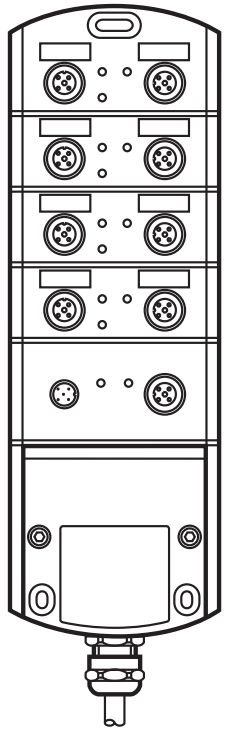
Device manual

Input/output module
CompactModule metal

**CR2033**

UK



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# Contents

# 1 Preliminary note

Technische Daten, Zulassungen, Zubehör und weitere Informationen unter www.ifm.com.

## 1.1 Symbols used

► Instruction
> Reaction, result
[…] Designation of keys, buttons or indications
→ Cross-reference

Important note
Non-compliance may result in malfunction or interference.

Information
Supplementary note

**⚠ WARNING**
Warning of serious personal injury.
Death or serious irreversible injuries may result.

**⚠ CAUTION**
Warning of personal injury.
Slight reversible injuries may result.

**NOTE**
Warning of damage to property.

# 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 gmbh 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.

This is a class A installation. It can cause radio interference in domestic areas. In this case the operator is requested to take appropriate measures.

# 3 Function and features

The CR2033 I/O module enables decentralised evaluation of sensor signals and decentralised triggering of actuators and proportional valves.

- The module supports binary/analogue inputs/outputs and is therefore classified in the device profile "I/O module" to CiA DS 401.
- As regards the input/output functions, the module can be configured and it supports the following functions:
  - analogue inputs
    (0...10/32 V, 0...20 mA, ratiometric, binary and binary with diagnosis)
  - binary inputs
  - binary outputs
  - PWM outputs up to 4 A
- There are 1 server SDO and the 4 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 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.

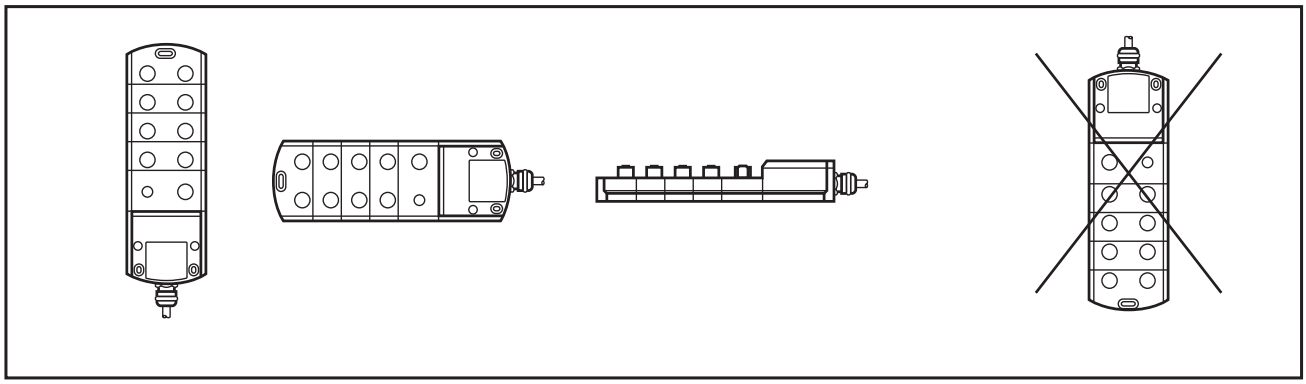


The CR2033 I/O module ist not approved for safety-relevant tasks in the field of safety of persons.

*) factory default values (→ 8.1 Parameter list)

## 4 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.



preferred Mounting variants wrong

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.

# 5 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.

## 5.1 M12 sockets

Use sockets with gold-plated contacts.

Use protective caps (supplied) for unconnected connectors of the I/O module.

## 5.2 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.

## 5.3 M16 cable gland

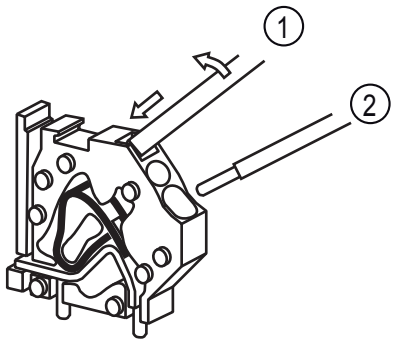
Use a suitable cable to ensure ingress resistance of the M16 cable gland.

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).

## 5.4 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 IN = 4 A → 100 % overload = 8 A)
  Test duration: 5 minutes

## 5.5 CAGECLAMP ® connection technology




1: Screwdriver
2: Wire

► Insert screwdriver an tilt slightly.
> Spring opens.
► Insert wire.
► Remove screwdriver.
> Spring closes.

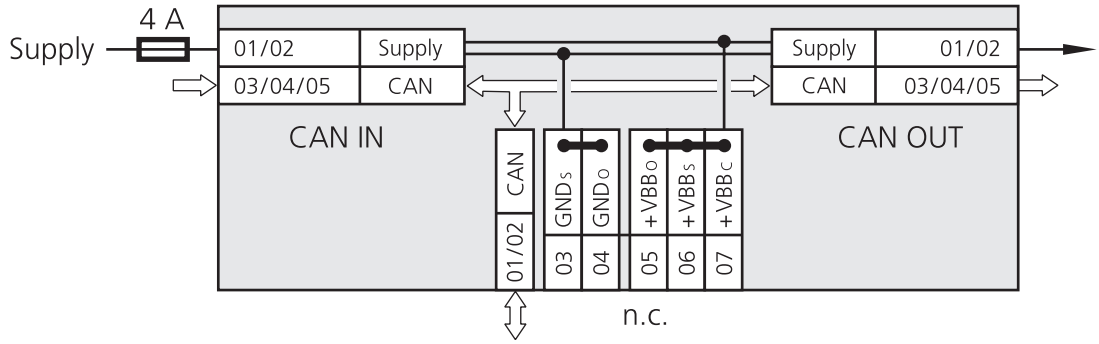
## 5.6 Fuses

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.

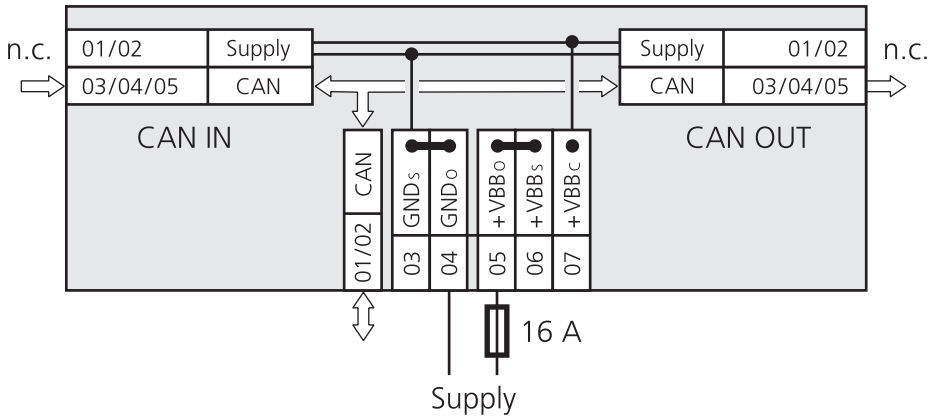
| | | | |
|---|---|---|---|
| 1 | Supply via M12 CANin/CANout plug | 3+4 / 5+6+7 | 4 A |
| 2 | Supply via clamps<br>(not via M12 CANin/CANout plug) | 3+4 / 5+6 | 16 A |
| 3 | Separate supply via clamps and M12 CANin/ CANout plug | 6+7 | 16 A<br>4 A |
| 4 | Supply via clamps<br>(via M12 CANin/CANout plug) | 6+7 | 16 A<br>4 A |

## 5.7 Examples for connection

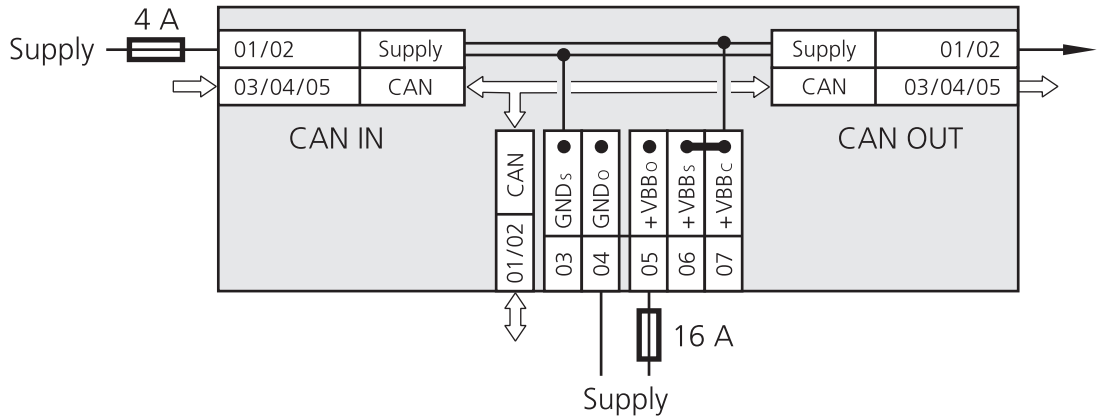
**Example 1**



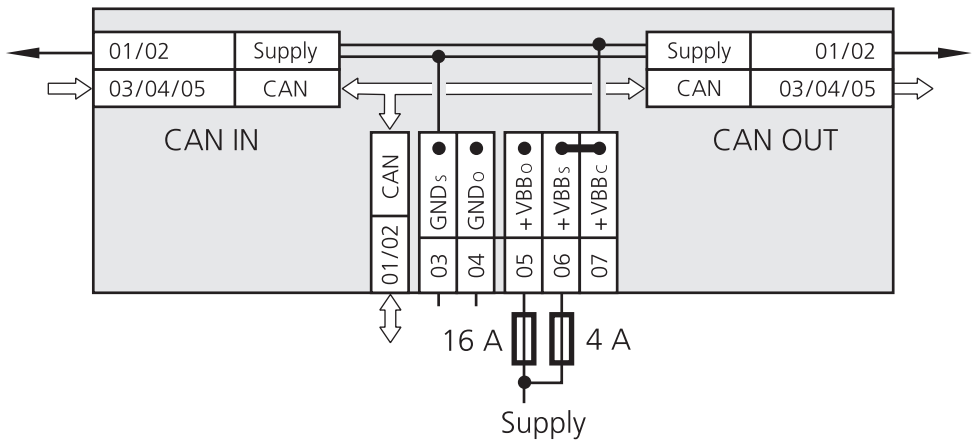

**Example 2**




**Example 3**




**Example 4**

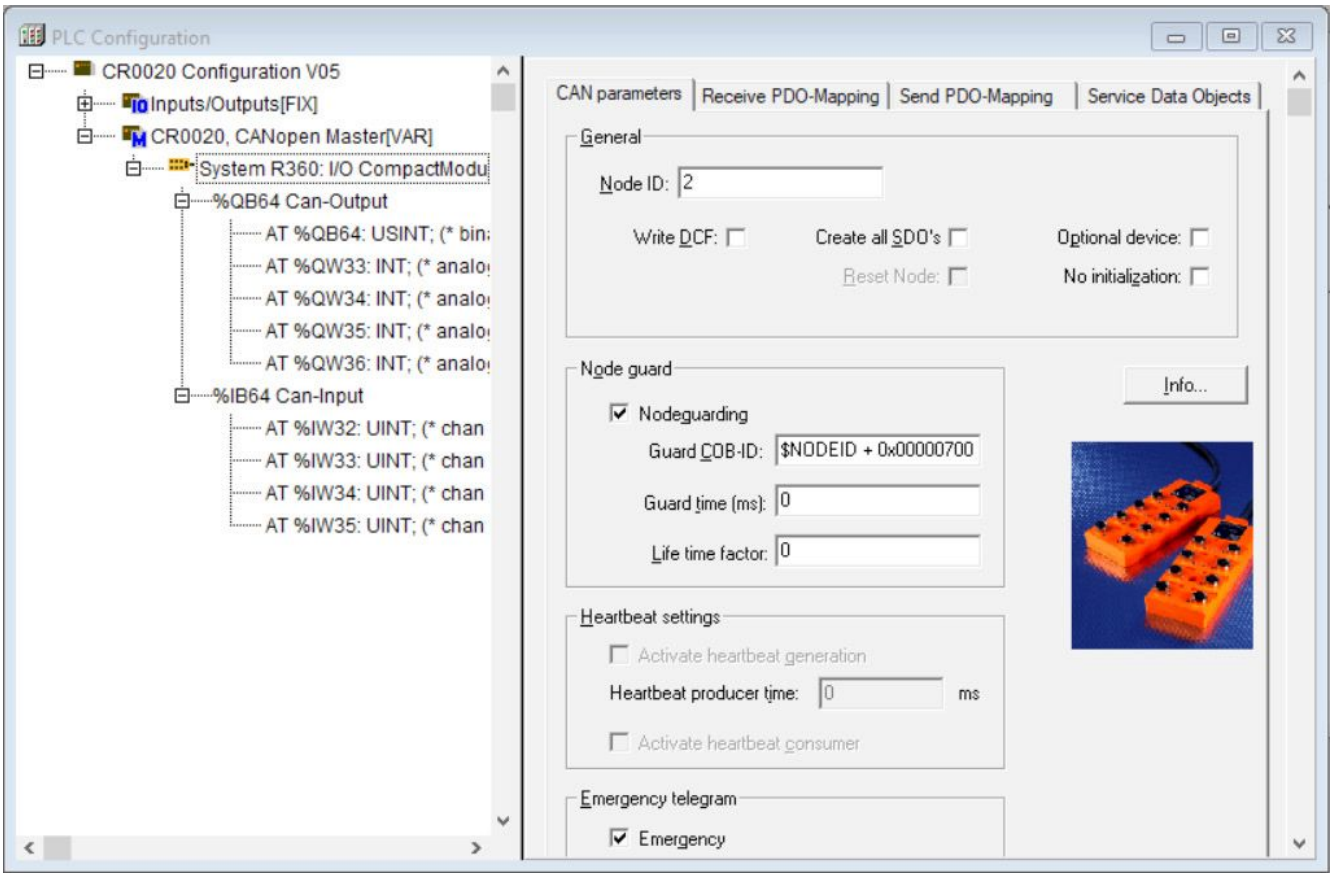



= jumper inserted

# 6 Set-up

## 6.1 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 CODESY manual and the CODESYS online help.

## 6.2 PLC configuration in CODESYS 3.5

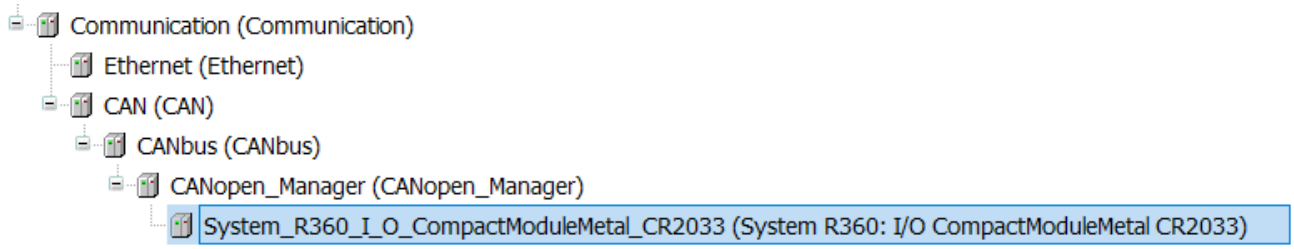
The "Electronic Data Sheet“ (EDS) is installed in the [Device Repository]. Proceed as follows in the main menu:

► Click on [Tools] / [Device Repository].

► Select [Fieldbuses] / [CiA CANopen] / [CiA Remote Device] and click on [Install].

► Select EDS file and click on [Open].

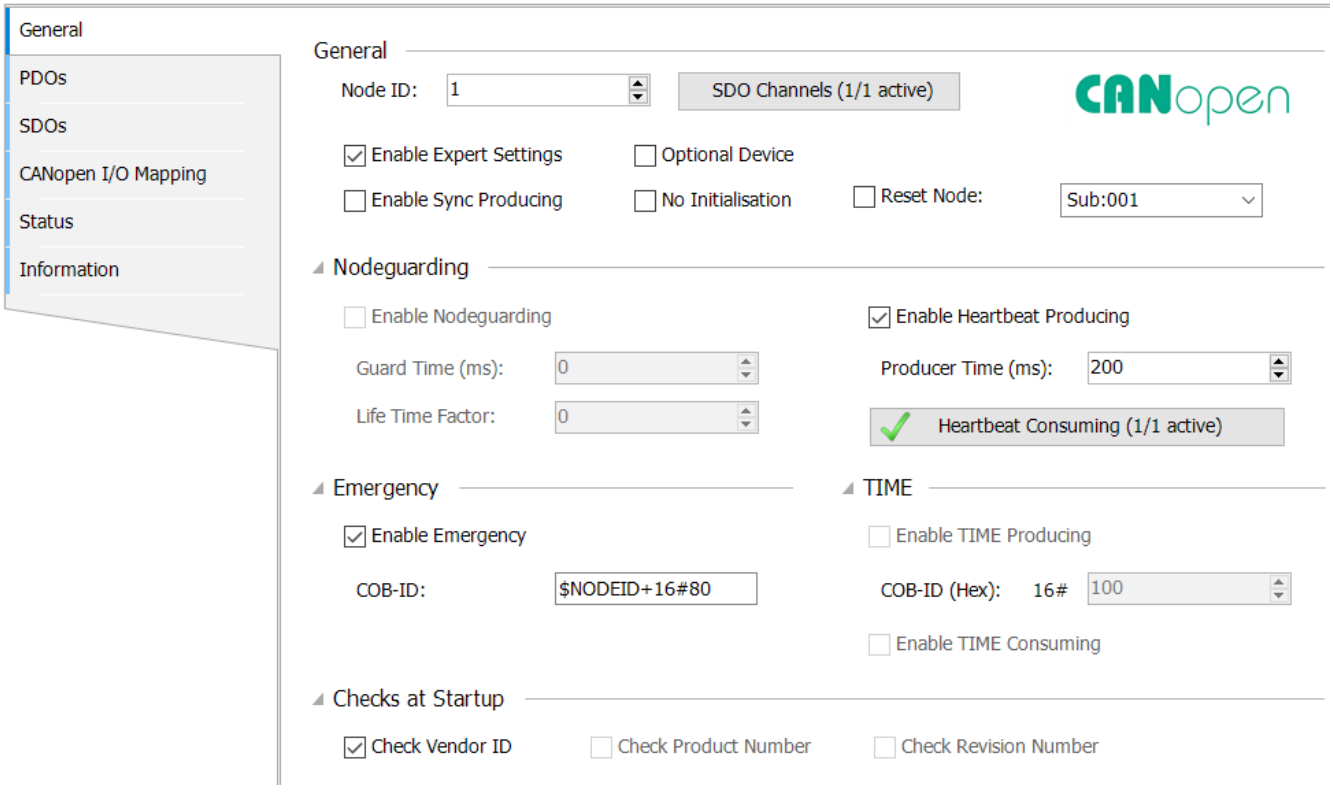
> In CODESYS 3.5 the devices are integrated as CiA remote devices in the device tree under a [CANopen_Manager] element.




The CANopen communication is configured via the CODESYS configuration editor.

### 6.2.1 Heartbeat configuration

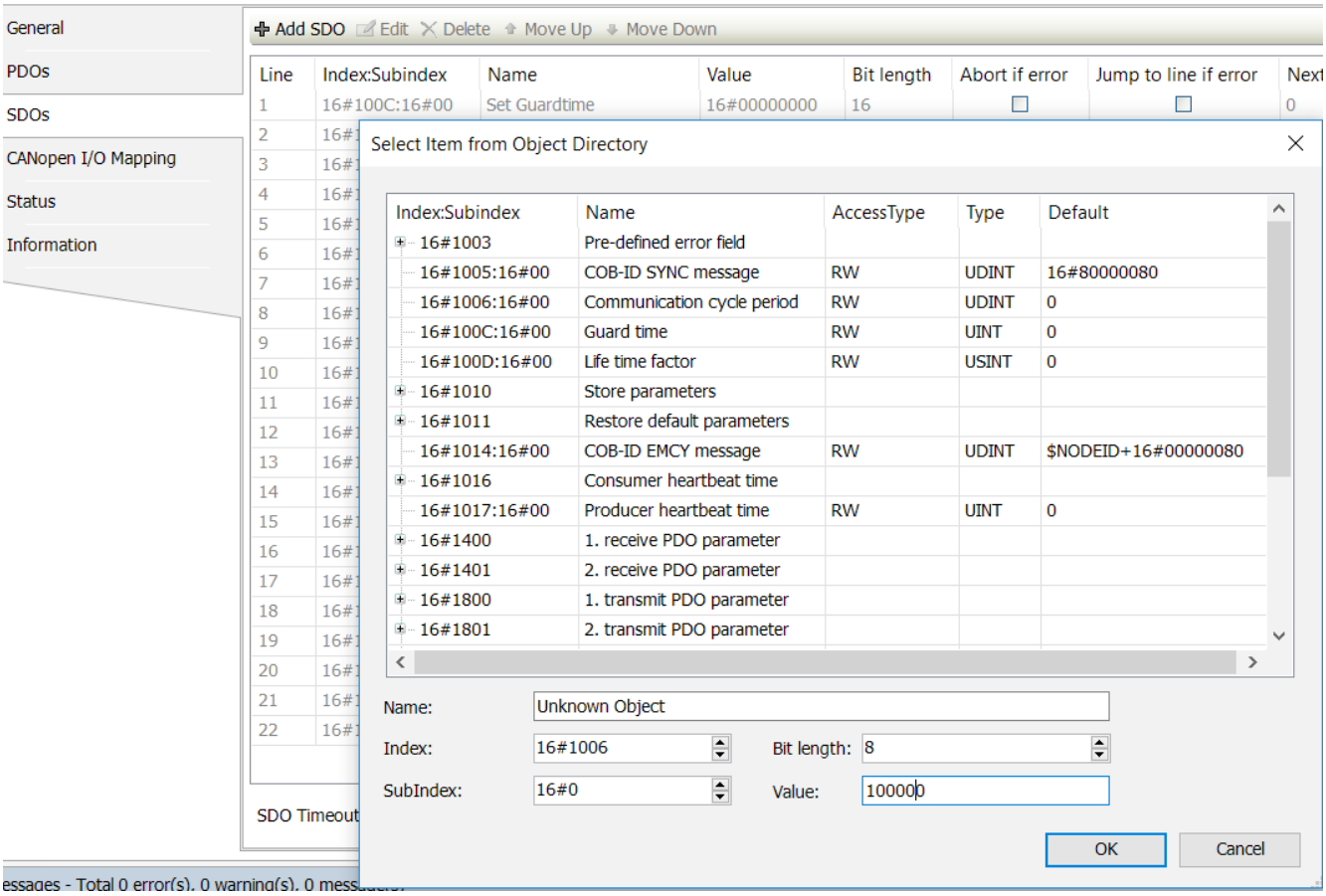
The function [Reset Node] must be activated on the tab [General] so that the device applies the parameters set for heartbeat monitoring of the CANopen Manager.

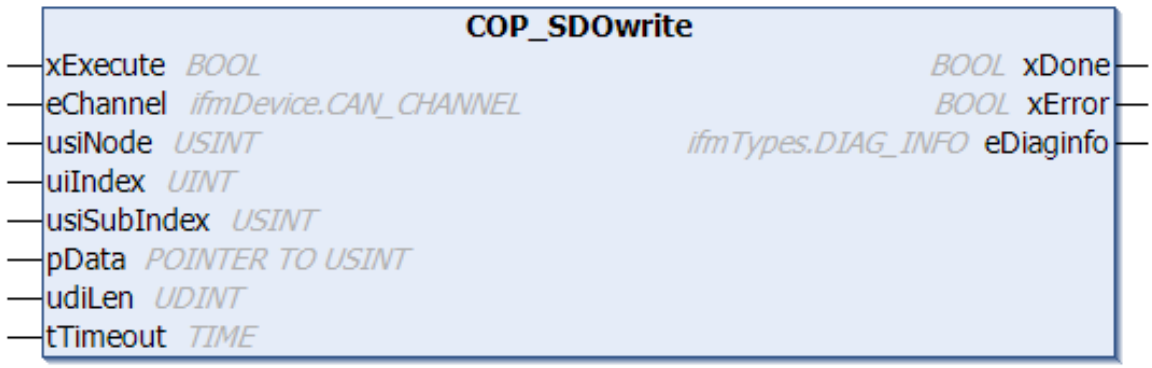


### 6.2.2 SyncMonitoring

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 [µs].




## 6.3 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.

# 7 Technical data

## CR2033

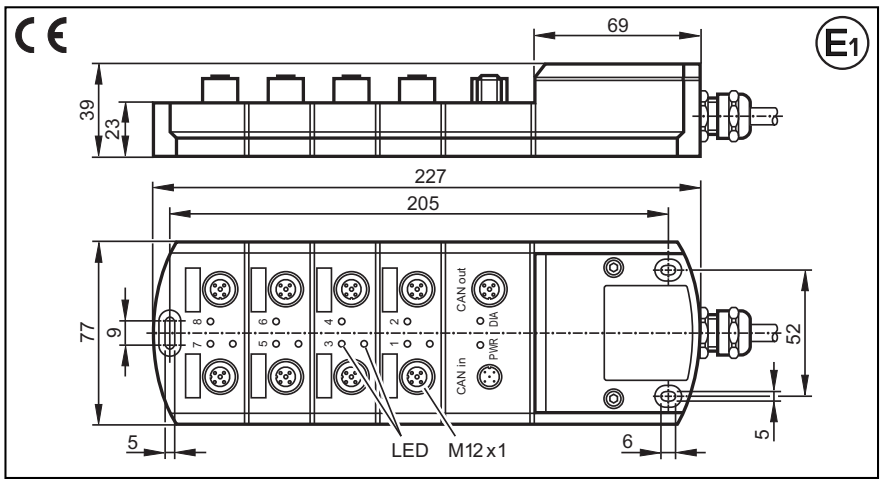
CompactModule Metal

I/O module
digital and analogue
for R360 system

CANopen interface

Surface electrostatically
coated (cathodic immersion)

10...32 V DC

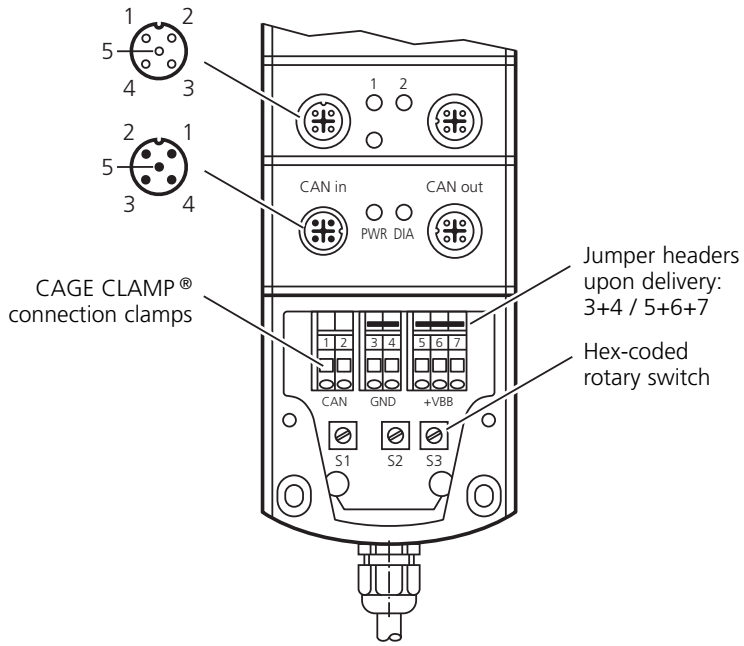



| Technical data | 8 inputs (4 digital / 4 analogue)<br>4 outputs (digital or PWM) |
|---|---|
| Housing | Die-cast zinc housing with 8 outputs and terminal chamber<br>surface electrostatically coated (cathodic immersion), black |
| Dimensions (l x w x h) | 227 x 77 x 39 mm (without cable gland) |
| Installation | Screw connection by means of 3 M5 x l screws to DIN 912 or DIN 7984 |
| Connections | |
| Operating voltage and CAN bus | 7-pole terminal strip with CAGE CLAMP® connection technology<br>(2 x 2-pole / 1 x 3-pole) 0.08...4 mm² (AWG 28...AWG 12), nominal current 20 A<br>Identical potentials can be linked using a jumper header<br>(GND and $U_B$ potentials linked upon delivery)<br>Cable entry via M16 cable gland |
| Inputs/Outputs | 8 x M12 connector (socket), 5-pole |
| CANin/CANout | 2 x M12 connector (plug/socket), 5-pole |
| Weight | 1.2 kg |
| Inputs | 8 |
| can be configured as | 4 digital, positive-switching (high side)<br>4 analogue, 0...10/32 V, 0/4...20 mA, ratiometric<br>or digital, positive-switching |
| Sensor supply $I_{max}$ | 400 mA |
| Outputs | 4 |
| can be configured as | digital, positive-switching (high side), with diagnostic capability<br>PWM channel |
| switching current per output | max. 4 A |
| total current | max. 16 A |
| Operating voltage $U_B$ | 10...32 V DC |
| Current consumption | ≤ 50 mA (without external load at 24 V DC) |
| Operating temperature | –40...85 °C |
| Storage temperature | –40...85 °C |
| Protection | IP 67 |
| Interface | CAN interface 2.0 B, ISO 11898 |
| Baud rate | 20 Kbits/s...1 Mbit/s (default setting 125 Kbits/s)<br>(adjustable using hex-code switches in the terminal chamber<br>or via the CANopen object directory) |
| Communication profile | CANopen, CiA DS 301 version 4, CiA DS 401 version 2.1 |
| Node ID (default) | hex 20 (= dec 32)<br>(adjustable using hex-code switches in the terminal chamber<br>or via the CANopen object directory) |
| Displays | 1 LED green (PWR)<br>1 LED red (diagnosis, DIA)<br>12 LEDs yellow (status of the inputs / outputs) |

**CR2033** | **Technical data**

UK

Connecting and operating elements




Hex-code switch coding

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

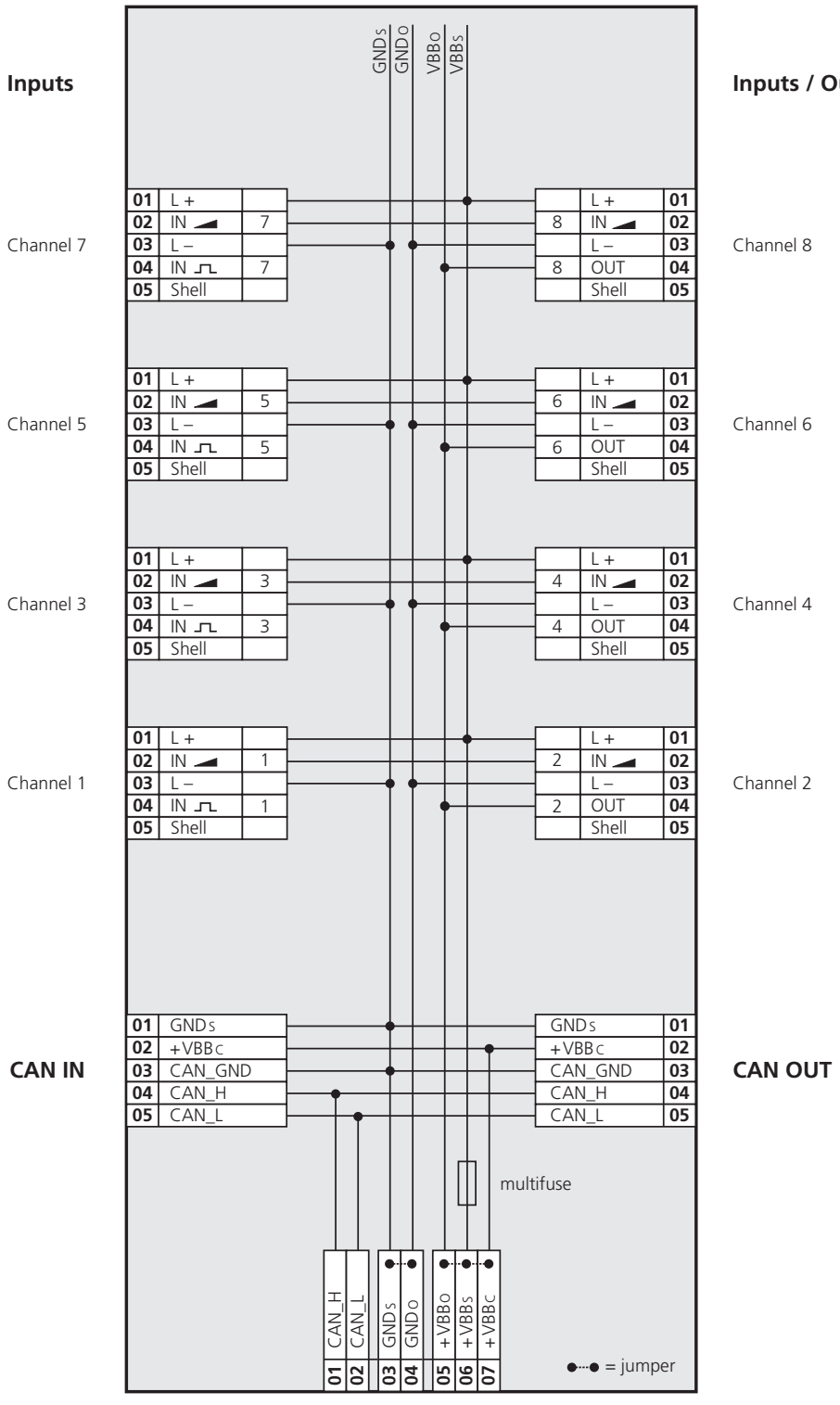
Operating states (LEDs)

| LED | Status | Description |
|---|---|---|
| PWR (green) | OFF<br>ON<br><br><br>2.0 Hz | no supply voltage<br>module in stand-by mode<br>CANopen status: PREOPERATIONAL / PREPARED<br>outputs = OFF<br>module active<br>CANopen status: OPERATIONAL<br>outputs are updated |
| DIA (red) | OFF<br>ON | communication OK<br>communication disturbed<br>• node guard / heartbeat error<br>(if node guarding / heartbeat is activated)<br>• no synch objects<br>(if synch monitoring is activated) |
| IN (yellow) | ON | binary input switched |
| OUT (yellow) | ON | binary output: output switched (ON)<br>analogue output: PWM preset value ≠ 0 |

| CR2033 | Characteristics of the inputs / outputs |
|---|---|
| **Inputs**<br>Channel 1, 3, 5, 7 (pin 4) | ■ Digital inputs<br>Switch-on level 0.4...0.7 $U_B$<br>Switch-off level 0.2...0.24 $U_B$<br>Input resistance 3 kΩ<br>Input frequency max. 1 kHz |
| Channel 1...8 (pin 2)<br>can be configured as ... | ■ Analogue inputs (voltage, current or ratiometric)<br>The analogue signals can be connected to the sockets 1, 3, 5, 7 or alternatively to the sockets 2, 4, 6, 8 (pin 2 of the sockets 1-2, 3-4, 5-6 and 7-8 linked).<br>The LED (yellow) for the analogue input is on the socket side 1, 3, 5, 7. |
| | Voltage inputs<br>Input voltage 0...10/32 V<br>Resolution 10 bits<br>Input resistance 50/30 kΩ<br>Input frequency 50 Hz<br>Accuracy ± 1 % FS |
| | Current inputs<br>Input current 0/4...20 mA<br>Resolution 10 bits<br>Input resistance 400 Ω<br>Input frequency 50 Hz<br>Accuracy ± 1 % FS |
| | Ratiometric inputs for potentiometric transducers (e.g. joystick)<br>Function $((U_{IN} – ½U_B) ÷ ½U_B)$ x 1000 ‰<br>Value range 0...1000 ‰ |
| | Digital inputs<br>Switch-on level 0.7 $U_B$<br>Switch-off level 0.4 $U_B$<br>Input resistance 30 kΩ<br>Input frequency max. 50 Hz |
| **Outputs**<br>Channel 2, 4, 6, 8 (pin 4)<br>can be configured as ... | ■ Semiconductor outputs, with diagnostic capability (wire break and short circuit) short-circuit and overload protected<br>Switching voltage 10...32 V DC<br>Switching current max. 4 A<br>Total current max. 16 A |
| | ■ PWM outputs<br>PWM frequency 20...250 Hz<br>Pulse duty factor 0...1000 ‰<br>Resolution 1 ‰<br>Switching current max. 4 A (referred to PWM value 1000 ‰.)<br>Total current max. 16 A |
| Note | also see wiring (following page) |
| | **Test standards and regulations** |
| Climatic test | Damp heat to EN 60068-2-30, test Db<br>(≤ 95% rel. humidity, non-condensing)<br>Salt mist test to EN 60068-2-52, test Kb, severity level 3<br>Protection test to EN 60529 |
| Mechanical resistance | Vibration to EN 60068-2-6, test Fc<br>Shock to EN 60068-2-27, test Ea<br>Bump to EN 60068-2-29, test Eb |
| Immunity<br>to conducted interference | to ISO 7637-2, pulses 2, 3a, 3b, 4, severity level 4, function state A<br>to ISO 7637-2, pulse 5, severity level 1, function state A<br>to ISO 7637-2, pulse 1, severity level 4, function state C |
| Immunity<br>to interfering fields | according to UN/ECE-R10 at 100 V/m (E1 type approval)<br>and DIN EN 61000-6-2 (CE) |
| Interference emission | according to UN/ECE-R10 (E1 type approval)<br>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 |

**CR2033** | **Wiring**






**CAN Interface / Supply**

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)

# 8 Parameter and EMCY object overview

Automatic saving of the communication and unit parameters can be activated or deactivated by means of the "save all parameters" entry (see object directory, index 1010). When the value 0x02 is entered into SIdx 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" (see 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.

## 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 inputs/outputs | adjustable | after PreOp |
| PWM Frequency | 2001 | 0x64 (100 Hz) | adjustable | after PreOp |
| Node-ID *) | 20F0, 20F1 | 0x20 (0d32) | yes | after a reset |
| Baud rate *) | 20F2, 20F3 | 0x04 (125 kBit/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 |
| 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 | 0xFF (asynchronous) | adjustable | immediately |
| Event Timer Trans PDO1 | 1800 05 | 0x00 | adjustable | immediately |
| COB-ID Trans PDO 2 | 1801 01 | 0x280 + Node-ID | adjustable | after a reset |

| Parameter | Index in object directory | Default (factory preset) | Change automatically saved | Change effective |
|---|---|---|---|---|
| Trans Type Trans PDO 2 | 1801 02 | 0x01 (synchronous) | adjustable | immediately |
| Event Timer Trans PDO2 | 1801 05 | 0x00 | adjustable | immediately |

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 (→ 7 Technical data)



Explanation of the abbreviations:

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

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

(see also --> 12 Terms and abbreviations)

## 8.2 EMCY Object

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

| EMCY Code | Error Reg | Additional Code | Description |
|---|---|---|---|
| 0x3300 | 0x05 | 0x00 | "Output Voltage"<br>Supply voltage VBBO of the outputs is missing |
| 0x6100 | 0x11 | 0x00 | "Internal Software"<br>Overflow of a Tx queue,<br>e.g. frequency of the RxPDOs is too high.<br>Only external reset via an entry in 1003 00 |
| 0x6101 | 0x11 | 0x00 | "Internal Software"<br>Overflow of a Tx queue<br>e.g. device does not communicate with the bus.<br>Only external reset via an entry in 1003 00 |
| 0x8000 | 0x11 | 0x00 | "Monitoring" (Synch Error)<br>For "communication cycle"<br>no synch object is received<br>(only in OPERATIONAL).<br>Reset with the next synch OBJ or PREOP. |

| EMCY Code | Error Reg | Additional Code | Description |
|---|---|---|---|
| 0x8130 | 0x11 | 0x00 | "Monitoring" (Guarding Error/Heartbeat Error)<br>For "guard time" x "life time factor"<br>no guard object is received or<br>heartbeat object outside the expected time.<br>Reset after node is active again. |
| 0xFF00 | 0x81 | bit coded | "Device Specific"<br>0000 0001 channel 2 short circuit 1)<br>0000 0010 channel 4 "<br>0000 0100 channel 6 "<br>0000 1000 channel 8 "<br>0001 0000 channel 2 wire break 2)<br>0010 0000 channel 4 "<br>0100 0000 channel 6 "<br>1000 0000 channel 8 " |
| | | | 1) short circuit only with outputs in ON mode<br>2) wire break only with outputs in OFF mode |

Only the first error of an error group is indicated.
If there is for example an error "short circuit" on channel 2 and then on channel 4, only the error which occured first is signalled.

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

# 9 Object directory

## 9.1 Manufacturer Specific Profile Area; index 2000 to 5FFF

| Index | S-Idx | Name | Typ | Default | Beschreibung |
|---|---|---|---|---|---|
| 2000 | 0 | I/O Configuration | u8, ro | 0x0C | Number of the entries<br>(= number of the output channels) |
| | 1 | Configuration binary input channel 1 | u8, rw | 0x01 | 0 = OFF<br>1 = binary input |
| | 2 | Configuration output channel 2 | u8, rw | 0x02 | 0 = OFF<br>2 = binary output<br>4 = analogue output (PWM) |
| | 3 | Configuration binary input channel 3 | u8, rw | 0x01 | 0 = OFF<br>1 = binary input |
| | 4 | Configuration output channel 4 | u8, rw | 0x02 | 0 = OFF<br>2 = binary output<br>4 = analogue output (PWM) |

| Index | S-Idx | Name | Typ | Default | Beschreibung |
|---|---|---|---|---|---|
| | 5 | Configuration binary input channel 5 | u8, rw | 0x01 | 0 = OFF<br>1 = binary input |
| | 6 | Configuration output channel 6 | u8, rw | 0x02 | 0 = OFF<br>2 = binary output<br>4 = analogue output (PWM) |
| | 7 | Configuration binary input channel 7 | u8, rw | 0x01 | 0 = OFF<br>1 = binary input |
| | 8 | Configuration output channel 8 | u8, rw | 0x02 | 0 = OFF<br>2 = binary output<br>4 = analogue output (PWM) |
| | 9 | Configuration analogue input channel pair 1/2 | u8, rw | 0x03 | 0 = OFF<br>3 = voltage 0...10.000 mV<br>6 = ratiometric 0...1000 ‰<br>7 = current 0...20.000 µA<br>9 = voltage 0...32.000 mV<br>A = binary input with analogue evaluation<br>B = binary input with analogue evaluation with diagnosis |

| Index | S-Idx | Name | Typ | Default | Beschreibung |
|---|---|---|---|---|---|
| | 10 | Configuration analogue input channel pair 3/4 | u8, rw | 0x03 | 0 = OFF<br>3 = voltage 0...10.000 mV<br>6 = ratiometric 0...1000 ‰<br>7 = current 0...20.000 µA<br>9 = voltage 0...32.000 mV<br>A = binary input with analogue evaluation<br>B = binary input with analogue evaluation with diagnosis |
| 2000 | 11 | Configuration analogue input channel pair 5/6 | u8, rw | 0x03 | 0 = OFF<br>3 = voltage 0...10.000 mV<br>6 = ratiometric 0...1000 ‰<br>7 = current 0...20.000 µA<br>9 = voltage 0...32.000 mV<br>A = binary input with analogue evaluation<br>B = binary input with analogue evaluation with diagnosis |
| | 12 | Configuration analogue input channel pair 7/8 | u8, rw | 0x03 | 0 = OFF<br>3 = voltage 0...10.000 mV<br>6 = ratiometric 0...1000 ‰<br>7 = current 0...20.000 µA<br>9 = voltage 0...32.000 mV<br>A = binary input with analogue evaluation<br>B = binary input with analogue evaluation with diagnosis |
| 2001 | 0 | PWM<br>Frequency | u8, rw | 0x64 (100 Hz) | Setting in Hz (20...250 Hz)<br>If an invalid value is entered, the<br>previous value remains valid. |
| 20F0<br>20F1 | 0 | Setting of the Node ID *) | u8, rw | 0x20 (= 0d32) | The node ID used to access the module in the CANopen network. |
| 20F2<br>20F3 | 0 | Setting of the Baud rate *) | u8, rw | 0x04 | Baud rate of the CAN network<br>0 = 1000 kBaud<br>1 = 800 kBaud<br>2 = 500 kBaud<br>3 = 250 kBaud<br>4 = 125 kBaud (Default)<br>5 = 100 kBaud<br>6 = 50 kBaud<br>7 = 20 kBaud |
| The entries 20F0/20F1 and 20F2/20F3 must always contain identical values.<br>The new entries are valid after a reset (switching the module off/on).<br>Values outside the permissible ranges will be rejected. | | | | | |

| Index | S-Idx | Name | Typ | Default | Beschreibung |
|---|---|---|---|---|---|
| *) Observe hex-code switch position!<br>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".<br>(for position and coding of the hex-code switches --> 7 Technical data) | | | | | |

## 9.2 Manufacturer Specific Profile Area; index 1000 to 1FFF



| Index | S-Idx | Name | Typ | Default | Beschreibung |
|---|---|---|---|---|---|
| 1000 | 0 | Device type | u32, ro | 0x000F0191 | Profile 401;<br>Inputs and outputs, binary and analogue |
| 1001 | 0 | Error register | u8, ro | 0x00 | Bit-coded to profile 301,<br>the following is supported:<br>0b 0000 0000 no error<br>0b 0000 0001 generic error<br>0b 0001 0000 communication error<br>0b 1000 0000 manufacturer specific |
| 1003 | 0 | Pre-defined errorfield | u8, ro | 0x04 | An error list with 4 entries is supported. |
| | 1 | Error history | u64, ro | 0x00 | Error occured, coded according to the EM-CY list, the last error is in the subindex 1. |
| 1005 | 0 | COB-ID<br>synch objekt | u32, rw | 0x00000080 | - Module generates no synch message (bit 30 = 0)<br>- 11-bit identifier system (bit 29 = 0)<br>- Identifier of the synch message |
| 1006 | 0 | Communic.<br>Cycle | u32, rw | 0x00000000 | Max. time between 2 synch objects in µs<br>Useful resolution = 1ms |
| 1008 | 0 | Device name | str, ro | CR2033 | Device name |
| 1009 | 0 | HW Version | str, ro | x.x | Hardware version |
| 100A | 0 | SW Version | str, ro | x.x | Software version |
| 100C | 0 | Guard time | u16, rw | 0x0000 | Time in ms<br>Within this time the output module expects a "node guarding" of the network master.<br>If the value 0 is entered here, this function is not supported.<br>Note:<br>Node monitoring with "node guarding" or "heartbeat" can only to be used as an alternative. |

| Index | S-Idx | Name | Typ | Default | Beschreibung |
|---|---|---|---|---|---|
| 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.<br>The module changes the CANopen status to PREOP.<br>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 |
| | 1 | "Alle Parameter sichern" | u32, rw | 0x02 | Automatic saving of all changed parameters OFF/ON.<br>0 = AutoSave OFF<br>2 = AutoSave ON |
| 1011 | 0 | Number of restore-options | u8, ro | 0x01 | Number of the "restore" options |
| | 1 | "Alle Parameter reset" | 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<br>Emergency | u32, rw | 0x00000080<br>+<br>Node-ID | - EMCY is valid (Bit 31 = 0)<br>- EMCY is not valid (Bit 31 = 1)<br>- 11 Bit ID (Bit 29 = 0)<br>- ID = 0x80 + Node ID<br>CAN identifier can be changed<br>by the user. |
| 1016 | 0 | Number of options Consumer heartbeat time | u8, ro | 0x01 | Number of the monitored units |
| | 1 | Consumer heartbeat time | u32, rw | 0x00 | Heartbeat monitoring time for node n.<br>Monitoring of only one node is supported.<br>0x0nnttttt = monitoring time [ms]<br>0x0nnttttt = node number<br>(If nn or tttt = 0, no monitoring is carried out)<br>Note:<br>Node monitoring with "node guarding"<br>or "heartbeat" is only to be used as an<br>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 |
| | 1 | Vendor-ID | u32, ro | 0x0069666D | Vendor ID to CiA specification |

| Index | S-Idx | Name | Typ | Default | Beschreibung |
|---|---|---|---|---|---|
| 1400 | 0 | Receive PDO 1 | u8, ro | 0x02 | Number of the entries Rec PDO 1<br>Binary outputs |
| | 1 | COB-ID PDO 1 | u32, rw | 0x200 +<br>Node-ID | - PDO is valid (bit 31 = 0)<br>- CAN ID of the 1st Rec PDOs |
| | 2 | Trans Type PDO 1 | u8, rw | 0x01 | 0x00 = synch acyclic<br>0x01...0xF0 = synch cylic,<br>Outputs are only updated after "n"<br>synch objects.<br>n = 0x01 (1) ... 0xF0 (240)<br>0xFC/0xFD not implemented<br>0xFE = asynch manuf. specific event,<br>outputs are updated immediately<br>0xFF = asynch device profile event, outputs are updated immediately |
| 1401 | 0 | Receive PDO 2 | u8, ro | 0x02 | Number of the entries Rec PDO 2<br>Analogue outputs |
| | 1 | COB-ID PDO 2 | u32, rw | 0x300 +<br>Node-ID | - PDO is valid (Bit 31 = 0)<br>- CAN ID of the 2nd Rec PDOs |
| | 2 | Trans Type PDO 2 | u8, rw | 0x01 | 0x00 = synch acyclic<br>0x01...0xF0 = synch cylic,<br>Outputs are only updated after "n"<br>synch objects.<br>n = 0x01 (1) ... 0xF0 (240)<br>0xFC/0xFD not implemented<br>0xFE = asynch manuf. specific event,<br>outputs are updated immediately<br>0xFF = asynch device profile event,<br>outputs are updated immediately |
| 1600 | 0 | Mapping Rec PDO 1 | u32, ro | 0x01 | Number of the application objects linked with the binary output PDO |
| | 1 | Index im Objektverzeichnis | u32, ro | 0x6200 01 | 6200 Sldx 01 contains 1 byte<br>0b 0000 0001 channel 2 binary output<br>0b 0000 0010 channel 4 "<br>0b 0000 0100 channel 6 "<br>0b 0000 1000 channel 8 " |
| 1601 | 0 | Mapping Rec PDO 2 | u32, ro | 0x04 | Number of the application objects linked with the analogue output PDO |

| Index | S-Idx | Name | Typ | Default | Beschreibung |
|---|---|---|---|---|---|
| | 1 | Index im Objek-tverzeichnis | u32, ro | 0x6411 01 | 6411 Sldx 01 contains the preset value of the analogue output channel 2.<br>The value is interpreted as pulse/break ratio in ‰.<br>(depending on the configuration of the index 2000 → 9 Object directory). |
| | 2 | Index im Objek-tverzeichnis | u32, ro | 0x6411 02 | 6411 Sldx 02 contains the preset value of the analogue output channel 4.<br>The value is interpreted as pulse/break ratio in ‰.<br>(depending on the configuration). |
| 1601 | 3 | Index im Objek-tverzeichnis | u32, ro | 0x6411 03 | 6411 Sldx 03 contains the preset value of the analogue output channel 6.<br>The value is interpreted as pulse/break ratio in ‰.<br>(depending on the configuration). |
| | 4 | Index im Objek-tverzeichnis | u32, ro | 0x6411 04 | 6411 Sldx 04 contains the preset value of the analogue output channel 8.<br>The value is interpreted as pulse/break ratio in ‰.<br>(depending on the configuration). |
| 1800 | 0 | Trans PDO 1 | u8, ro | 0x05 | Number of the entries Trans PDO 1<br>Binary inputs |
| | 1 | COB-ID PDO 1 | u32, rw | 0x180 +<br>Node-ID | - PDO is valid (bit 31 = 0)<br>- CAN ID of the 1st Trans PDOs |
| | 2 | Trans Type PDO 1 | u8, rw | 0xFF | 0x00 = synch acyclic<br>0x01...0xF0 = synch cyclic;<br>Inputs are only transferred after "n" synch objects.<br>n = 0x01 (1) ... 0xF0 (240)<br>0xFC/0xFD not implemented<br>0xFE = asynch man. spec. event;<br>Inputs are immediately transferred.<br>0xFF = asynch device profile event;<br>Inputs are immediately transferred. |
| | 5 | Event timer Trans PDO 1 | u16,rw | 0x00 | Max. transfer break (0...65535 ms) in trans type "asynch",<br>when this time has elapsed the PDO is transferred even if the appl. event has not occurred. |
| 1801 | 0 | Trans PDO 2 | u8, ro | 0x05 | Number of the entries Trans PDO 2<br>Analogue inputs |
| | 1 | COB-ID PDO 2 | u32, rw | 0x280 +<br>Node-ID | - PDO is valid (Bit 31 = 0)<br>- CAN ID of the 2nd Trans PDOs |

| Index | S-Idx | Name | Typ | Default | Beschreibung |
|---|---|---|---|---|---|
| | 2 | Trans Type PDO 2 | u8, rw | 0x01 | 0x00 = synch acyclic<br>0x01...0xF0 = synch cyclic;<br>Analogue values are only transferred after "n" synch objects.<br>n = 0x01 (1) ... 0xF0 (240)<br>0xFC...0xFF not implemented |
| 1A00 | 0 | Mapping Trans PDO 1 | u32, ro | 0x01 | Number of the linked application objects (binary inputs) |
| | 1 | Index im Objek-tverzeichnis | u32, ro | 0x600 01 | Idx 6000, SIdx 01 contains 1 Byte<br>0b 0000 0001 channel 1<br>0b 0000 0010 channel 3<br>0b 0000 0100 channel 5<br>0b 0000 1000 channel 7 |
| 1A01 | 0 | Mapping Trans PDO 2 | u32, ro | 0x04 | Number of the linked application objects (analogue inputs) |
| | 1 | Index im Objek-tverzeichnis | u32, ro | 0x6401 01 | Idx 6401, SIdx 01 contains the analogue value channel 1/2 |
| | 2 | Index im Objek-tverzeichnis | u32, ro | 0x6401 02 | Idx 6401, SIdx 02 contains the analogue value channel 3/4 |
| | 3 | Index im Objek-tverzeichnis | u32, ro | 0x6401 03 | Idx 6401, SIdx 03 contains the analogue value channel 5/6 |
| | 4 | Index im Objek-tverzeichnis | u32, ro | 0x6401 04 | Idx 6401, SIdx 04 contains the analogue value channel 7/8 |



## 10 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.

## 11 Declaration of conformity

Prüfnormen und Bestimmungen siehe Technische Daten.

Die CE-Konformitätserklärung und die E1-Zulassung sind abrufbar unter: www.ifm.com

# 12 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<br>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."<br>(user and manufacturer organisation in Germany/Erlangen)<br>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;<br>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<br>Guard Master: one or several slaves no longer reply<br>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.<br>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 |
| Identifier | see ID |
| Idx Index; | together with the S index it forms the address of an entry in the object directory |
| Life Time Factor | 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 | is used to describe the error class (guarding monitoring, synch etc.) |
| 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 | (also 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<br>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;<br>in the CANopen network for transfer of process data in real time; such as the speed of a motor<br>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.<br>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<br>In this mode only NMT commands are transferred. |
| Rec PDO | Receive Process Data Object (also Rx PDO) |
| ro | read only (unidirectional) |
| rw | read-write (bidirectional) |
| Rx-Queue | reception buffer |
| s16 | data type signed 16 bit |
| SDO | Service Data Object;<br>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.<br>The transfer of the individual messages is confirmed by the addressed participant.<br>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 (also 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 object | 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 (also Tx PDO) | transmit process data object (also Tx PDO) |
| Trans SDO (also Tx SDO) | transmit service data object (also Tx SDO) |
| Tx-Queue | (transmit) transmission buffer |
| u8 (16, 32) | data type unsigned 8 (16, 32) bits |
| wo | write only |