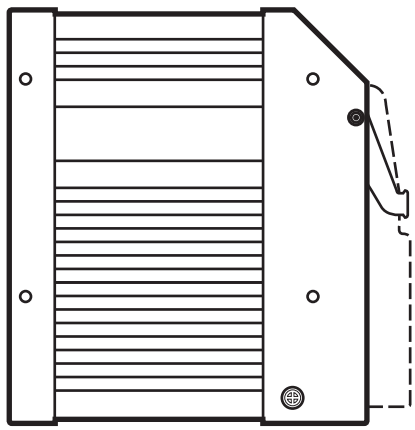
Device manual

SmartModul
Input/output module

CR2512

UK

80269925 / 00 01 / 2018



Contents

1 Preliminary note 3
2 Safety instructions 3
3 Function and features 3
4 Function 4
5 Mounting 5
6 Electrical connection 5
7 Set-up 6
7.1 PLC configuration in CODESYS 2.3 6
7.2 PLC configuration in CODESYS 3.5 7
7.2.1 Heartbeat configuration 7
7.2.2 SyncMonitoring 8
7.3 Electronic Data Sheet 8
8 Parameter settings 9
8.1 Parameter list 10
9 Technical data 11
10 Object directory 16
11 Fault correction 24
11.1 EMCY Object 24
12 Maintenance, repair and disposal 25
13 Approvals / standards 25
14 Terms and abbreviations 25

1 Preliminary note

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

► Instruction
→ Cross-reference

Important note
Non-compliance can result in malfunctions or interference.

Information
Supplementary note

UK

2 Safety instructions

This description is part of the unit. It contains texts and drawings concerning the correct handling of the controller 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 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.

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

3 Function and features

Das E/A-Modul CR2512 dient zur dezentralen Auswertung von Sensorsignalen und zur Ansteuerung von Aktoren und Proportionalventilen. Über die integrierte Strommessung kann der Spulenstrom überwacht und zur Regelung genutzt werden.

4 Function

- The module supports binary inputs and binary/analogue 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:
  - binary inputs (can also be used as node ID selector)
  - 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 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 (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 (→ 9.1 Parameter list) upon request.

5 Mounting

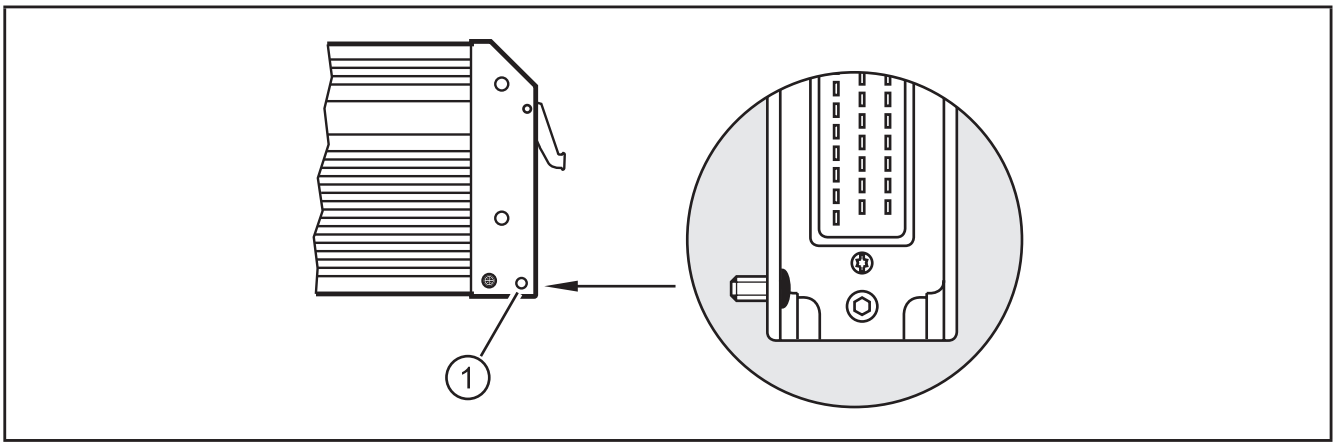
In order to expose the module to the minimum mechanical stress it should preferably be mounted horizontally or vertically on the mounting panel. The module must be fixed with four screws to DIN 7500 or DIN 7984 (M5 x L).

If possible, the module should be mounted in such a way that the cable entry of the plug points downwards.

As the self-heating of the electronics of the unit is dissipated via the housing, sufficient cooling must be ensured in case of "sandwich mounting" of modules.

6 Electrical connection

To ensure the protection of the device against electrical interference and the safe function of the device, the housing must be connected to the ground of the vehicle.



1: Drill hole for ground connection

► Establish a connection between the device and the ground of the vehicle using M5 screws.

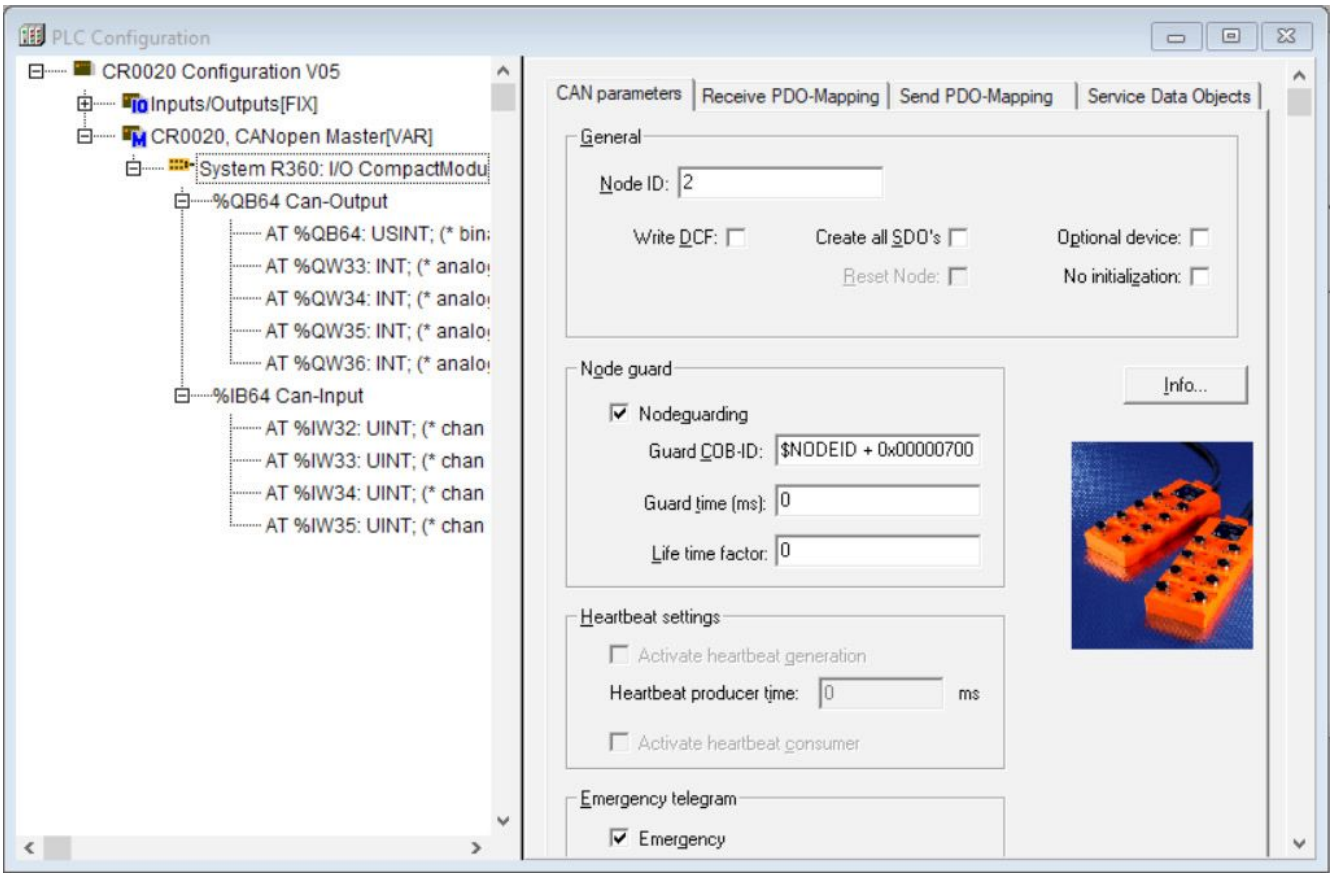
► To protect the whole system (wiring and module) the individual electric circuits must be protected.

Designation	Potential	Pin No.	Fuse
Operating voltage sensors/module	VBB_S	23	2 A
Operating voltage outputs	VBB_O	05	15 A

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 CODESY manual and the CODESYS online help.

7.2 PLC configuration in CODESYS 3.5

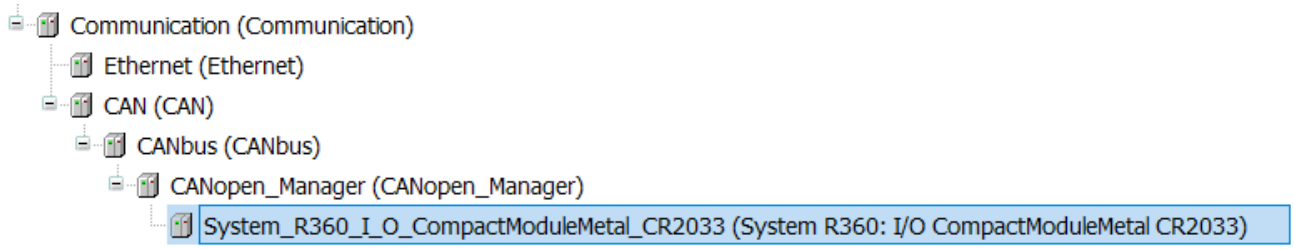
The "Electronic Data Sheet“ (EDS) is installed in the [Device Repository]. Proceed as follows in the main menu:

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

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

► Select EDS file and click on [Open].

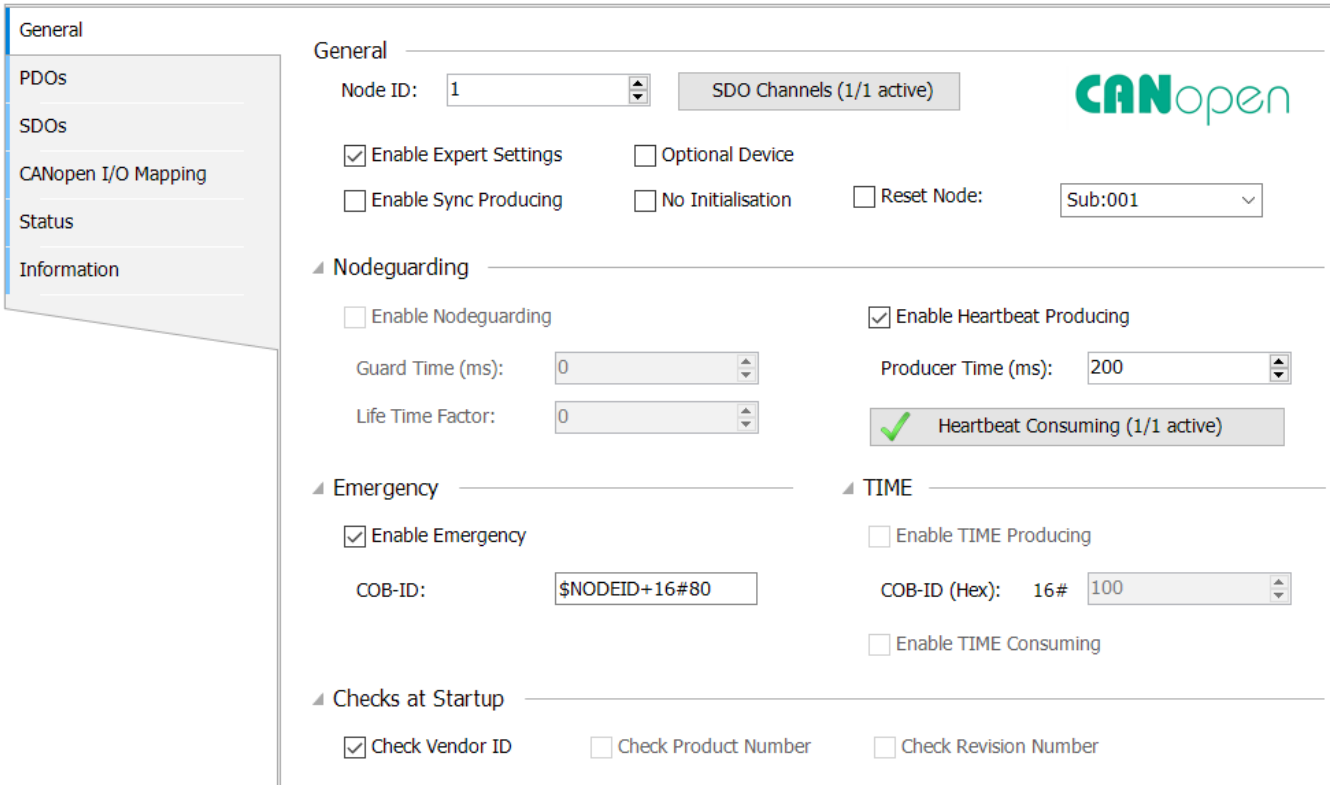
> In CODESYS 3.5 the devices are integrated as CiA remote devices in the device tree under a [CANopen_Manager] element.



The CANopen communication is configured via the CODESYS configuration editor.

7.2.1 Heartbeat configuration

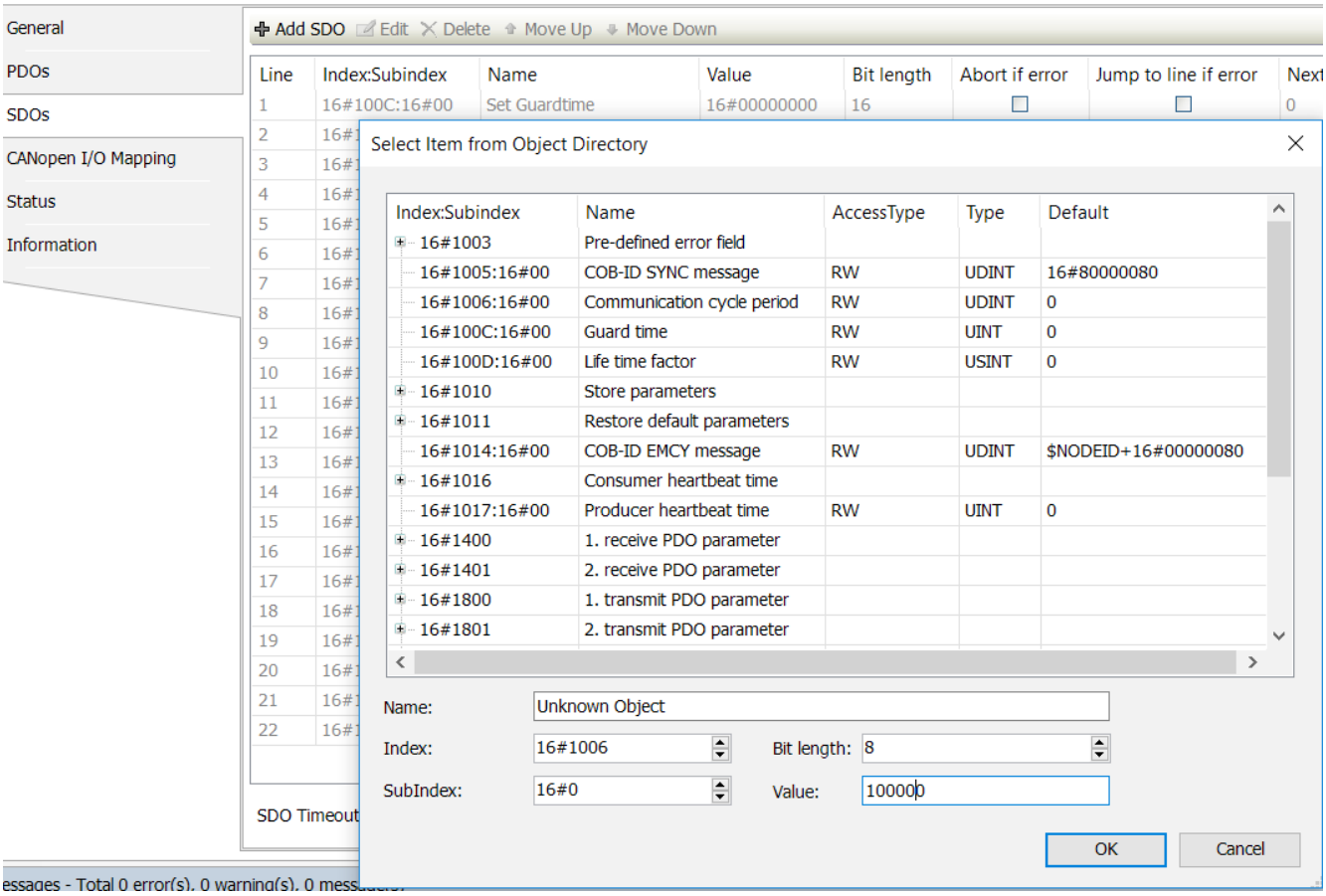
The function [Reset Node] must be activated on the tab [General] so that the device applies the parameters set for heartbeat monitoring of the CANopen Manager.

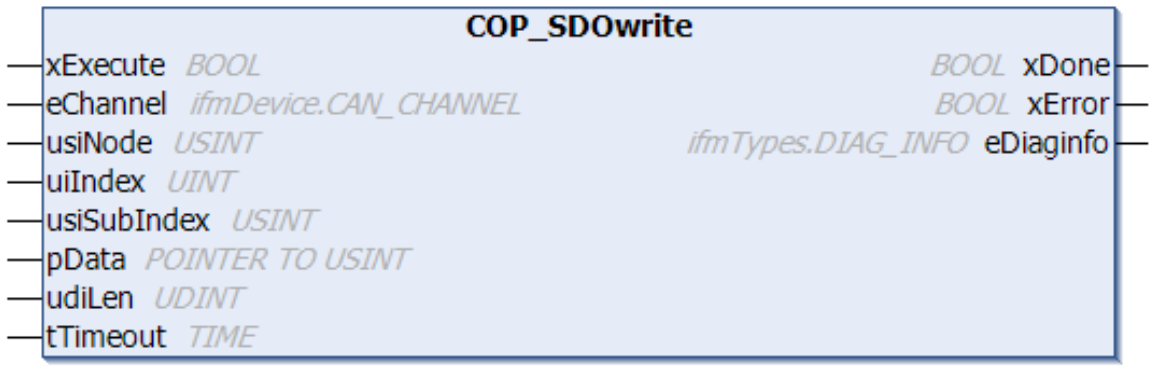


7.2.2 SyncMonitoring

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 [µs].





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 settings

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.

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.

Explanation of the abbreviations:

0x...=	hexadecimal number	str =	string
0b...=	bit-coded	rw =	read-write
0d...=	decimalnumerical value	ro =	read only
		u8 =	unsigned 8 bit
		u16 =	unsigned 16 bit
		u32 =	unsigned 32 bit

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-Frequenz	2001	0x64 (100Hz)	adjustable	after PreOp
Control parameters (P/I values, max. current) Channel 1/2 Channel 3/4 Channel 5/6 Channel 7/8	 2004 2005 2006 2007	 - - - -	 adjustable adjustable adjustable adjustable	 after PreOp after PreOp after PreOp 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 Object	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	0x01 (synchronous)	adjustable	immediately
Event Timer Trans PDO 1	1800 05	0x00	adjustable	immediately
COB-ID Trans PDO 2	1801 01	0x280 + Node-ID	einstellbar	after a reset
Trans Type Trans PDO 2	1801 02	0x01 (synchronous)	adjustable	immediately
Event Timer Trans PDO 2	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).

9 Technical data

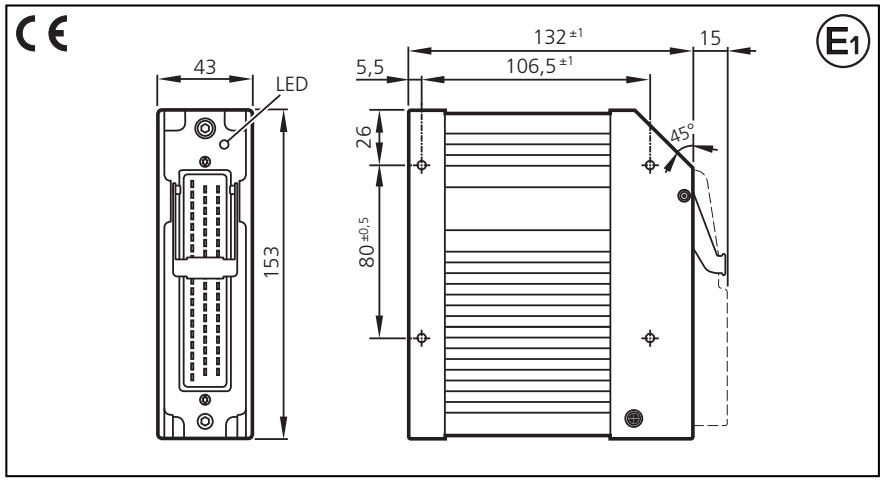
CR2512

SmartModule

I/O module
digital and analogue
for R 360 system

CANopen
interface

Supply voltage
10...32 V DC



Technical data	4 digital inputs 8 digital/PMW outputs with integrated current measurement
Housing	closed screened metal housing with flange fastening
Dimensions (l x w x h)	132 x 43 x 153 mm
Installation	by means of 4 M5xL screws to DIN 7500 or DIN 7984 mounting position horizontal or vertical to the mounting wall
Connection	55-pin connector, latched, protected against reverse polarity type AMP housing or Framatome AMP junior timer contacts, crimp connection 0.5/2.5 mm²
Weight	0.95 kg
Inputs	4
can be configured as	digital, for positive sensor signals (low side) and can be used for selecting the node ID offset
Outputs	8
can be configured as	digital, positive-switching (high side) analogue, PWM channel (PWM value 0 ‰; 50...1000 ‰) analogue, current-controlled channel (20...1000mA; 80...4000mA)
Switching current per output	max. 4 A (with / without current monitoring)
Total current	max. 12 A
Supply 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 (for inserted plug with individually sealed cores e.g. EC2084)
Interface	CAN interface 2.0 B, ISO 11898
Baud rate	20 Kbits/s...1 Mbit/s (default setting 125 Kbits/s)
Communication profile	CANopen, CiA DS 301 version 4, CiA DS 401 version 2.1
Node ID (default)	hex 20 (= dec 32)
Status LED	two-colour LED (red/green)

CR2512

Operating status

Status LED

During the start-up or reset of the controller the green and the red LEDs light simultaneously. This appears as orange.

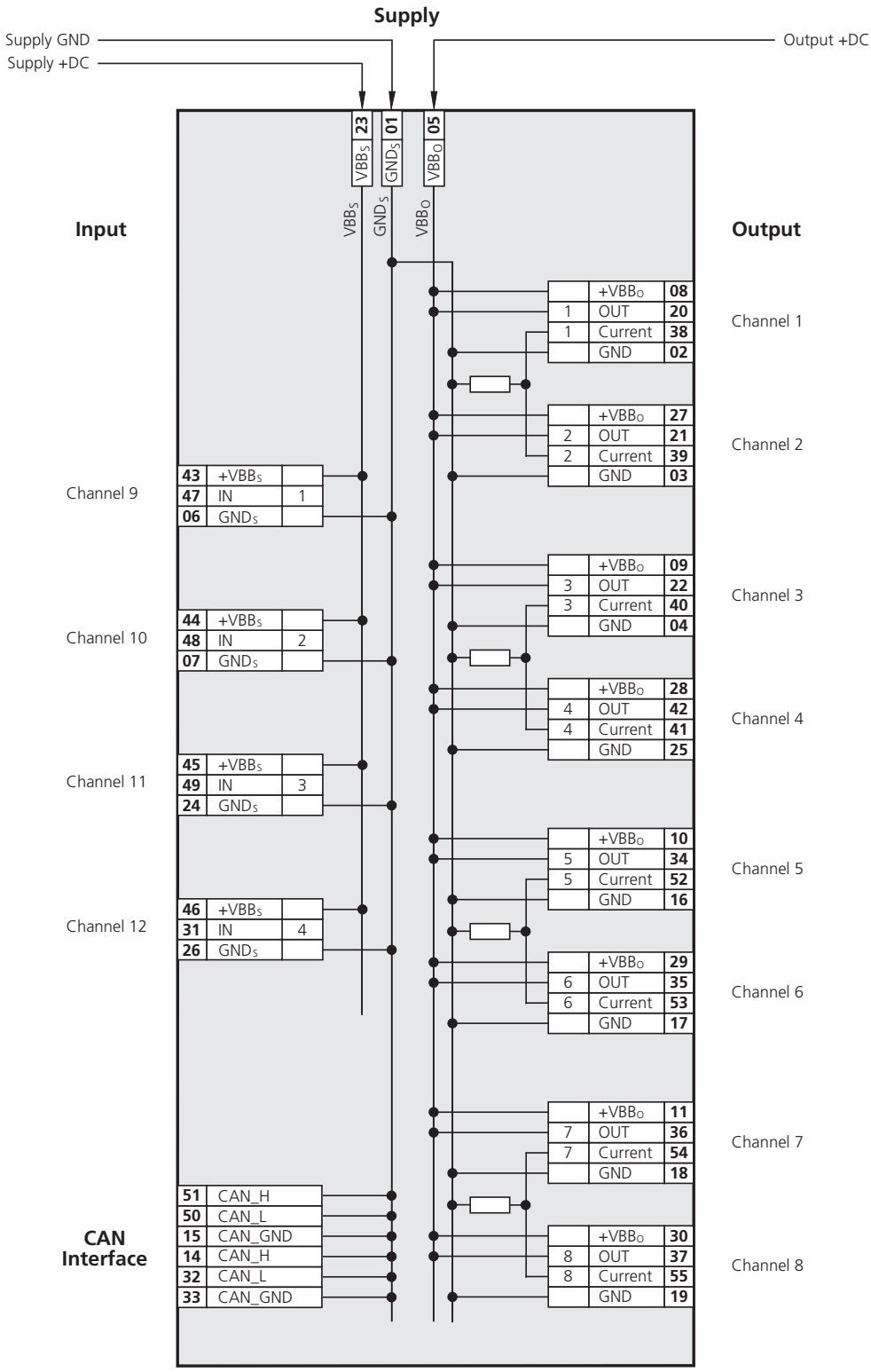
LED	Status	Description
green	OFF	no supply voltage
	ON	module in stand-by mode CANopen status: PREOPERATIONAL / PREPARED outputs = OFF
	1.0 Hz	At least one input was configured as node ID selector. After power on LED flashes n times according to the set node ID offset. Then the module changes into the CANopen status PREOPERATIONAL
	2.0 Hz	module active CANopen status: OPERATIONAL outputs are updated
red	OFF	communication OK
	ON	communication disturbed • node guard / heartbeat error (if node guarding/heartbeat is activated) • no synch objects (if synch monitoring is activated)

Test standards and regulations

Climatic test	Moisture/heat to EN 60068-2-30, test Db (≤ 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 2a, 3a, 3b, severity level 4, function state A to ISO 7637-2, pulse 5, severity level 4, function state B to ISO 7637-2, pulse 1, 2b, severity level 4, function state C
Immunity to interfering fields	according to UN/ECE-R10 at 100 V/m (E1 type approval) and EN 61000-6-2 (CE)
Interference emission	according to UN/ECE-R10 (E1 type approval) and EN 61000-6-4 (CE)

CR2512	Characteristics of the inputs/outputs
Outputs Channels 1...8 can be configured as ...	■ Semi-conductor outputs (high side), short-circuit and overload protection switching voltage 10...32 V DC switching current max. 4 A (with/without current monitoring) 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 Two outputs each are combined (1+2, 3+4, 5+6, 7+8). The output signal is present at only one of the two outputs while the other output is OFF (e.g. left/right or up/down functions). It is possible to immediately switch over from one output to the other. PWM frequency 20...250 Hz pulse/break ratio 0 ‰; 50...1000 ‰ resolution 1 ‰ switching current max. 4 A (referred to PWM value 1000‰) With smaller PWM values this current value is reduced. value range -1000...+1000 ‰ Values > +1000‰ are internally rounded to +1000 ‰. Values < -1000‰ are internally rounded to -1000‰. With the values between -50...+50 ‰ the output is switched off. value output +50...+1000‰ are present at the odd-numbered outputs (channels 1, 3, 5, 7) -1000...-50‰ are present at the even-numbered outputs (channels 2, 4, 6, 8)
	■ 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 (see control parameters) control characteristics can be set via the object directory (see control parameters) setting resolution 1 mA precision ± 2% FS switching current max. 4 A load resistance min. 3/12 Ω (at U_B = 12 V DC) min. 6/24 Ω (at U_B = 24 V DC) value range -4000...+4000 mA Values > +4000 mA are rounded to +4000mA. Values < -4000 mA are rounded to -4000mA. Values -80...+80 mA are interpreted as "OFF". value output 80...4000 mA are present at the odd-numbered channels (1, 3, 5, 7) -4000...-80 mA are present at the even-numbered channels (2, 4, 6, 8)
	Digital and PWM/current output can be combined to one connection pair, i.e. one output acts as binary, the other output as PWM/current output. The outputs can then be switched separately from each other.
Control parameters	By indicating the max. load current [mA] for each output pair the respective control or value range (1000 or 4000mA) is selected automatically. In addition the P/I behaviour of the current control function for each output pair can be parameterised.
Free-wheel diode is integrated!	To avoid a falsification of the measuring result, no external free-wheel diode must be connected in parallel with the load in the "current-controlled output" operating mode.
Inputs Channels 9...12 can be configured as ...	■ Binary inputs, for positive sensor signals (low side) switch-on level 0.4...0.7 U_B switch-off level 0.2...0.24 U_B input resistance 3 kΩ input frequency 50 Hz
	■ Node ID selector Each input can be allotted a value between 2^0 and 2^3. The resulting numerical value is added to the basic node ID according to the input and the value. If inputs are configured as node ID selector, the module does not go into the PRE-OPERATIONAL status after switch-on before a valid signal (”0” or ”1”) has been present at the selector inputs for at least 500ms and the resulting node ID has been received.
	It must be possible to clearly assign the value of the node ID selector to the inputs, i.e. the inputs must have different values!

CR2512 | **Wiring**



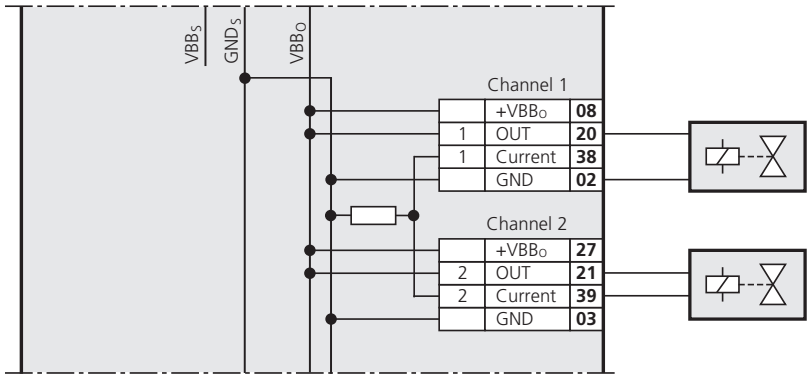
Abbreviations

CAN_H = CAN interface (high)
CAN_L = CAN interface (low)
GND_O = GND (output)
GND_S = GND (sensors/module)
PWM = output for pulse-width modulated signals
VBB_O = supply voltage (output)
VBB_S = supply voltage (sensors/module)

CR2512 | **Configuration examples (outputs channel pair 1/2)**

UK

Example 1

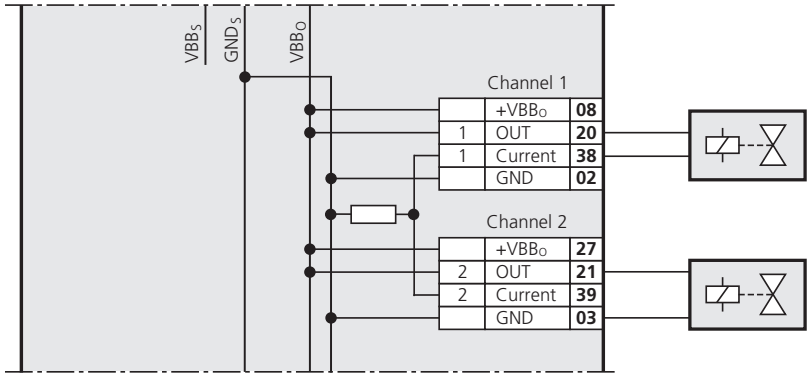


output functions

digital
e.g. two-way valves

digital
e.g. two-way valves
with current monitoring

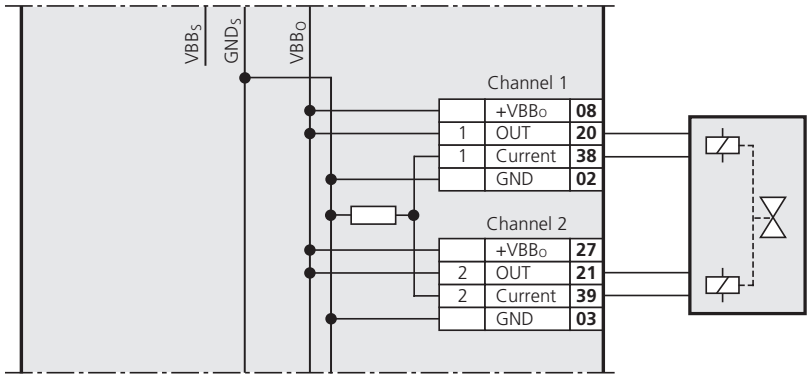
Example 2



PWM or current-controlled
e.g. proportional valve

digital
e.g. two-way valves

Example 3



PWM or current-controlled
e.g. proportional valve

10 Object directory

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 (= 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)

Explanation of the abbreviations:

0x...= hexadecimal number
0b...= bit-coded
0d...= decimal numerical

str = string
rw = read-write
ro = read only
u8 = unsigned 8 bit
u16 = unsigned 16 bit
u32 = unsigned 32 bit

Index	S-Idx	Designation	Type	Default	Description
2000	9	Configuration channel 9 (input 1)	u8, rw	0x01	0 = disabled 1 = binary input 100 = Node-ID-selector, value 2^0 = 1 101 = Node-ID-selector, value 2^1 = 2 102 = Node-ID-selector, value 2^2 = 4 103 = Node-ID-selector, value 2^3 = 8
2000	10	Configuration channel 10 (input 2)	u8, rw	0x01	0 = disabled 1 = binary input 100 = Node-ID-selector, value 2^0 = 1 101 = Node-ID-selector, value 2^1 = 2 102 = Node-ID-selector, value 2^2 = 4 103 = Node-ID-selector, value 2^3 = 8
2000	11	Configuration channel 11 (input 3)	u8, rw	0x01	0 = disabled 1 = binary input 100 = Node-ID-selector, value 2^0 = 1 101 = Node-ID-selector, value 2^1 = 2 102 = Node-ID-selector, value 2^2 = 4 103 = Node-ID-selector, value 2^3 = 8
2000	12	Configuration channel 12 (input 4)	u8, rw	0x01	0 = disabled 1 = binary input 100 = Node-ID-selector, value 2^0 = 1 101 = Node-ID-selector, value 2^1 = 2 102 = Node-ID-selector, value 2^2 = 4 103 = Node-ID-selector, value 2^3 = 8
If several inputs are configured as node ID selector, different values have to be assigned!					
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
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 presetactual 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 presetactual value difference)

Index	S-Idx	Designation	Type	Default	Description
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-Anteil Kanal 3, 4	u8, rw	0x32	P value of the current control function channel 3, 4 (= value in % referred to the presetactual 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 presetactual 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 presetactual 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 presetactual 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 presetactual 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 presetactual value difference)
2007	3	max. current channel 7, 8	u16, rw	0xFA0	max. possible load current in mA (= current at 1000‰ PWM)
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
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.					

Communication Profile Area; index 1000 to 1FFF

Index	S-Idx	Designation	Type	Default	Description
1000	0	Device type	u32, ro	0x000B0191	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	0x02	An error list with 1 entry is supported.
1003	1	Error history	u64, ro	0x00	Error occured, coded according to the EMCY list, the last error is in the subindex 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	CR2512	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 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 "heartbeat" 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

Index	S-Idx	Designation	Type	Default	Description
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 = 1) - EMCY is not valid (Bit 31 = 0) In default setting the EMCY transfer is deactivated. - 11 Bit ID (Bit 29 = 0) - ID = 0x80 + Node-ID CAN-Identifier can be change 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 "heartbeat" 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
1018	1	Vendor-ID	u32, ro	0x0069666D	Vendor ID to CiA specification
1200	0	Server SDOs	u8, ro	0x02	Number of the entries
1200	1	COB-ID Rec SDO	u32, ro	0x600 + Node-ID	- SDO ist gültig (Bit 31 = 0) - CAN-ID des Receive SDOs
1017	2	COB-ID Trans SDO	u32, ro	0x580 + Node-ID	-SDO is valid (bit 31 = 0) -CAN ID of the transmit SDO
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

Index	S-Idx	Designation	Type	Default	Description
1400	2	Trans Type PDO 1	u8, rw	0x01	0x00 = synch acyclic 0x01...0xF0 = synch cylic, 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 cylic, 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 Sldx 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 Sldx 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, see page 33).
1601	2	Index in the object directory	u32, ro	0x6411 02	6411 Sldx 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 Sldx 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 Sldx 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	0x04	Number of the entries Trans PDO 1 Binary inputs
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; Inputs are only transferred after "n" synch objects. n = 0x01 (1) ... 0xF0 (240) 0xFC/0xFD not implemented 0xFE = asynch man. spec. event; Inputs are immediately transferred. 0xFF = asynch device profile event; Inputs are immediately transferred.
1800	3	Inhibit time Trans PDO 1	u16, rw	0x00	Shortest repeat time, during this time the PDO is only transferred once in Trans Type "asynch.".
1800	5	Event timer Trans PDO 1	u16,rw	0x00	Max. transfer break in trans type "asynch", when this time has elapsed the PDO is transferred even if the appl. event has not occurred.
1801	0	Trans PDO 2	u8, ro	0x04	Number of the entries Trans PDO 2 (Actual current value)
1801	1	COB-ID PDO 2	u32, rw	0x280 + Node-ID	-PDO is valid (Bit 31 = 0) -CAN ID of the 2nd Trans PDOs
1801	2	Trans Type PDO 2	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.
1801	3	Inhibit time Trans PDO 2	u16, rw	0x00	Shortest repeat time, during this time the PDO is only transferred once in Trans Type "asynch.".

Index	S-Idx	Designation	Type	Default	Description
1801	5	Event timer Trans PDO 2	u16,rw	0x00	Max. transfer break in trans type "asynch", 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	0x01	Number of the linked application objects (binary inputs)
1A00	1	Index in the object directory	u32, ro	0x600 01	Idx 6000, SIdx 01 contains 1 byte 0b 0000 0001 channel 9 (input 1) 0b 0000 0010 channel 10 (input 2) 0b 0000 0100 channel 11 (input 3) 0b 0000 1000 channel 12 (input 4)
1A01	0	Mapping Trans PDO 2	u32, ro	0x01	Number of the linked application objects (actual current values)
1A01	1	Index in the object directory	u32, ro	0x2002 01 0x2002 02 0x2002 03 0x2002 04	Idx 2002, SIdx 01 contains the actual current value channel 1/2 Idx 2002, SIdx 02 contains the actual current value channel 3/4 Idx 2002, SIdx 03 contains the actual current value channel 5/6 Idx 2002, SIdx 04 contains the actual current value channel 7/8

11 Fault correction

11.1 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" 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 coded	"Device Specific" The output current could not be achieved because the load resistor is too high/small. 0000 0000 channel 1 0000 0001 channel 2 0000 0010 channel 3 0000 0100 channel 4 0000 1000 channel 5 0001 0000 channel 6 0010 0000 channel 7 0100 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 occured first is signalled. CANopen does not allow to send two identical EMCY objects one after the other.

12 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.

13 Approvals / standards

The EC declaration of conformity and approvals can be found at: www.ifm.com

14 Terms and abbreviations

0b ...	binary value (for bit coding), e.g. 0b0001 0000
0d ...	decimal 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 analog 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 1131)
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 service data object
u8 (16, 32)	data type unsigned 8 (16, 32) bits
wo	write only