunctions or uncertainties please contact the manufacturer. Tampering with the unit can lead to considerable risks for the safety of persons and plant. It is not permitted and leads to the exclusion of any liability and warranty claims.

3 Function and features

The CR2031 I/O module enables decentralised triggering of actuators and proportional valves. The coil current can be monitored and controlled via the integrated current measurement.

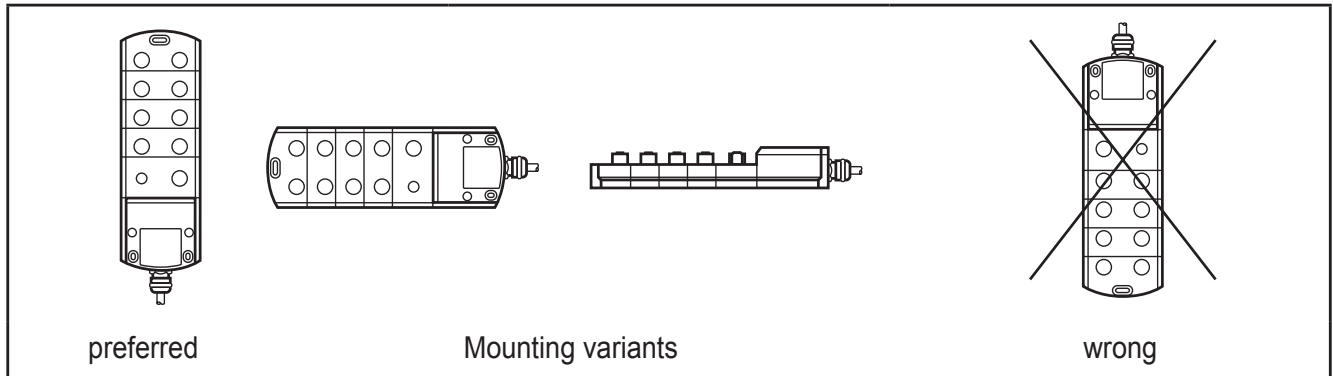
4 Function

- The module supports binary/analogue outputs and is therefore classified in the device profile "I/O module" to CiA DS 401.
- As regards the output functions, the module can be configured and it supports the following functions:
 - binary outputs with/without current detection; up to 4 A
 - PWM outputs with/without current detection; up to 4 A
 - current-controlled PWM outputs, up to 4 A
 - selectable current measuring range 0...1 A or 0...4 A.
- There are 1 server SDO and the 3 default PDOs to CiA DS 401. The PDO mapping cannot be changed (static PDO mapping). The default identifiers are assigned according to the "predefined connection set".
- The COB IDs of the PDOs as well as the transmission type (synch / asynch) of the individual PDOs can be configured.
- The module expects a synch object. The CAN identifier of the synch object can be configured.
- The module supports "node guarding" and "heartbeat". The "guard time", the "life time factor" and the "heartbeat time" can be configured. When there are no heartbeat or node guarding signals, the outputs are automatically switched off by the operating system.
- The module generates an emergency object. The COB ID of the EMCY object can be configured.
- The module stores the last error.
The error code of the corresponding emergency object is stored.
- The module supports a reset function, i.e. assignment of the parameters to the factory default values* upon request.
- The CR2031 I/O module is not approved for safety-relevant tasks in the field of safety of persons.

*) factory default values → 8.1 Parameter list.

5 Mounting

To protect the module against mechanical stress it must be mounted so that it lies completely flat on an even mounting surface. To do so, three cylinder screws with hexagon socket (M5 x L) to DIN 912 or DIN 7984 must be used.



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To avoid contact corrosion between the mounting screws and the module housing, do not use any stainless steel screws or nickel-plated screws! In very corrosive environments such as extremely salty air, we recommend to use screws with surface finishing on a zinc/nickel basis with thick-film passivation and sealing. For normal corrosive requirements zinc-plated screws are sufficient.

6 Electrical connection



To guarantee the electrical interference protection of the module, the housing must be connected to GND (e.g. to the ground of the vehicle).



Due to the maximum operating temperature of 85 °C and the internal heating of the unit, the respective minimum rated temperature of the connection cable must be taken into account.

6.1 M12 sockets

- ▶ Use sockets with gold-plated contacts.
- ▶ Use protective caps (supplied) for unconnected connectors of the I/O module.

6.2 Tightening torque of the cover screws (terminal chamber)

To close the terminal chamber the cover screws are tightened with a tightening torque of 1.2 Nm.

6.3 M16 cable gland

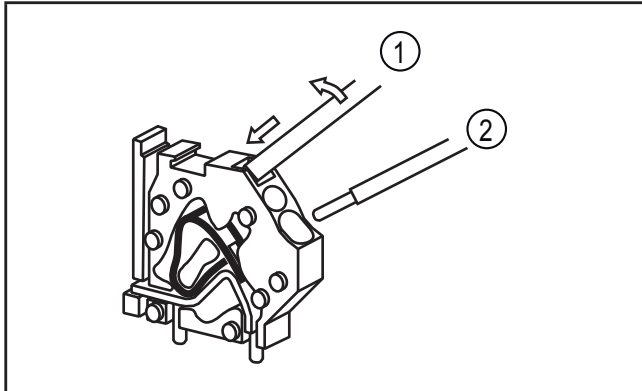
Use a suitable cable to ensure ingress resistance of the M16 cable gland.

If the M12 connectors are used for the device supply and CAN connection, close the terminal chamber with the supplied M16 cover plug (remove the cable gland and insert the M16 cover plug).

6.4 Definition of short-circuit and overload protection

- Short-circuit test:
All outputs must withstand a short-circuit current limited to 60 A flowing between output and ground (GND) or supply voltage (+VBB).
Test duration: 3 minutes
- Overload test:
Outputs must not be destroyed by a 100 % overload.
(e.g. nominal switching current $I_N = 4\text{ A} \rightarrow 100\% \text{ overload} = 8\text{ A}$)
Test duration: 5 minutes

6.5 CAGE CLAMP ® connection technology



- 1: Screwdriver
2: Wire

- ▶ Insert screw driver and tilt slightly.
- > Spring opens.
- ▶ Insert wire.
- ▶ Remove screw driver.
- > Spring closes.

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6.6 Types of connection and fuses

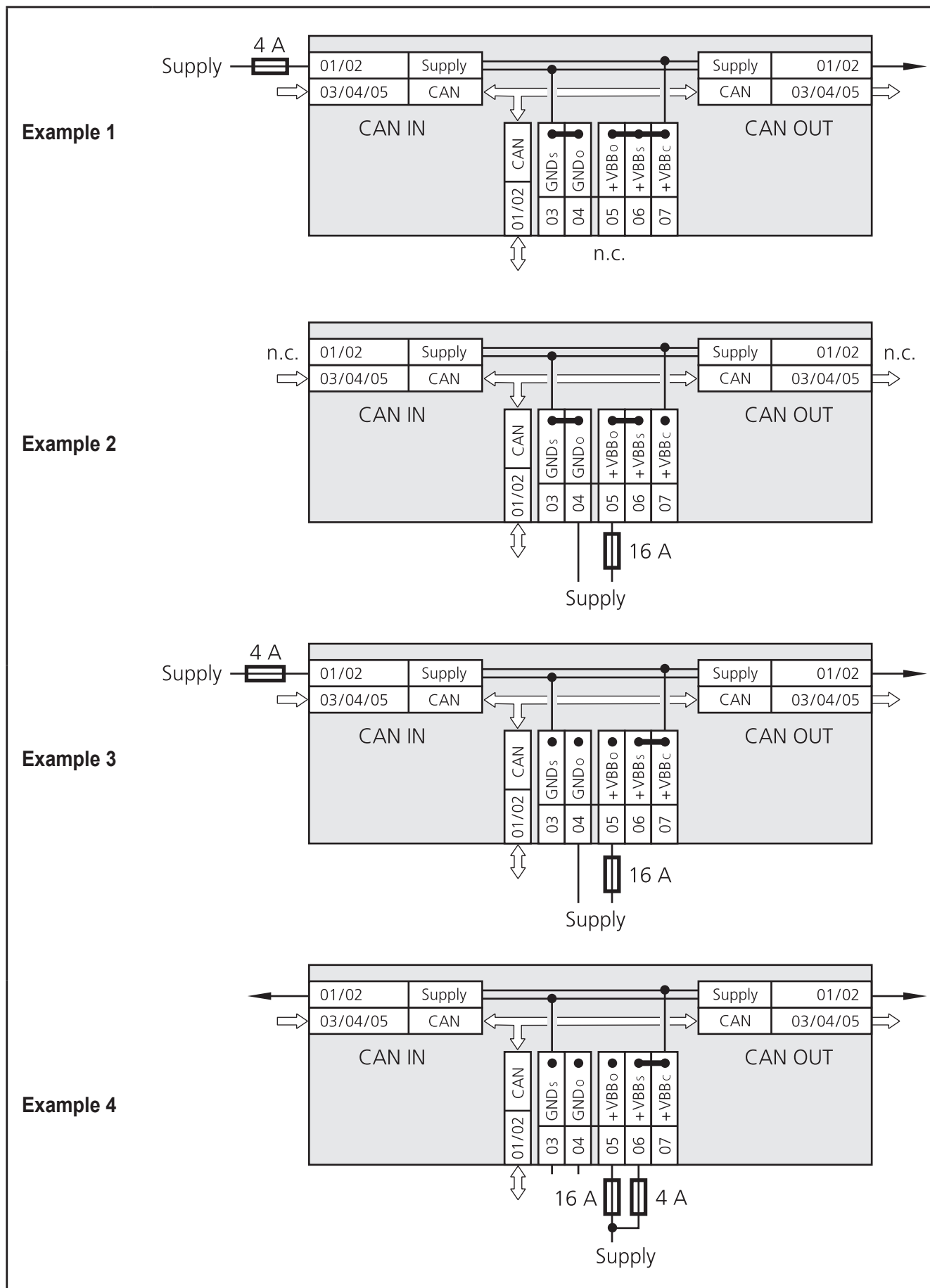
To protect the whole system (wiring and module) the individual electric circuits are to be protected using fuses according to the type of connection and jumper settings. The M12 plugs are designed for max. 4 A, the clamps for max. 16 A.

Example	Connection (→ 6.7)	Jumpers	Fuse
1	Supply via M12 CANin/CANout plug	3+4 / 5+6+7	4 A
2	Supply via clamps 3+4 / 5+6 16 A (not via M12 CANin/CANout plug)	3+4 / 5+6	16 A
3	Separate supply via clamps and M12 CANin/CANout plug	6+7	16 A 4 A
4	Supply via clamps (via M12 CANin/CANout plug)	6+7	16 A 4 A



Note: Do not use examples 3 and 4 with the I/O modules CR2032 and CR2033 in one supply line.

6.7 Examples types of connection

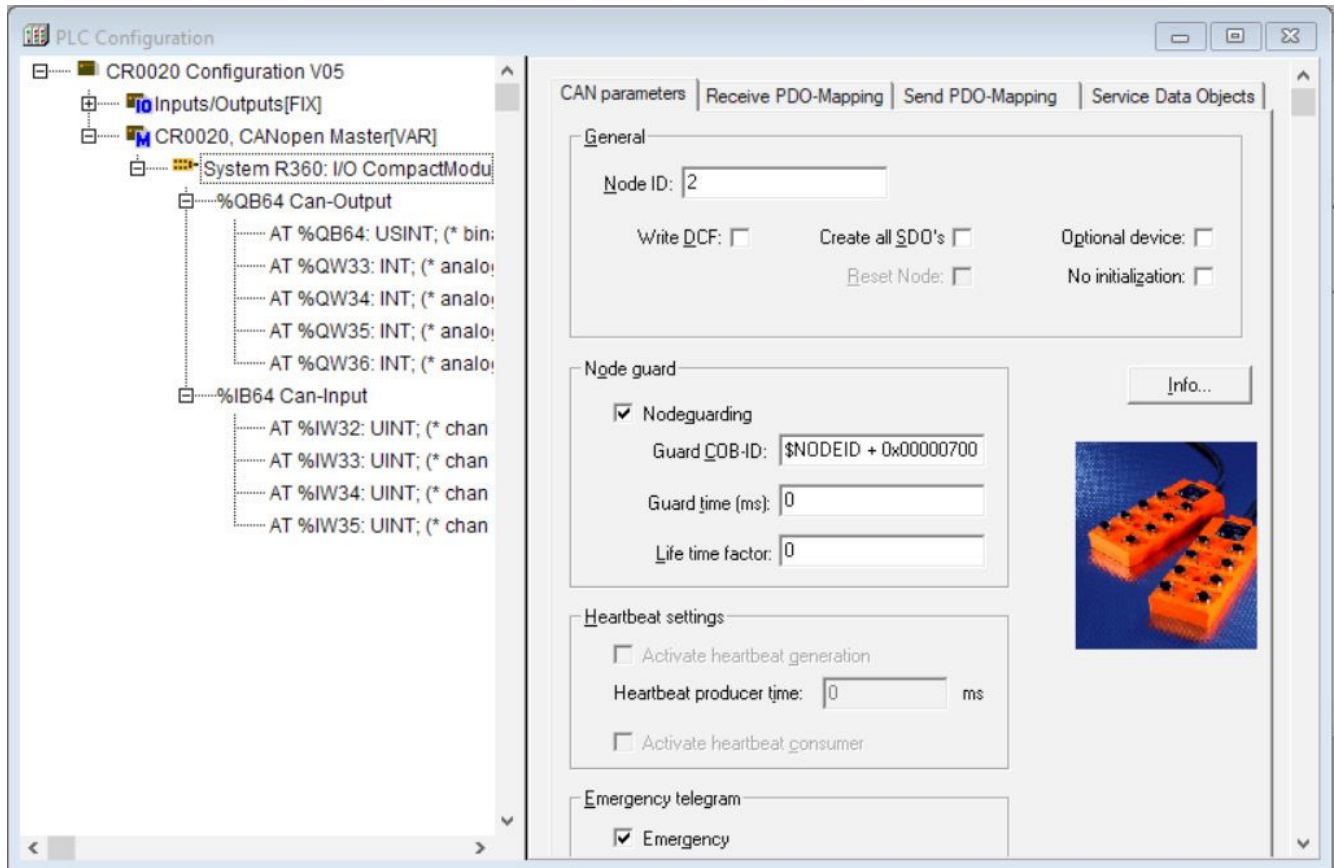


—●— = jumper inserted

7 Set-up

7.1 PLC configuration in CODESYS 2.3

Parameter setting of the device functions and of the CAN interface is directly done from the application programmed with CODESYS 2.3. To do so, the "Electronic Data Sheet" (EDS) is integrated via the CODESYS PLC configuration.



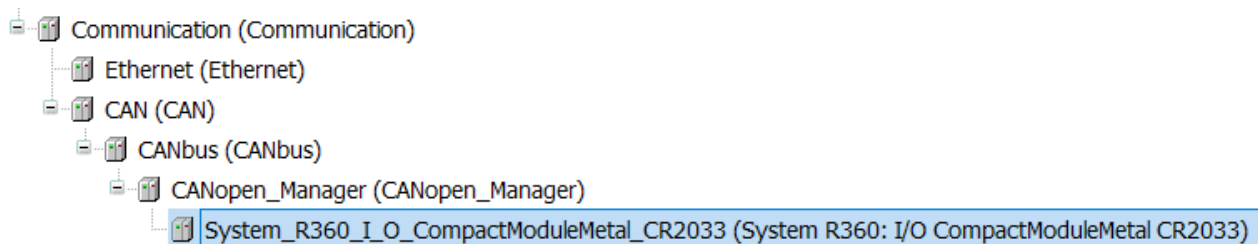
CODESYS dialogue "PLC configuration" (example)

For a description of the setting and application of the "PLC configuration" dialogue see the CODESYS manual and the CODESYS online help.

7.2 PLC configuration in CODESYS 3.5

The "Electronic Data Sheet" (EDS) is installed in the [Device Repository]. Proceed as follows in the main menu:

- ▶ Click on [Tools] / [Device Repository].
 - ▶ Select [Fieldbuses] / [CiA CANopen] / [CiA Remote Device] and click on [Install].
 - ▶ Select EDS file and click on [Open].
- > In CODESYS 3.5 the devices are integrated as CiA remote devices in the device tree under a [CANopen_Manager] element.



The CANopen communication is configured via the CODESYS configuration editor.

7.2.1 Heartbeat configuration

The function [Reset Node] must be activated on the tab [General] so that the device applies the parameters set for heartbeat monitoring of the CANopen Manager.

General

Node ID: 1 SDO Channels (1/1 active) **CANopen**

☒ Enable Expert Settings ☐ Optional Device

☐ Enable Sync Producing ☐ No Initialisation ☐ Reset Node: Sub:001

▲ **Nodeguarding**

☐ Enable Nodeguarding ☒ Enable Heartbeat Producing

Guard Time (ms): 0 Producer Time (ms): 200

Life Time Factor: 0 **Heartbeat Consuming (1/1 active)**

▲ **Emergency**

☒ Enable Emergency

COB-ID: \$NODEID+16#80

▲ **TIME**

☐ Enable TIME Producing

COB-ID (Hex): 16# 100

☐ Enable TIME Consuming

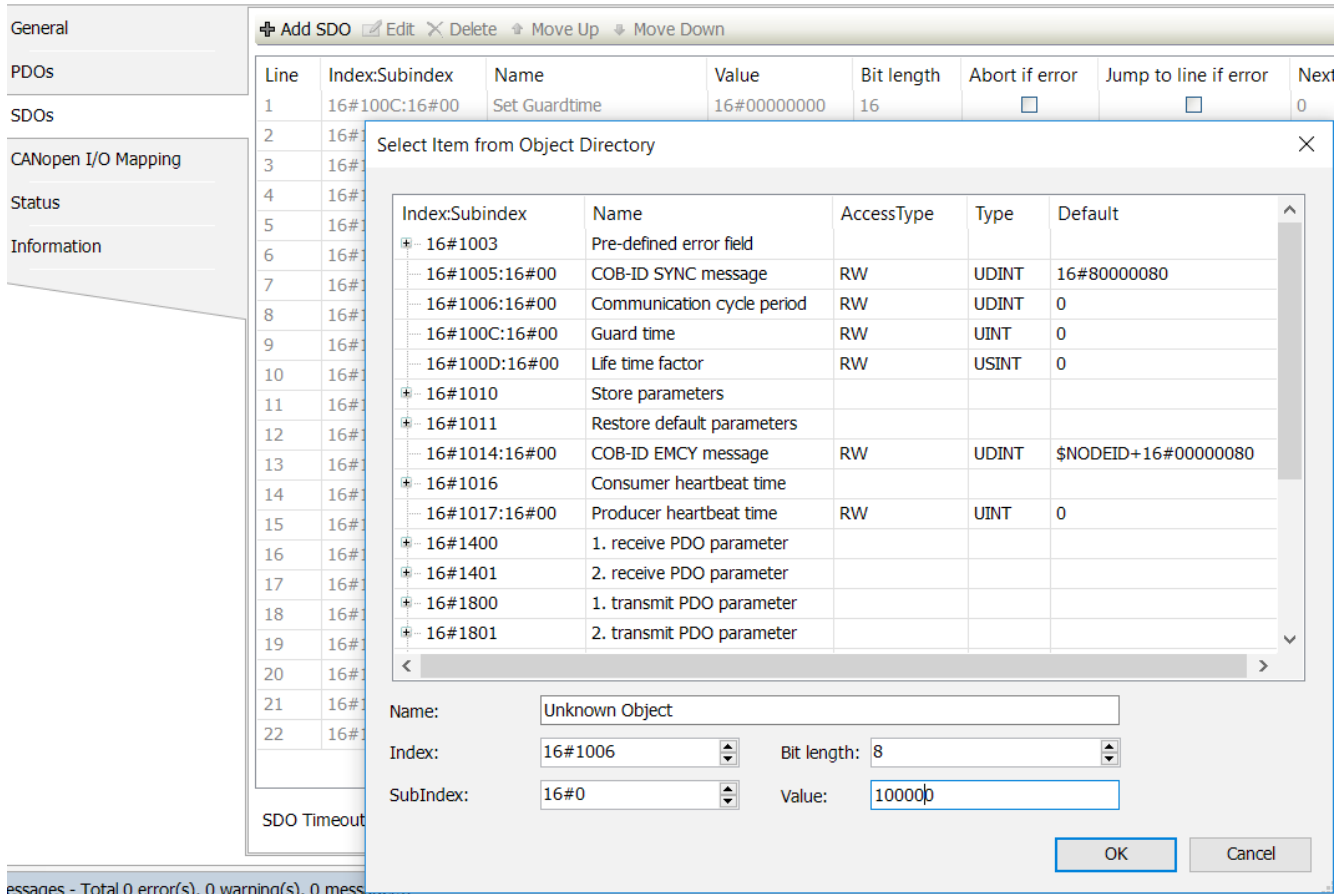
▲ **Checks at Startup**

☒ Check Vendor ID ☐ Check Product Number ☐ Check Revision Number

7.2.2 SyncMonitoring

To activate the device-internal monitoring of the Sync cycle, the monitoring time has to be written into the object directory entry 0x1006. This is possible by supplementing the SDO list in the CANopen configurator or during the operating time via the function block COP_SDOWrite.

The monitoring time is indicated in microseconds [μ s].



The screenshot shows the CANopen configurator interface. On the left, the 'General' tab is selected, and the 'SDOs' section is expanded. The main window displays a table of SDOs. A dialog box titled 'Select Item from Object Directory' is open, showing a list of objects. The object 16#1006:16#00, 'Communication cycle period', is selected. Below the list, the 'Name' field is set to 'Unknown Object', the 'Index' is 16#1006, the 'SubIndex' is 16#0, and the 'Value' is 10000. The 'Bit length' is 8. The 'OK' button is highlighted.

Line	Index:Subindex	Name	Value	Bit length	Abort if error	Jump to line if error	Next
1	16#100C:16#00	Set Guardtime	16#00000000	16	<input type="checkbox"/>	<input type="checkbox"/>	0
2	16#100D:16#00	Life time factor	0	16	<input type="checkbox"/>	<input type="checkbox"/>	0
3	16#100E:16#00	Store parameters		16	<input type="checkbox"/>	<input type="checkbox"/>	0
4	16#100F:16#00	Restore default parameters		16	<input type="checkbox"/>	<input type="checkbox"/>	0
5	16#1010:16#00	COB-ID SYNC message	16#80000080	16	<input type="checkbox"/>	<input type="checkbox"/>	0
6	16#1011:16#00	Communication cycle period	0	16	<input type="checkbox"/>	<input type="checkbox"/>	0
7	16#1012:16#00	Guard time	0	16	<input type="checkbox"/>	<input type="checkbox"/>	0
8	16#1013:16#00	Life time factor	0	16	<input type="checkbox"/>	<input type="checkbox"/>	0
9	16#1014:16#00	COB-ID EMCY message	\$NODEID+16#00000080	16	<input type="checkbox"/>	<input type="checkbox"/>	0
10	16#1015:16#00	Consumer heartbeat time	0	16	<input type="checkbox"/>	<input type="checkbox"/>	0
11	16#1016:16#00	Producer heartbeat time	0	16	<input type="checkbox"/>	<input type="checkbox"/>	0
12	16#1017:16#00	1. receive PDO parameter		16	<input type="checkbox"/>	<input type="checkbox"/>	0
13	16#1018:16#00	2. receive PDO parameter		16	<input type="checkbox"/>	<input type="checkbox"/>	0
14	16#1019:16#00	1. transmit PDO parameter		16	<input type="checkbox"/>	<input type="checkbox"/>	0
15	16#1020:16#00	2. transmit PDO parameter		16	<input type="checkbox"/>	<input type="checkbox"/>	0
16	16#1021:16#00			16	<input type="checkbox"/>	<input type="checkbox"/>	0
17	16#1022:16#00			16	<input type="checkbox"/>	<input type="checkbox"/>	0
18	16#1023:16#00			16	<input type="checkbox"/>	<input type="checkbox"/>	0
19	16#1024:16#00			16	<input type="checkbox"/>	<input type="checkbox"/>	0
20	16#1025:16#00			16	<input type="checkbox"/>	<input type="checkbox"/>	0
21	16#1026:16#00			16	<input type="checkbox"/>	<input type="checkbox"/>	0
22	16#1027:16#00			16	<input type="checkbox"/>	<input type="checkbox"/>	0

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7.3 Electronic Data Sheet

The EDS contains the description of all parameters and I/O data of the device in a format defined by CANopen. The EDS files are provided for all CANopen slaves by ifm electronic.

The EDS files are available at www.ifm.com.

8 Parameter setting

Automatic saving of the communication and unit parameters can be activated or deactivated by means of the "save all parameters" entry (→ 12 Object directory, index 1010). When the value 0x02 is entered into Sldx 01, all parameters are automatically saved if changes were made.

With the value 0x00 there is no automatic saving, i.e. changed parameters will only be valid until the unit is switched off or until the next reset is made.

With the function "restore" (→ 12 Object directory, index 1011) the parameters (except the baud rate and the node ID) can be assigned to the factory default values. With the next power on they become valid.

Control characteristics (index 2004...7)

The current control behaviour can be parameterised separately for each channel pair in the P and I values. For each of the 4 output pairs the max. load current [mA] has to be indicated. By means of this value the respective measuring range (1 A or 4 A) is automatically selected.

8.1 Parameter list

Parameter	Index in object directory	Default (factory preset)	Change automatically saved	Change effective
Manufacturer Specific Profile Area; index 2000 to 5FFF				
I/O Configuration	2000	binary outputs	adjustable	after PreOp
PWM Frequency	2001	0x64 (100 Hz)	adjustable	after PreOp
Control parameters (P/I values, max. current)				
Channel 1/2	2004	--	adjustable	after PreOp
Channel 3/4	2005	--	adjustable	after PreOp
Channel 5/6	2006	--	adjustable	after PreOp
Channel 7/8	2007	--	adjustable	after PreOp
Node ID *)	20F0, 20F1	0x20 (0d32)	yes	after a reset
Baud rate *)	20F2, 20F3	0x04 (125 Kbits/s)	yes	after a reset
Communication Profile Area; Index 1000 to 1FFF				
COB ID Synch Objekt	1005	0x80	adjustable	after a reset
Communication Cycle	1006	0x00 (Off)	adjustable	immediately
Guard Time	100C	0x00 (Off)	adjustable	immediately
Life Time Factor	100D	0x00	adjustable	immediately
Save Parameter	1010	0x02 (AutoSave ON)	yes	immediately
COB ID EMCY	1014	0x80 + Node ID	adjustable	after a reset
Consumer Heartbeat time	1016	0x00 (Off)	adjustable	immediately
Producer Heartbeat time	1017	0x00 (Off)	adjustable	immediately

Parameter	Index in object directory	Default (factory preset)	Change automatically saved	Change effective
COB ID Rec PDO 1	1400 01	0x200 + Node ID	adjustable	after a reset
Trans Type Rec PDO 1	1400 02	0x01 (synchronous)	adjustable	immediately
COB ID Rec PDO 2	1401 01	0x300 + Node ID	adjustable	after a reset
Trans Type Rec PDO 2	1401 02	0x01 (synchronous)	adjustable	immediately
COB ID Trans PDO 1	1800 01	0x180 + Node ID	adjustable	after a reset
Trans Type Trans PDO 1	1800 02	0x01 (synchronous)	adjustable	immediately
Event Timer Trans PDO1	1800 05	0x00	adjustable	immediately

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The life time factor 0 is interpreted as 1.

The first guard protocol is assessed as "start guarding" even if guarding is not active at this time (guard time = 0).

*) Observe the position of the hex-code switch!

Entries in the object directory are only valid if the hex-code switches for baud rate (S1) and/or node ID (S2, S3) are in the position "F". (For position and coding of the hex-code switches see connecting and operating elements → 10 Technical data)

Explanation of the abbreviations:

0x...= hexadecimal number
 0b...= binary value
 0d...= decimal numerical value

str = string
 rw = read-write
 ro = read only
 u8 = unsigned 8 bit
 u16 = unsigned 16 bit

9 Programming

9.1 General

The I/O module must be initialised as CANopen slave with the CANopen start functions "COP_MSTR_BOOTUP" and "COP_MSTR_MAIN" by the R 360 master and set to the state "OPERATIONAL" (LED "PWR" flashes, 2 Hz).

9.2 Programming function

If the function "CR2031" is integrated into the program, this automatically ensures a continuous updating of the I/O data in the controller. The function "CR2031" is in the library "CR2031_x.lib" of the programming software CODESYS.

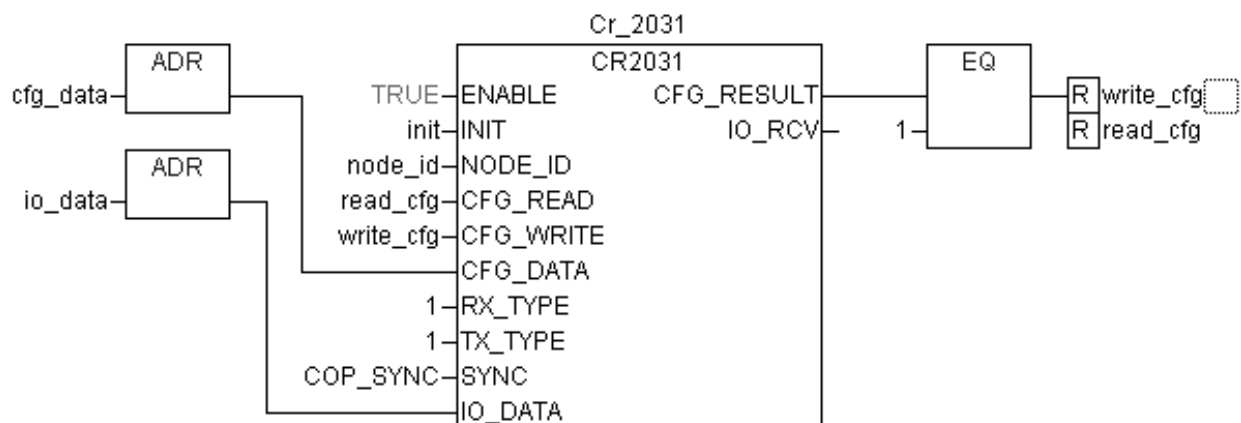
If no configuration data are transferred to the I/O module, the device operates with the default values set at the factory.

Before commissioning change the node ID of the I/O module set at the factory, if necessary. Check whether the baud rate of the master and that of the module are identical or set accordingly (also see notes on hex-code switch → 8.1).

Default values:	Switch position
baud rate = 0x04 (= 125 Kbits/s)	S1 = "F"
node ID = 0x20 (= 0d32)	S2, S3 = "F"

With FUNCTION CR2031

1. the configuration is transferred TO the CR2031 via structurevariable `cfg_data` IF `write_cfg` is TRUE.
2. the I/O data OF the CR2031 are read OR written via the structurevariable `io_data`.
3. the current configuration is read via structurevariable `cfg_data` OF the CR2031 IF `read_cfg` is TRUE.

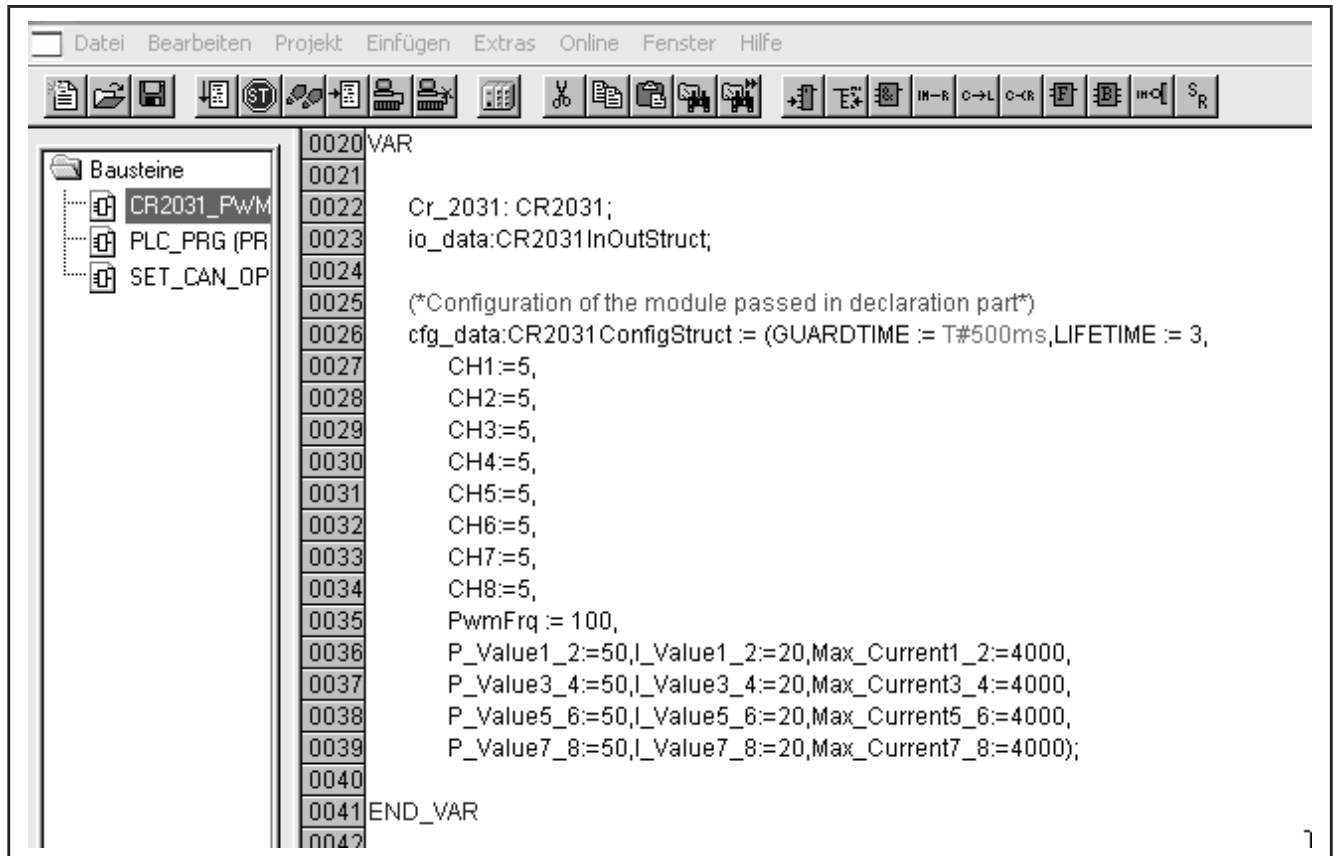


Screen shot of the CODESYS programming platform

9.3 Data structures

The CR2031 configuration and I/O data are transferred via data structures. The structure as well as other variable types must be declared in the declaration part. For configuration data the declaration part can already contain an assignment of values.

In the program access to a structure component can be represented as follows:



Screen shot of the CODESYS programming platform



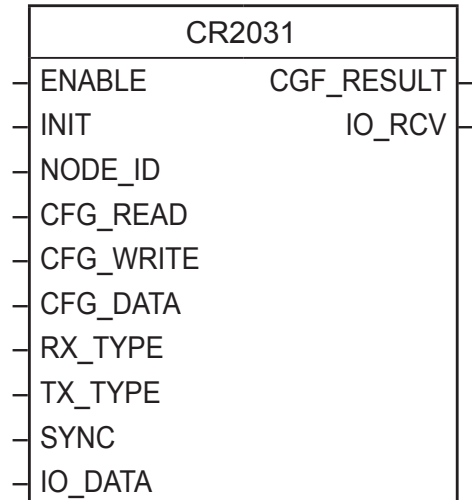
More programming examples of the I/O module can be obtained from ifm electronic upon request.

9.3.1 Function CR2031

Function: CR2031

Library: CR2031_x.lib

Purpose: Sets parameters and reads the configuration and I/O data of the input/output module CR2031



Parameter:

Name	Data type	Description
Inputs		
ENABLE	BOOL	TRUE: function processing
INIT	BOOL	TRUE: function initialisation FALSE: cyclical function call
NODE_ID	BYTE	Node identifier
CFG_READ	BOOL	TRUE: read the current configuration of the I/O module
CFG_WRITE	BOOL	TRUE: write the current configuration of the I/O module
CFG_DATA	DWORD	Address of the configuration data (data structure)
RX_TYPE	BYTE	Receive transmission type (default = 0; synch acyclic)
TX_TYPE	BYTE	Transmit Transmission Type (default = 1; synch cyclic)
SYNC	BOOL	CANopen synchronisation cycle (system variable COB_SYNC)
IO_DATA	DWORD	Address of the input/output data (data structure)
Ausgänge		
CGF_RESULT	BYTE	1 = configuration read or written successfully 2 = configuration not yet read or written 3 = configuration cannot be read or written (missing or incorrect node ID or faulty device)
IO_RCV	BOOL	TRUE: for one cycle if new data were transmitted



If not described otherwise, a "FALSE" signal with boolean data types is always the negation of the described "TRUE" signal.

9.3.2 Data structure CR2031 ConfigStruct

Data structure: CR2031 ConfigStruct

Purpose: Parameter and configuration data can be written or read. The data structure is assigned to the function input "CFG_DATA" via the ADR operator.

```

TYPE CR2031 ConfigStruct
STRUCT
    GUARDTIME: TIME;
    LIFETIME: BYTE;
    Ch1: BYTE;          (*2000/1*)  (*0,2,4,5*)
    Ch2: BYTE;          (*2000/2*)  (*0,2,4,5*)
    Ch3: BYTE;          (*2000/3*)  (*0,2,4,5*)
    Ch4: BYTE;          (*2000/4*)  (*0,2,4,5*)
    Ch5: BYTE;          (*2000/5*)  (*0,2,4,5*)
    Ch6: BYTE;          (*2000/6*)  (*0,2,4,5*)
    Ch7: BYTE;          (*2000/7*)  (*0,2,4,5*)
    Ch8: BYTE;          (*2000/8*)  (*0,2,4,5*)
    PwmFrq: BYTE;       (*2001/0*)
    P_Value1_2: BYTE;   (*2004/1*)
    I_Value1_2: BYTE;   (*2004/2*)
    Max_Current1_2: WORD; (*2004/3*)
    :
    P_Value7_8: BYTE;   (*2007/1*)
    I_Value7_8: BYTE;   (*2007/2*)
    Max_Current7_8: WORD; (*2007/3*)
END_STRUCT
END_TYPE
  
```

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Structure components:

Name	Data type	Description
GUARDTIME	TIME	Guarding time of the module [ms]
LIFETIME	BYTE	Lifetime of the module
Ch1	BYTE	Config. channel 1 0 = disabled (OFF) 2 = binary output * 4 = analogue output (PWM) 5 = analogue output (PWM; current-controlled)
Ch2	BYTE	Config. channel 2 0 = disabled (OFF) 2 = binary output * 4 = analogue output (PWM) 5 = analogue output (PWM; current-controlled)
Ch3	BYTE	Config. channel 3 0 = disabled (OFF) 2 = binary output * 4 = analogue output (PWM) 5 = analogue output (PWM; current-controlled)
⋮	⋮	⋮
Ch8	BYTE	Config. channel 8 0 = disabled (OFF) 2 = binary output * 4 = analogue output (PWM) 5 = analogue output (PWM; current-controlled)
PwmFrq	BYTE	PWM frequency in Hz; 20 to 250 Hz (default 100 Hz)
P_Value1_2	BYTE	P value of the current control function channel pair 1/2 value in % referred to the preset-actual value difference (default 50)

Name	Data type	Description
I_Value1_2	BYTE	I value of the current control function channel pair 1/2 value in % referred to the preset-actual value difference (default 20)
Max_Current1_2	WORD	max. possible load current in mA channel pair 1/2 current at 1000‰ PWM (default 4000 mA)
P_Value3_4	BYTE	P value of the current control function channel pair 3/4 value in % referred to the preset-actual value difference (default 50)
I_Value3_4	BYTE	I value of the current control function channel pair 3/4 value in % referred to the preset-actual value difference (default 20)
Max_Current3_4	WORD	max. possible load current in mA channel pair 3/4 current at 1000‰ PWM (default 4000 mA)
P_Value5_6	BYTE	P value of the current control function channel pair 5/6 value in % referred to the preset-actual value difference (default 50)
I_Value5_6	BYTE	I value of the current control function channel pair 5/6 value in % referred to the preset-actual value difference (default 20)
Max_Current5_6	WORD	max. possible load current in mA channel pair 5/6 current at 1000‰ PWM (default 4000 mA)
P_Value7_8	BYTE	P value of the current control function channel pair 7/8 value in % referred to the preset-actual value difference (default 50)
I_Value7_8	BYTE	I value of the current control function channel pair 7/8 value in % referred to the preset-actual value difference (default 20)
Max_Current7_8	WORD	max. possible load current in mA channel pair 7/8 current at 1000‰ PWM (default 4000 mA)

*) default

**) Mode 5 is only available if connection is made via the outputs with current monitoring (see also wiring → 10 Technical data).

9.3.3 Data structure: CR2031 InOutStruct

Data structure: CR2031 InOutStruct

Purpose: The current I/O data of the module are read or written. The data structure is assigned to the function input "IO_DATA" via the ADR operator.

```

TYPE CR2031 inOutStruct
STRUCT
    BinOut1: BOOL;
    BinOut2: BOOL;
    BinOut3: BOOL;
    BinOut4: BOOL;
    BinOut5: BOOL;
    :
    BinOut8: BOOL;
    AnaOut1_2: INT;
    :
    AnaOut7_8: INT;
    ActCurrent1_2: WORD;
    :
    ActCurrent7_8: WORD;
END_STRUCT
END_TYPE

```

Structure components:

Name	Data type	Description
BinOut1	BOOL	Output status channel 1 (if Ch1 configuration = 2)
BinOut2	BOOL	Output status channel 2 (if Ch2 configuration = 2)
BinOut3	BOOL	Output status channel 3 (if Ch3 configuration = 2)
BinOut4	BOOL	Output status channel 4 (if Ch4 configuration = 2)
BinOut5	BOOL	Output status channel 5 (if Ch5 configuration = 2)
BinOut6	BOOL	Output status channel 6 (if Ch6 configuration = 2)
BinOut7	BOOL	Output status channel 7 (if Ch7 configuration = 2)
BinOut8	BOOL	Output status channel 8 (if Ch8 configuration = 2)
AnaOut1_2	INT	Analogue output value (if Ch1_2 config. = 4 or 5) channel 1 or 2
AnaOut3_4	INT	Analogue output value (if Ch3_4 config. = 4 or 5) channel 3 or 4
AnaOut5_6	INT	Analogue output value (if Ch5_6 config. = 4 or 5) channel 5 or 6
AnaOut7_8	INT	Analogue output value (if Ch7_8 config. = 4 or 5) channel 7 or 8
ActCurrent1_2	WORD	Actual current value [mA], channel 1 or 2
ActCurrent3_4	WORD	Actual current value [mA], channel 3 or 4
ActCurrent5_6	WORD	Actual current value [mA], channel 5 or 6
ActCurrent7_8	WORD	Actual current value [mA], channel 7 or 8

*) The odd-numbered channels 1, 3, 5, 7 are active if the variable contains a positive value.
The even-numbered channels 2, 4, 6, 8 are active if the variable contains a negative value.

**) The actual current value can only be read if connection is made via the outputs with current monitoring (see also wiring → 10 Technical data).

UK

10 Technical data

CR2031

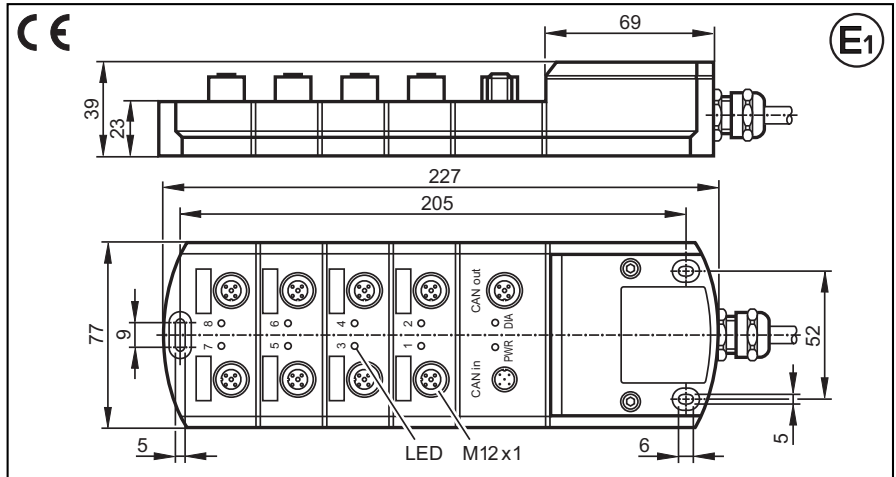
CompactModule Metal

Output module
digital and analogue
for R360 system

CANopen interface

Surface electrostatically
coated (cathodic immersion)

10...32 V DC



Technical data

Housing

Dimensions (l x w x h)

Installation

Connections

Operating voltage and CAN bus

Outputs

CANin/CANout

Weight

Outputs

can be configured as

switching current per output

total current

Operating voltage U_B

Current consumption

Operating temperature

Storage temperature

Protection

Interface

Baud rate

Communication profile

Node ID (default)

Indication

8 digital / PWM outputs with integrated current measurement

Die-cast zinc housing with 8 outputs and terminal chamber
surface electrostatically coated (cathodic immersion), black

227 x 77 x 39 mm (without cable gland)

Screw connection by means of 3 M5 x l screws to DIN 912 or DIN 7984

7-pole terminal strip with CAGE CLAMP® connection technology
(2 x 2-pole / 1 x 3-pole) 0.08...4 mm² (AWG 28...AWG 12), nominal current 20 A
Identical potentials can be linked using a jumper header
(GND and U_B potentials linked upon delivery)
Cable entry via M16 cable gland
8 x M12 connector (socket), 5-pole
2 x M12 connector (plug/socket), 5-pole

1.2 kg

8

digital, positive-switching (high side)
PWM channel,
or current-controlled channel

max. 4 A

max. 16 A

10...32 V DC

≤ 50 mA (without external load at 24 V DC)

-40...85 °C

-40...85 °C

IP 67

CAN interface 2.0 B, ISO 11898

20 Kbits/s...1 Mbit/s (default setting 125 Kbits/s)
(adjustable using hex-code switch in the terminal chamber
or via the CANopen object directory)

CANopen, CiA DS 301 version 4, CiA DS 401 version 2.1

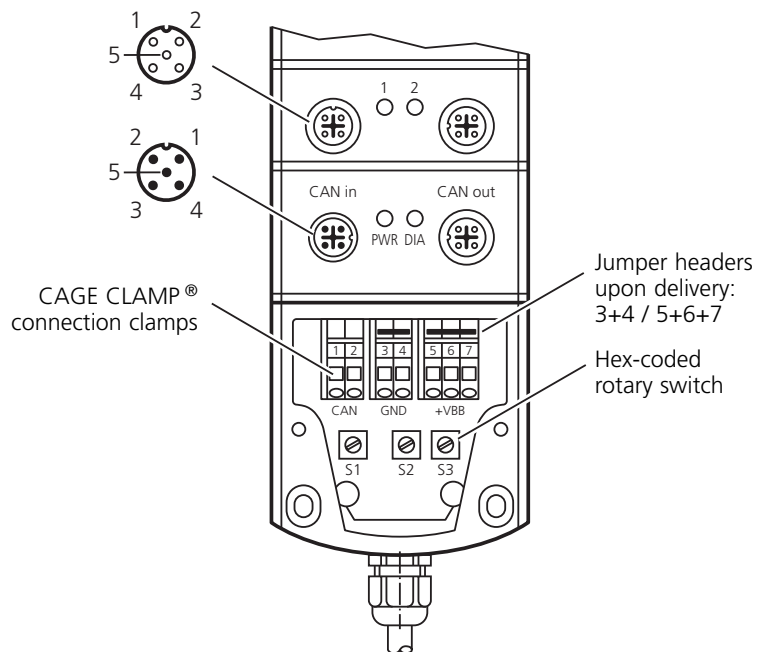
hex 20 (= dec 32)
(adjustable using 2 hex-code switches in the terminal chamber
or via the CANopen object directory)

1 LED green (PWR)
1 LED red (diagnosis, DIA)
8 LEDs yellow (status of the outputs)

CR2031

Connecting and operating elements

Technical data



Hex-code switch coding

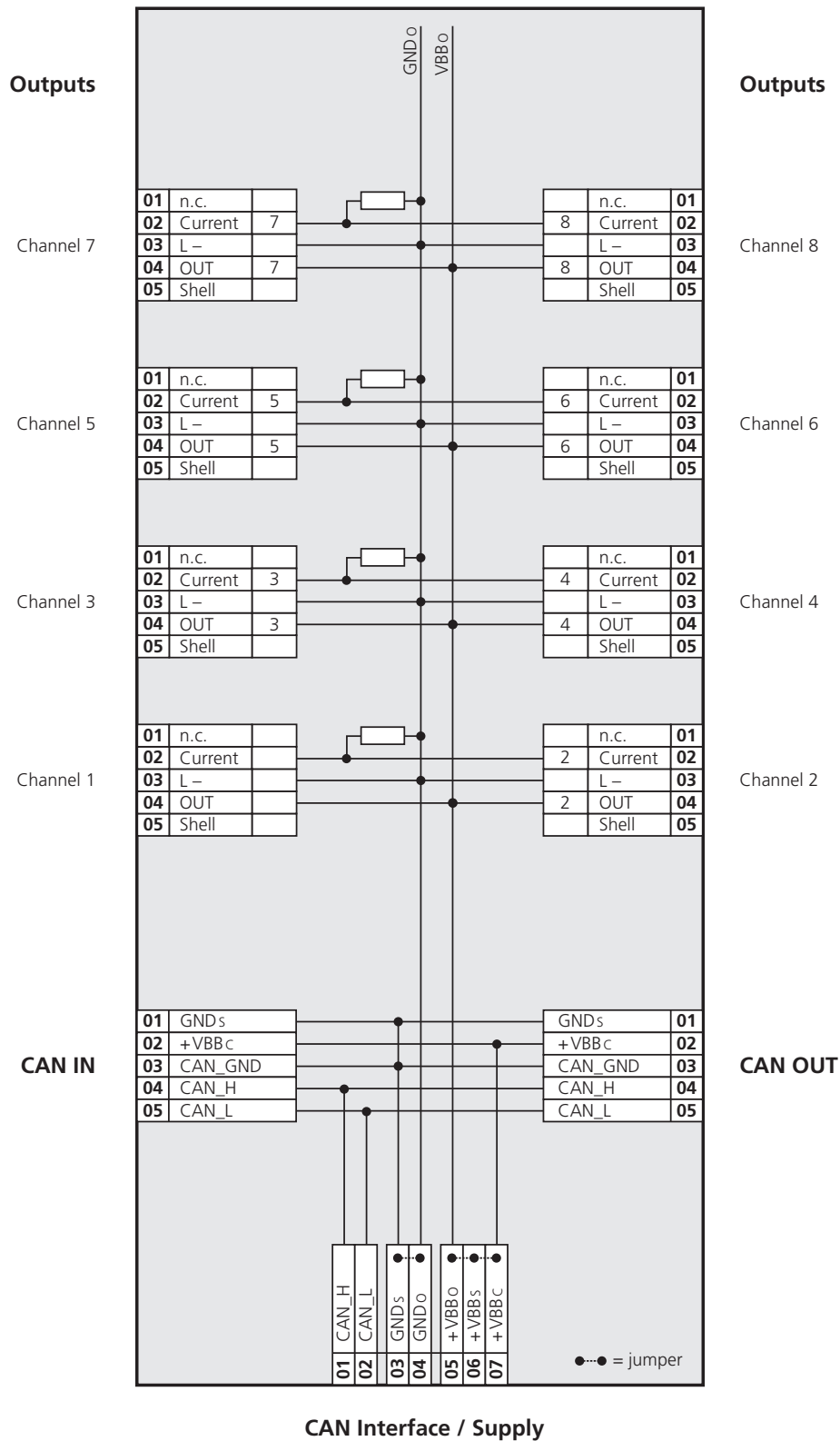
Switch	Position	Description
S1 Baud rate	0	1000 Kbits/s
	1	800 Kbits/s
	2	500 Kbits/s
	3	250 Kbits/s
	4	125 Kbits/s
	5	100 Kbits/s
	6	50 Kbits/s
	7	20 Kbits/s
	8...E	not defined
S2 Node ID _H	F	adjustment via object directory (default)
S3 Node ID _L	0...7	high nibble, e.g. 20 hex (= 32 dec)
	F	adjustment via object directory (default)
	0...E	low nibble, e.g. 20 hex (= 32 dec)
	F	adjustment via object directory (default)



Operating states (LEDs)

LED	Status	Description
PWR (green)	OFF	no supply voltage
	ON	module in stand-by mode
	2.0 Hz	CANopen status: PREOPERATIONAL / PREPARED
		outputs = OFF
DIA (red)	OFF	module active
	ON	CANopen status: OPERATIONAL
		outputs are updated
		communication OK
OUT (yellow)	OFF	communication disturbed
	ON	<ul style="list-style-type: none"> • node guard / heartbeat error (if node guarding / heartbeat is activated) • no synch objects (if synch monitoring is activated)
		binary output: output switched (ON)
		analogue output: PWM preset value ≠ 0
		current preset value > 20

CR2031	Characteristics of the outputs
Digital outputs	8 semiconductor outputs; short-circuit and overload protected Switching voltage 10...32 V DC Switching current max. 4 A Total current max. 16 A The current measurement of 2 channels each can be selected by means of the wire connections. The following channels are combined: 1+2, 3+4, 5+6, 7+8
PWM outputs	With the configuration as "PWM output" two outputs each are combined (1+2, 3+4, 5+6, 7+8). PWM frequency 20...250 Hz Pulse duty factor 50...1000 % Resolution 1 % Switching current max. 4 A Total current max. 16 A
Current outputs	With the configuration as "current-controlled output" two outputs each are combined (1+2, 3+4, 5+6, 7+8). PWM frequency 20...250 Hz Control range 20...1000 mA / 80...4000 mA Control resolution 1 mA / 4 mA (see control parameters) Setting resolution 1 mA Control characteristics can be set via the object directory (see control parameters) Accuracy $\pm 2\%$ FS Switching current max. 4 A Load resistance min. 12 / 3 Ω (at $U_B = 12$ V DC) min. 24 / 6 Ω (at $U_B = 24$ V DC)
Control parameters	By indicating the max. load current [mA] for each output pair the respective control or value range (1000 or 4000 mA) is automatically selected. In addition the P/I behaviour of the current controller can be parameterised for each output pair.
Free-wheel diode is integrated!	To avoid errors in the measuring result, no external free-wheel diode must be connected in parallel with the load in the "current-controlled output" operating mode.
	Test standards and regulations
Climatic test	Damp heat to EN 60068-2-30, test Db ($\leq 95\%$ rel. humidity, non-condensing) Salt mist test to EN 60068-2-52, test Kb, severity level 3 Protection test to EN 60529
Mechanical resistance	Vibration to EN 60068-2-6, test Fc Shock to EN 60068-2-27, test Ea Bump to EN 60068-2-29, test Eb
Immunity to conducted interference	to ISO 7637-2, pulses 2, 3a, 3b, 4, severity level 4, function state A to ISO 7637-2, pulse 5, severity level 1, function state A to ISO 7637-2, pulse 1, severity level 4, function state C
Immunity to interfering fields	according to UN/ECE-R10 at 100 V/m (E1 type approval) and DIN EN 61000-6-2 (CE)
Interference emission	according to UN/ECE-R10 (E1 type approval) and DIN EN 61000-6-3 (CE)
Tests for railway applications	EN 50155 clause 12.2 mechanical/climatic tests EN 50121-3-2 EMC noise emission and noise immunity additional information on request



Abbreviations

CAN_H = CAN interface (high)
 CAN_L = CAN interface (low)
 GND_O = ground (output)
 GND_S = ground (module)

PWM = output for pulse-width modulated signals
 VBB_C = operating voltage (via CANin/CANout plug)
 VBB_O = operating voltage (output)
 VBB_S = operating voltage (module)

11 Fault correction

11.1 EMCY Object

The following error codes to DSP-401 and DSP-301 are supported:

EMC Code	Error Reg	Additional Code	Description
0x3300	0x05	0x00	"Output Voltage" Supply voltage VBBO of the outputs is missing
0x6100	0x11	0x00	"Internal Software" Overflow of a Tx queue, e.g. frequency of the RxPDOs is too high. Only external reset via an entry in 1003 00
0x6101	0x11	0x00	"Internal Software" Overflow of a Tx queue, e.g. device does not communicate with the bus. Only external reset via an entry in 1003 00
0x6200	0x81	bit coded	"User Software" I/O configuration is not permissible. EMCY object contains faulty channel pair, each bit represents a channel pair. 0000 0010 channel pair 1, 2 0000 1000 channel pair 3, 4 0010 0000 channel pair 5, 6 1000 0000 channel pair 7, 8
0x8000	0x11	0x00	"Monitoring" (Synch Error) For "communication cycle" no synch object is received (only in OPERATIONAL). Reset with the next synch OBJ or PREOP.
0x8130	0x11	0x00	"Monitoring" (Guarding Error/Heartbeat Error) For "guard time" x "life time factor" no guard object is received or heartbeat object outside the expected time. Reset after node is active again.
0xFF00	0x81	bit-codiert	"Device Specific" The output current could not be achieved because the load resistor is too high/small. 0000 0001 channel 1 0000 0010 channel 2 0000 0100 channel 3 0000 1000 channel 4 0001 0000 channel 5 0010 0000 channel 6 0100 0000 channel 7 1000 0000 channel 8



Only the first error of an error group is indicated.

If there is for example an error "load resistor is too high/small" on channel 1 and then on channel 2, only the error which occurred first is signalled.

CANopen does not allow to send two identical EMCY objects one after the other.

12 Object directory

12.1 Manufacturer Specific Profile Area; index 2000 to 5FFF

Index	S-Idx	Designation	Type	Default	Description
2000	0	I/O Konfiguration	u8, ro	0x08	Number of the entries (= number of the output channels)
2000	1	Configuration channel 1 (output)	u8, rw	0x02	0 = OFF 2 = binary output 4 = analogue output (PWM) 5 = analogue output (current-controlled)
2000	2	Configuration channel 2 (output)	u8, rw	0x02	0 = OFF 2 = binary output 4 = analogue output (PWM) 5 = analogue output (current-controlled)
2000	3	Configuration channel 3 (output)	u8, rw	0x02	0 = OFF 2 = binary output 4 = analogue output (PWM) 5 = analogue output (current-controlled)
2000	4	Configuration channel 4 (output)	u8, rw	0x02	0 = OFF 2 = binary output 4 = analogue output (PWM) 5 = analogue output (current-controlled)
2000	5	Configuration channel 5 (output)	u8, rw	0x02	0 = OFF 2 = binary output 4 = analogue output (PWM) 5 = analogue output (current-controlled)
2000	6	Configuration channel 6 (output)	u8, rw	0x02	0 = OFF 2 = binary output 4 = analogue output (PWM) 5 = analogue output (current-controlled)
2000	7	Configuration channel 7 (output)	u8, rw	0x02	0 = OFF 2 = binary output 4 = analogue output (PWM) 5 = analogue output (current-controlled)
2000	8	Configuration channel 8 (output)	u8, rw	0x02	0 = OFF 2 = binary output 4 = analogue output (PWM) 5 = analogue output (current-controlled)
2001	0	PWM Frequency	u8, rw	0x64 (100 Hz)	Setting in Hz (20...250 Hz) If an invalid value is entered, the previous value remains valid.
2002	0	Actual current values	u8, ro	0x04	Number of the entries (= number of the current measuring channels)
2002	1	Current values channel 1, 2	u8, ro	–	Actual current value in mA
2002	2	Current values channel 3, 4	u8, ro	–	Actual current value in mA

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Index	S-Idx	Designation	Type	Default	Description
2002	3	Current values channel 5, 6	u8, ro	–	Actual current value in mA
2002	4	Current values channel 7, 8	u8, ro	–	Actual current value in mA
2004	0	Control parameters channel 1, 2	u8, ro	0x03	Number of the entries (= number of the control parameters)
2004	1	P value channel 1, 2	u8, rw	0x32	P value of the current control function channel 1, 2 (= value in % referred to the preset- actual value difference)
2004	2	I value channel 1, 2	u8, rw	0x14	I value of the current control function channel 1, 2 (= value in % referred to the preset- actual value difference)
2004	3	max. current channel 1, 2	u16, rw	0xFA0	max. possible load current in mA (= current at 1000‰ PWM)
2005	0	Control parameters channel 3, 4	u8, ro	0x03	Number of the entries (= number of the control parameters)
2005	1	P value channel 3, 4	u8, rw	0x32	P value of the current control function channel 3, 4 (= value in % referred to the preset- actual value difference)
2005	2	I value channel 3, 4	u8, rw	0x14	I value of the current control function channel 3, 4 (= value in % referred to the preset- actual value difference)
2005	3	max. current channel 3, 4	u16, rw	0xFA0	max. possible load current in mA (= current at 1000‰ PWM)
2006	0	Control parameters channel 5, 6	u8, ro	0x03	Number of the entries (= number of the control parameters)
2006	1	P value channel 5, 6	u8, rw	0x32	P value of the current control function channel 5, 6 (= value in % referred to the preset- actual value difference)
2006	2	I value channel 5, 6	u8, rw	0x14	I value of the current control function channel 5, 6 (= value in % referred to the preset- actual value difference)
2006	3	max. current channel 5, 6	u16, rw	0xFA0	max. possible load current in mA (= current at 1000‰ PWM)
2007	0	Control parameters channel 7, 8	u8, ro	0x03	Number of the entries (= number of the control parameters)
2007	1	P value channel 7, 8	u8, rw	0x32	P value of the current control function channel 7, 8 (= value in % referred to the preset- actual value difference)
2007	2	I value channel 7, 8	u8, rw	0x14	I value of the current control function channel 7, 8 (= value in % referred to the preset- actual value difference)
2007	3	max. current channel 7, 8	u16, rw	0xFA0	max. possible load current in mA (= current at 1000‰ PWM)

Index	S-Idx	Designation	Type	Default	Description
20F0 20F1 **)	0	Setting of the Node ID *)	u8, rw	0x20 (= 0d32)	The node ID used to access the module in the CANopen network.
20F2 20F3 **)	0	Setting of the Baud rate *)	u8, rw	0x04	Baud rate of the CAN network 0 = 1000 kBaud 1 = 800 kBaud 2 = 500 kBaud 3 = 250 kBaud 4 = 125 kBaud (default) 5 = 100 kBaud 6 = 50 kBaud 7 = 20 kBaud

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*) Observe hex-code switch position!

Entries under 20F0/20F1 and 20F2/20F3 are only valid if the hex-code switches for baud rate (S1) and/or node ID (S2, S3) are in the position "F". (For position and coding of the hex-code switches see connecting and operating elements → 10 Technical data)

**) The entries 20F0/20F1 and 20F2/20F3 must always contain identical values. The new entries are valid after a reset (switching the module off/on).

Values outside the permissible ranges will be rejected.

Explanation of the abbreviations:

0x...= hexadecimal number
0b...= binary value
0d...= decimal numerical value

str = string
rw = read-write
ro = read only
u8 = unsigned 8 bit
u16 = unsigned 16 bit

12.2 Communication Profile Area; index 1000 to 1FFF

Index	S-Idx	Designation	Type	Default	Description
1000	0	Device type	u32, ro	0x00030191	Profile 401; Inputs and outputs, binary and analogue
1001	0	Error register	u8, ro	0x00	Bit-coded to profile 301, the following is supported: 0b 0000 0000 no error 0b 0000 0001 generic error 0b 0001 0000 communication error 0b 1000 0000 manufacturer specific
1003	0	Pre-defined errorfield	u8, ro	0x00	An error list with 4 entries is supported.
1003	1	Error history	u64, ro	0x00	Error occurred, coded according to the EMCY list, the last error is in the sub- index 1.
1005	0	COB ID synch objekt	u32, rw	0x00000080	Module generates no synch message (bit 30 = 0) 11-bit identifier system (bit 29 = 0) Identifier of the synch message
1006	0	Communic. Cycle	u32, rw	0x00000000	Max. time between 2 synch objects in µs Useful resolution = 1ms
1008	0	Device name	str, ro	CR2031	Device name
1009	0	HW Version	str, ro	x.x	Hardware version

Index	S-Idx	Designation	Type	Default	Description
100A	0	SW Version	str, ro	x.x	Software version
100C	0	Guard time	u16, rw	0x0000	Time in ms Within this time the output module expects a "node guarding" of the network master. If the value 0 is entered here, this function is not supported. Note: Node monitoring with "node guarding" or "heart-beat" can only to be used as an alternative.
100D	0	Life time factor	u8, rw	0x00	If no "node guarding" is received for "guard time" x "life time", the module switches the outputs off. The module changes the CANopen status to PREOP. The result from "guard time" x "life time" must be between 0 and 65535.
1010	0	Number of save options	u8, ro	0x01	Number of the "save" options
1010	1	"Save all parameters"	u32, rw	0x02	Automatic saving of all changed parameters OFF/ON. 0 = AutoSave OFF 2 = AutoSave ON
1011	0	Number of restore options	u8, ro	0x01	Number of the "restore" options
1011	1	"Reset for all parameters"	u32, rw	0x01	If the string "load" is entered here, the parameters are assigned to the factory default values and are valid after the next reset.
1014	0	COB ID Emergency	u32, rw	0x00000080 + Node ID	- EMCY is valid (Bit 31 = 0) - EMCY is not valid (Bit 31 = 1) - 11 Bit ID (Bit 29 = 0) - ID = 0x80 + Node ID CAN identifier can be changed by the user
1016	0	Number of options Consumer heartbeat time	u8, ro	0x01	Number of the monitored units
1016	1	Consumer heartbeat time	u32, rw	0x00	Heartbeat monitoring time for node n. Monitoring of only one node is supported. 0x0nntttt = monitoring time [ms] 0x0nntttt = node number (If nn or tttt = 0, no monitoring is carried out) Note: Node monitoring with "node guarding" or "heart-beat" is only to be used as an alternative.
1017	0	Producer heartbeat time	u16, rw	0x00	Time interval [ms] where the inclination sensor generates a producer heartbeat.
1018	0	Number of identity objects	u8, ro	0x01	Device identification

Index	S-Idx	Designation	Type	Default	Description
1018	1	Vendor ID	u32, ro	0x0069666D	Vendor ID to CiA specification
1400	0	Receive PDO 1	u8, ro	0x02	Number of the entries Rec PDO 1 Binary outputs
1400	1	COB ID PDO 1	u32, rw	0x200 + Node ID	- PDO is valid (bit 31 = 0) - CAN ID of the 1st Rec PDOs
1400	2	Trans Type PDO 1	u8, rw	0x01	0x00 = synch acyclic 0x01...0xF0 = synch cyclic, Outputs are only updated after "n" synch objects. n = 0x01 (1) ... 0xF0 (240) 0xFC/0xFD not implemented 0xFE = asynch manuf. specific event, outputs are updated immediately 0xFF = asynch device profile event, outputs are updated immediately
1401	0	Receive PDO 2	u8, ro	0x02	Number of the entries Rec PDO 2 Analogue outputs
1401	1	COB ID PDO 2	u32, rw	0x300 + Node ID	- PDO is valid (Bit 31 = 0) - CAN ID of the 2nd Rec PDOs
1401	2	Trans Type PDO 2	u8, rw	0x01	0x00 = synch acyclic 0x01...0xF0 = synch cyclic, Outputs are only updated after "n" synch objects. n = 0x01 (1) ... 0xF0 (240) 0xFC/0xFD not implemented 0xFE = asynch manuf. specific event, outputs are updated immediately 0xFF = asynch device profile event, outputs are updated immediately
1600	0	Mapping Rec PDO 1	u32, ro	0x01	Number of the application objects linked with the binary output PDO
1600	1	Index in the object directory	u32, ro	0x6200 01	6200 SIdx 01 contains 1 byte 0b 0000 0001 channel 1 0b 0000 0010 channel 2 0b 0000 0100 channel 3 0b 0000 1000 channel 4 0b 0001 0000 channel 5 0b 0010 0000 channel 6 0b 0100 0000 channel 7 0b 1000 0000 channel 8
1601	0	Mapping Rec PDO 2	u32, ro	0x04	Number of the application objects linked with the analogue output PDO
1601	1	Index in the object directory	u32, ro	0x6411 01	6411 SIdx 01 contains the preset value of the analogue output channel 1 or 2. The value is interpreted as pulse/break ratio in % or as preset current value (depending on the configuration of the index 2000, → 12 Object directory).
1601	2	Index in the object directory	u32, ro	0x6411 02	6411 SIdx 02 contains the preset value of the analogue output channel 3 or 4. The value is interpreted as pulse/break ratio in % or as preset current value (depending on the configuration).

Index	S-Idx	Designation	Type	Default	Description
1601	3	Index in the object directory	u32, ro	0x6411 03	6411 SIdx 03 contains the preset value of the analogue output channel 5 or 6. The value is interpreted as pulse/break ratio in ‰ or as preset current value (depending on the configuration).
1601	4	Index in the object directory	u32, ro	0x6411 04	6411 SIdx 04 contains the preset value of the analogue output channel 7 or 8. The value is interpreted as pulse/break ratio in ‰ or as preset current value (depending on the configuration).
1800	0	Trans PDO 1	u8, ro	0x05	Number of the entries Trans PDO 1 (Actual current value)
1800	1	COB ID PDO 1	u32, rw	0x180 + Node ID	- PDO is valid (Bit 31 = 0) - CAN ID of the 1st Trans PDOs
1800	2	Trans Type PDO 1	u8, rw	0x01	0x00 = synch acyclic 0x01...0xF0 = synch cyclic; Current values are only transferred after "n" synch objects. n = 0x01 (1) ... 0xF0 (240) 0xFC/0xFD not implemented 0xFE = asynch man. spec. event; Current values are immediately transferred. 0xFF = asynch device profile event; Current values are immediately transferred.
1800	5	Event timer Trans PDO 1	u16,rw	0x00	Max. transfer break in trans type "asynch" (0...65535 ms), when this time has elapsed the PDO is transferred even if the appl. event has not occurred.
1A00	0	Mapping Trans PDO 1	u32, ro	0x04	Number of the linked application objects (actual current values)
1A00	1	Index in the object directory	u32, ro	0x2002 01	Idx 2002, SIdx 01 contains the actual current value channel 1/2
1A00	2	Index in the object directory	u32, ro	0x2002 02	Idx 2002, SIdx 02 contains the actual current value channel 3/4
1A00	3	Index in the object directory	u32, ro	0x2002 03	Idx 2002, SIdx 03 contains the actual current value channel 5/6
1A00	4	Index in the object directory	u32, ro	0x2002 04	Idx 2002, SIdx 04 contains the actual current value channel 7/8

13 Maintenance, repair and disposal

As the module does not contain any components which must be maintained by the user, the housing must not be opened. The maintenance of the module may only be carried out by the manufacturer.

The disposal must be carried out according to the corresponding national environmental regulations.

14 Declaration of conformity

For test standards and regulations → 10 Technical data.

The CE Declaration of Conformity and the E1-approval are available at www.ifm.com.

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15 Terms and abbreviations

0b ...	binary value (for bit coding), e.g. 0b0001 0000
0d ...	decimal numerical value, e.g. 0d100
0x ...	hexadecimal value, e.g. 0x64 (= 100 decimal)
Baudrate	transmission speed (1 baud = 1 bit/s)
CAL	CAN Application Layer CAN-based network protocol on application level
CAN	Controller Area Network (bus system for use in mobile applications)
CAN_H	CAN-High; CAN connection /cable with high voltage level
CAN_L	CAN-Low; CAN connection /cable with low voltage level
CANopen	CAN-based network protocol on application level with an open configuration interface (object directory)
CiA	"CAN in Automation e.V." (user and manufacturer organisation in Germany/Erlangen) Definition and control body for CAN and CAN-based network protocols
CiA DS	Draft Standard (published CiA specification which usually has not been modified or supplemented for one year)
CiA DSP	Draft Standard Proposal (published CiA specification draft)
CiA WD	Work Draft (work draft accepted for discussion within CiA)
CiA DS 301	Specification for CANopen communication profile; describes the basic communication between network participants, such as the transfer of process data in real time, the exchange of data between units or the configuration stage. Depending on the application this is completed by the following CiA specifications:
CiA DS 401	Device profile for digital and analogue I/O modules
CiA DS 402	Device profile for drives
CiA DS 403	Device profile for HMI
CiA DS 404	Device profile for measurement and control technology
CiA DS 405	Specification for interfaces to programmable systems (IEC 61131-3)
CiA DS 406	Device profile for encoders
CiA DS 407	Application profile for local public transport
COB	CANopen Communication Object (PDO, SDO EMCY, ...)
COB ID	CANopen Identifier of a Communication Object
Communication cycle	the synchronisation time to be monitored, max. time between 2 Sync objects
EMCY Object	Emergency Object (alarm message, device indicates an error)

Error Reg	Error Register (entry with an error code)
Guarding Error	Node or network participant could or can no longer be found Guard Master: one or several slaves no longer reply Guard Slave: no polling of the slave
Guard Time	During this time the network participant expects a "Node Guarding" of the network master
Heartbeat	Cyclic monitoring with parameter setting among network participants. In contrast to "node guarding" no superior NMT master is required.
ID (Identifier)	identifies a CAN message. The numerical value of the ID also contains a priority for the access to the bus system. ID 0 = top priority
Idx	index; together with the S index it forms the address of an entry in the object directory
Life Time Factor	number of attempts in case of a missing Guarding reply
Monitoring	is used to describe the error class (guarding monitoring, synch etc.)
NMT	network management
NMT-Master/- Slaves	The NMT master controls the operating states of the NMT slaves
Node Guarding	adjustable cyclic monitoring of slave network participants by a higher master node as well as the monitoring of this polling process by the slave participants
Node ID	node identifier (identification of a participant in the CANopen network)
Object (OBJ)	term for data/messages which can be exchanged in the CANopen network
Object directory	contains all CANopen communication parameters of a device as well as device-specific parameters and data. Access to the individual entries is possible via the index and S index.
Operational	Operating state of a CANopen participant. In this mode SDOs, NMT commands and PDOs can be transferred.
PDO	Process Data Object; in the CANopen network for transfer of process data in real time; such as the speed of a motor. PDOs have a higher priority than SDOs; in contrast to the SDOs they are transferred without confirmation. PDOs consist of a CAN message with identifier and up to 8 bytes of user data.
PDO Mapping	describes the application data transferred with a PDO.
Pre-Op	Preoperational; operating state of a CANopen participant. After application of the supply voltage each participant automatically goes into this state. In the CANopen network only SDOs and NMT commands can be transferred in this mode but no process data.
Prepared	(also stopped) operating state of a CANopen participant In this mode only NMT commands are transferred.
Rec PDO (Rx PDO)	Receive Process Data Object
ro	read only (unidirectional)
rw	read-write (bidirectional)
Rx-Queue	reception buffer
s16	data type signed 16 bit
SDO	Service Data Object. With this object direct access to the object directory of a network participant is possible (read/write). An SDO can consist of several CAN messages. The transfer of the individual messages is confirmed by the addressed participant. With the SDOs devices can be configured and parameters can be set.
Server SDO	process and parameter set to make the object directory of a network participant available to other participants (clients).
S-Idx (SIdx)	Subindex within the object directory of a CANopen device
Start Guarding	start node guarding
str	data type string (variable for strings such as text "load")

Sync Error	missing Sync OBJ in the adjustable communication cycle
Sync OBJ	synchronisation object for simultaneous update in the complete network or for accepting process data of the respective parameterised PDOs.
Sync Windows	time during which the synchronous PDOs have to be transferred
Time Stamp	time stamp to align existing clocks in network participants
Trans Type	type of process data transmission; synchronous, asynchronous
Trans PDO (Tx PDO)	transmit process data object
Trans SDO (Tx SDO)	transmit service data object
Tx-Queue	(transmit) transmission buffer
u8 (16, 32)	data type unsigned 8 (16, 32) bits
wo	write only