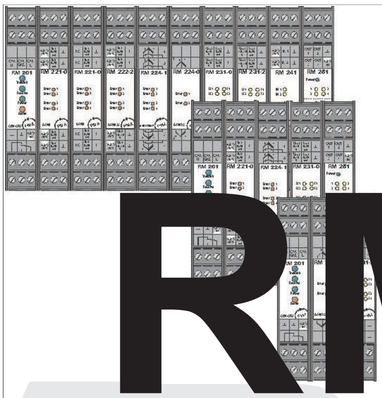
PMA Prozeß- und Maschinen-Automation GmbH

Modular I/O system



RM 200

CANopen

Operating Manual

CANopen

9499 040 62411

valid from: 8364

A publication of PMA Prozeß- und Maschinen Automation
P.O. Box 310229
D-34058 Kassel
Germany

Contents

1 Introduction 5

1.1 Scope of delivery 6

2 Safety Instructions general 7

3 Hints on operation 10

3.1 Mouting. 10

3.2 Interface connection 10

3.3 Address settings 11

3.4 Installation of cables 11

4 General 12

4.1 Supported I/O-modules. 12

5 Commissioning 13

5.1 DIP-Switch-Settings 13

5.2 Start-Up-Operation 15

5.3 Object Access via SDOs 15

5.4 EEPROM-Parameter-Storage 18

5.5 Node-Guarding and Life-Guarding. 18

6 Object directory 20

6.1 General 20

6.2 Table of Object-Listing. 20

7 Description of Individual Objects. 31

7.1 Structure of Object list according to WDP-404 31

7.2 General Hints 31

7.3 Digital Inputs 34

7.4 Digital Outputs 35

7.5 Analog Inputs. 38

7.6 Analog Outputs 43

7.7 Manufacturer Specific Objects, 0x5000 range 45

8 Emergency Messages 48

8.1 Start-Up Messages 48

8.2 Meaning of Individual Bytes 48

8.3 Reset of Error-Messages 49

9 PDO-processing 50
9.1 General 50
9.2 Default-Mapping 50
9.2.1 Calculating the Default-Mapping for Receive-PDOs 51
9.2.2 Calculation of the default mapping for transmit PDOs 51
9.3 Transmission types 52
10 CAN Glossary 53
10.1 Node States / Minimum Boot-Up 55
11 Hardware / Technical data 56
11.1 Connections. 56
11.1.1 24 V/DC- supply 56
11.1.2 CAN - connection 56
11.1.3 Alarm-relay 56
11.1.4 Bus termination 56
11.2 Replacement of the fuse on the RM 201 57
11.3 Transmit- / Receive - LED 57
11.4 Alarm-LED 57
11.5 Technical Data RM 201 58
12 Appendix 59
12.1 Definitions 59
12.2 FAQ - RM 200 Modules - General 60
12.3 FAQ - RM 200 Modules and KS98+. 61
12.4 Connection between RM 200 and KS98+ with CANopen interface 62
12.4.1 Cable connection KS98+ and RM 200 modules 63
12.4.2 Partial engineering for communication with a RM 200 node. 63
13 Index 64

1 Introduction

The input/output modules RM 200 with communication ports for CANopen or PROFIBUS-DP provide a high degree of flexibility when designing new plants. The compact, plug-in modules can be combined into cost-effective, de-centralized I/O islands. Due to the modular concept, type and number of the I/Os can be matched optimally to the requirements. Subsequent system extensions present no problems.

The fieldbus coupler module RM 201 (9407-738-20101) of the modular I/O system RM 200 is equipped with a CANopen interface for transmission of process data, parameters and configuration data. The connection is realized via screw-terminals. These serial communication interface permits connections to supervisory systems, visualization tools,etc.

Communication is according to the master/slave-principle. The coupler module RM 201 is always CANopen-slave.

Cable medium as well as physical and electrical interface properties:

- Network topology
  Linear bus with bus termination at both ends. Switchable termination resistance for RM 201.
- Transmission medium
  screened, twisted-pair cable
- Baudrates and cable length (without repeater)
  The maximum cable length depends on the used transmission rate.
  The baudrate of the RM 201 can be set via coding DIP-switches or can be recognized automatically.

Baudrate	Maximum cable length
10 / 20 /50 kbit/s	1000 m
100 kbit/s	800 m
125 kbit/s	500 m
250 kbit/s	250 m
500 kbit/s	100 m
800 kbit/s	50 m
1000 kbit/s	25 m

- Interface
  connectable with screw-/plug-in-terminals.
- Adressing
  Address settings via coding switches, range 01 ... 127, default 32

The modular I/O system RM 200 with CANopen interface offers many advantages with respect to handling and integration into a CAN network.

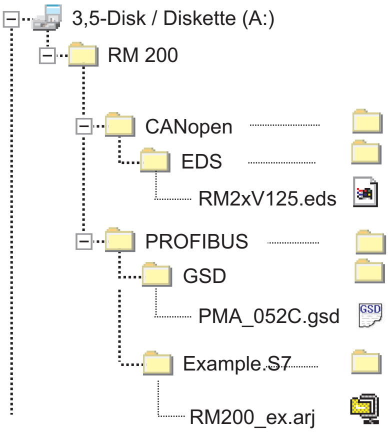
- Modules are pluggable in any order
  - up to 16 analog inputs per node
  - up to 16 analog outputs per node
  - up to 9 digital I/O modules per node
- Configuration of modules simply via CAN -configurator
- Broad range of available sensor and signal modules
- Plug and Play for the KS98+ - I/O-extension

ⓘ This document describes the coupler module RM 201 in the **Software-Version 1.25** or later.

1.1 *Scope of delivery*

The engineering set consists of:

- disk



Only for RM 201:	
RM2xV125.eds	Device description for CANopen, needed for CANopen-network configuration
Only for RM 202:	
PMA_052C.gsd	Device description file, used for PROFIBUS-DP configuration tools
RM200_ex.arj	Project example in STEP® 7

- operating manual for PROFIBUS-DP
- operating manual for CANopen

2 Safety Instructions general

INSTRUMENT SAFETY
This instrument was built and tested according to VDE 0411 / EN61010-1 and was shipped in safe condition. The unit was tested before delivery and has passed the tests required in the test plan.

In order to maintain this condition and to ensure safe operation, the user must follow the hints and warnings given in these safety notes and operating instructions.

The unit is intended exclusively for use as a measuring and control instrument in technical installations.

The insulation meets standard EN 61010-1 with the values for overvoltage category, degree of contamination, operating voltage range and protection class specified in the operating instructions / data sheet.

The instrument must be operated only by trained persons. Maintenance and repair should be carried out only by trained, qualified personnel familiar with the relevant hazards.

The instrument may be operated within the specified environmental conditions (see data sheet) without impairing its safety.

The instrument is intended for mounting in an enclosure. Its contact safety is ensured by installation in a housing or switch cabinet.

UNPACKING THE INSTRUMENT
Remove instrument and accessories from the packing. Enclosed standard accessories:
Operating notes or operating instructions for the instrument (if necessary, fixing elements).

Check, if the shipment is correct and complete and if the instrument was damaged by improper handling during transport and storage.

WARNING!
If the instrument is so heavily damaged that safe operation seems impossible, the instrument must not be taken into operation.

We recommend to keep the original packing for shipment in case of maintenance or repair.

Caution! The instrument contains electrostatically sensitive components.
The special packing protects the instrument against damage by electrostatic discharge (ESD). Therefor, the instrument may be transported only in this packing. During mounting, the rules for protection against ESD must be followed.

MOUNTING
Mounting is done in dustfree and dry rooms, either in a panel or in the relevant socket of a 19- inch instrument carrier.

The ambient temperature at the place of installation must not exceed the permissible nominal temperature specified for operation in the data sheet.
When mounting several instruments at high packing density, sufficient ventilation must be provided to ensure correct function.

The sealing devices (e.g. sealing ring) required for the relevant protection type must also be fitted.

Two captive screws are provided at the instrument front for fixing the 19- inch module in the instrument carrier. With other instruments, the fixing elements delivered with the instrument must be used.
The instruments may be mounted only outside the explosion-hazarded area!

ELECTRICAL CONNECTIONS
All electrical wiring must conform to local standards (e.g. VDE 0100 in Germany).
The input leads must be kept separate from signal and mains leads.
The protective earth must be connected to the relevant terminal (in the instrument carrier).

The cable screening must be connected to the terminal for grounded measurement. In order to prevent stray electric interference, we recommend using twisted and screened input leads.
The electrical connections must be made according to the relevant connecting diagrams.

COMMISSIONING
Before instrument switch- on, ensure that the rules given below were followed:

- Ensure that the supply voltage corresponds to the specification on the type label.
- All covers required for contact safety must be fitted.
- Before instrument switch- on, check if other equipment and / or facilities connected in the same signal loop
- is / are not affected. If necessary, appropriate measures must be taken.
- On instruments with protection class I, the protective earth must be connected conductingly with the relevant terminal in the instrument carrier.
- The instrument must be operated only when mounted in its enclosure.

OPERATION
Switch on the supply voltage.
The instrument is now ready for operation. If necessary, a warm- up time of approx.
15 min. should be taken into account.

WARNING !
Any interruption of the protective earth in the instrument carrier can impair the instrument safety. Purposeful interruption is not permissible.
If the instrument is damaged to an extent that safe operation seems impossible, shut it down and protect it against accidental operation.

TROUBLE SHOOTING
Before checking the instrument, all possibilities of error in other equipment and connections (input leads, wiring, equipment connected in the output circuit) should be checked. If the trouble cannot be located by checking these points, we recommend returning the instrument to the manufacturer.

HINT
Note that primary elements (especially thermocouples) connected to the energized transmitter are grounded in many cases, i.e. that the insulation resistance during operation can be reduced considerably. In these cases, additional connection to earth is not permissible.

SHUT- DOWN
For permanent shut- down, disconnect the instrument from all voltage sources and protect it against accidental operation.

Before instrument switch- off, check that other equipment and / or facilities connected in the same signal loop is / are not affected. If necessary, appropriate measures must be taken.

MAINTENANCE, REPAIR AND MODIFICATION
The instrument needs no particular maintenance.

WARNING!
When opening the instruments, or when removing covers or components, live parts or terminals can be exposed.

Before carrying out such work, the instrument must be disconnected from all voltage sources.

After completing such work, re- shut the instrument and re-fit all covers and components. Check, if the specifications on the type label are still correct, and change them, if necessary.

When opening the instruments, electrostatically sensitive components can be exposed.
The following work may be carried
out only at workstations which are protected against ESD.

Modifications, maintenance and repair may be carried out only by trained, authorized persons. For this, the user is invited to contact the PMA service.

If a trouble was found to be due to a blown fuse, the cause must be determined and removed. For replacement, only fuses of the same type and current rating as the original fuse must be used.

Using repaired fuses, or short- circuiting the fuse socket is inadmissible.

EXPLOSION PROTECTION
Non-intrinsically safe instruments must not be operated in explosion-hazarded areas. Moreover, the output and input circuits of the instrument / instrument carrier must not lead into explosion-hazarded areas. Exceptions refer only to instruments for which a certificate of conformity exists. For these EX- instruments, the specifications in the relevant certificate of conformity and the local regulations for installation of electrical apparatus in explosion-hazarded areas must be taken into account additionally.

3 Hints on operation

3.1 *Mouting*

An RM 200 system comprises a basic module (housing) for mounting on a snap-on rail with 3, 5 or 10 sockets.
The left socket is generally reserved for bus coupler module CANopen **RM 201**. Dependent of requirements, I/O modules or dummies are fitted in the other sockets. The modules click into the basic module and can be released for replacement by means of simple tools.

The connecting terminals can be withdrawn easily from the the modules.

The plug-in cards must not be plugged in or withdrawn with the supply voltage switched on.

The basic modules are intended for DIN-rail mounting according to EN 50022. The mouting is carried out by locking the metal ledge on the back side below. For dismantling a basic module the metal ledge must be released.

Module installation into a basic module: Slide in the module at the respective place. Listen to the ‘click’ for proper engaging. The installation of the fieldbus coupler always must be placed at the absolutely left position. All other modules can be installed at any position (but see below). For removing: Release the two ledges and pull out the module.

Temperature modules like RM 224-x should be placed far away from modules with higher power demand, e.g. RM 252, RM 231-x, RM 201 etc..

The relay module RM 252 should not be mounted right of the RM 201.

Using a mixture of modules with four channels and two channels please place the ones with two channels right from the four channels ones.

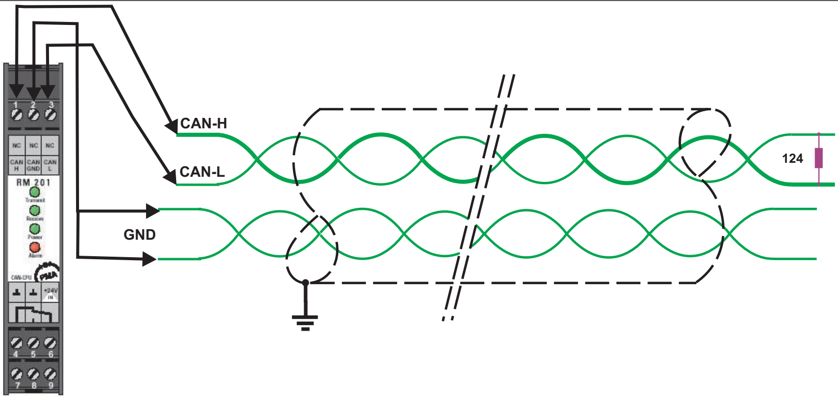
To keep the specified protection degree (IP20) epmty slots must be protected by slot covers RM 214.

The screw-/plug-in-terminals can be plugged in from above or below into the module housing (audible locking). Removing the scre-/plug-in-terminals takes place by levering out, e.g. With a screwdriver.
Due to contact-voltage proof not connected terminals should remain in the resprective place.

3.2 *Interface connection*

The CANopen bus is physically connected via screw-/plug-in terminals.

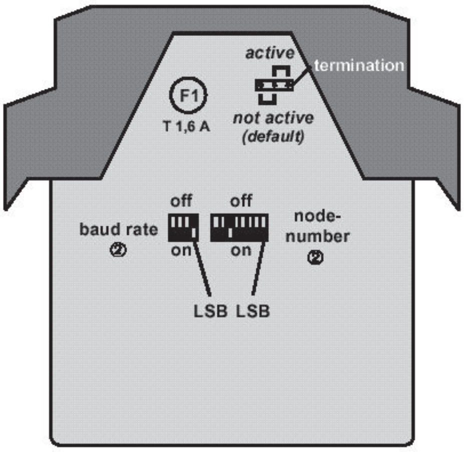
Fig.: 1 Connection CANopen



The construction of suitable cabling must be provided by the user, whereby the general cable specifications must be taken into account.

3.3 *Address settings*

The CANopen-address has to be set on the bus coupler RM 201 via DIP-switches.



DIP switches / Jumper

4 Bit DIP switch

DIP ①	Baud rate
0000	10 kBit
0001	20 kBit ②
0010	50 kBit
0011	100 kBit
0100	125 kBit
0101	250 kBit
0110	500 kBit
0111	800 kBit
1000	1000 kBit
1001	Auto Scan
4321	Switch-Pos.

8 Bit DIP switch

DIP ①	Node-No.
0000 0000	invalid
0000 0001	1
0000 0010	2
0000 0011	3
...	...
0010 0000	32 ②
...	...
0111 1110	126
0111 1111	127
8765 4321	Switch-Pos.

The positions of the switches are shown in binary-code. The number at the right position corresponds to the LSB (DIP-switch-poistion 1), the number at the left position corresponds to the MSB (DIP-switch-position 8).

3.4 *Installation of cables*

When laying the cables, the general hints for cable installation given by the supplier of the master module must be followed:

- Cable run in buildings (inside and outside cabinets)
- Cable run inside and outside buildings
- Potential compensation
- Cable screening
- Measures against interference voltages
- Stub line length
- Bus termination resistors are contained in RM 201, if required it can be switched on by a jumper.
- Earthing

The cable specifications are:

Transmission rate kBit / s	Bus length m	Cross section mm^2	Resistance mΩ/m
1000	$\leq$30	0,25 … 0,34	<70
800	$\leq$50	0,25 0,34	<70
500	$\leq$100	0,34 … 0,60	<60
250	$\leq$250	0,34 … 0,60	<60
125	$\leq$500	0,50 … 0,60	<40
100	$\leq$800	0,75 … 0,80	<26
50	$\leq$1000	0,75 0,80	<26

The recommended cable type should be a shielded twisted pair cable with two pairs according to ISO 11898.

4 General

Due to the concept of decentral in/output modules with CANopen respective PROFIBUS-DP-connection a high degree of flexibility is provided to the application engineer layouting his concept. The compact and cost-effective modules are to be combined to a device with the optimum number of in/outputs. A subsequent system extension is easily done due to the modular concept. The great variety of digital and analog in/output-modules allows the application of this system in many areas. In addition to the standard modules are special modules available.

This manual describes the modular I/O system with CANopen connection through the coupler RM 201.

The required modules were plugged in one carrier consisting of one bus connection and a housing. At present there are available carriers for 3, 5 and 10 modules. Each system allows up to 16 analog inputs and 16 analog outputs. This means 4 analog input modules and 4 analog output modules with 4 channels per module. Up to 8 analog modules RM 224-0 with two galvanic isolated thermocouple inputs, equivalent to 16 analog inputs, are allowed to plug in. The number of digital in/outputs is not restricted. The fieldbus coupler always takes the position left from the other modules .

Maximal amount of modules:

RM 241, RM 242, RM 243	(dig. In)	: 9
RM 251, RM 252	(dig. Out)	: 9
RM 221-x, RM 222-x, RM 224-1	(ana. In)	: 4
RM 224-0	(ana. In)	: 8
RM 231-x	(ana. Out)	: 4

Example:

1 fieldbus coupler, 3 analog input modules, 4 analog output modules,
1 digital input module, 1 digital output module.

This is a valid configuration, since there are not more than 4 analog input and 4 analog output modules. At any time, free slots may be filled up with digital in/output-modules. The limit of 9 in/output-modules has not been reached.

4.1 *Supported I/O-modules*

The following I/O modules are supported by the coupler RM 201 in the **Version V1.25 :**

RM 241	4 x dig. In	3 pole sensor (NPN / PNP)
RM 242	8 x dig. In	potential-bounded 24 V/DC signals
RM 243	4 x dig. In	230 V/AC signals
RM 251	8 x dig. Out	24 V / 1,5 A per output
RM 252	4 x dig. Out	4 x change-over-contact- relays
RM 221-x	4 x ana. In	standard signals / with galvanic isolation between modules
RM 222-x	4 x ana. In	standard signals / with sensor supply
RM 224-1	4 x Temp. In	RTD (Pt100) & TC / full range
RM 224-0	2 x TC. In	TC / full range / galvanic isolation
RM 231-x	4 x ana. Out	standard signals

The specified I/O modules can be combined according to the following design rules:
- there are available basic housing for 3, 5 and 10 modules.
- max. 16 analog inputs are supported.
- max. 16 analog outputs are supported.
- max. 72 digital in- or outputs per unit
- the CANopen coupler has to be placed always in the utter left slot of the housing.

5 Commissioning

5.1 *DIP-Switch-Settings*

The fieldbus coupler RM 201 can be adjusted to the preferred node number and baud rate via DIP-switches

4 Bit DIP-Switch (Baud Rate Selection)

switch position (*)	baud rate
0000	10 kBit
0001	20 kBit = default setting
0010	50 kBit
0011	100 kBit
0100	125 kBit
0101	250 kBit
0110	500 kBit
0111	800 kBit
1000	1000 kBit
1001 ... 1111	invalid

8 Bit DIP-Switch (Node Number Selection)

switch position (*)	node number
0000 0000	invalid
0000 0001	1
0000 0010	2
0000 0011	3
....	....
0010 0000	32 = default setting
....	....
0111 1110	126
0111 1111	127

(*) The switch position is given in binary format, the figure at the right end represents the LSB (DIP-switch-position 1), the figure at the left end represents the MSB (DIP-switch-position 4 for a 4digit switch respective DIP-switch-position 8 for a 8digit switch).

☞ In order to get the optimal benefits of the automatic default-mapping of the modular I/O system a node number smaller than 42 should be selected.

8 Bit DIP-Switch (Service Settings)

switch position (*)	function
1000 0000	invalid
1000 0001	downloading of default settings in EEPROM
1000 0010 … 1000 1111	free

Service-Settings:

The service-settings serve the search and correction of malfunctions. As soon as the diagnostic routine has run, the status will be indicated by the Receive-LED. A fault which cannot be repaired will be indicated by the Alarm-LED and the alarm output. As long as the service-setting is active, the device is unable to operate its normal function (CANopen-Slave-Node). Only after setting a valid baud rate the device will work as usual.

☞ Note:
The read in of the DIP switches status is done once immediately after powering up the device. After changing the DIP switch settings, the device has to be interrupted from the mains to enable the new settings.

Service-Setting 1:

Load EEPROM with default settings.
Some objects are saved nonvolatile in the EEPROM of the fieldbus coupler. So the device can be used after short voltage breakdown with the last settings. The device is delivered with the default settings as described in the object list in the manual.
If the device shows malfunction caused by wrong parameterization via CANopen, the default settings can be restored to the EEPROM with this service routine. The device should operate afterwards as delivered.

Status-Display:

- Five seconds after connection to the mains the yellow Receive-LED should be illuminated. The programming of the EEPROM with default settings is then finished.
- If an error occurs the red ALARM-LED is illuminated and the ALARM-relay pulls in. This indicates an error while writing the default settings to the EEPROM.

Changing the Device Configuration:

A change in the device configuration e.g. by adding a new in/output-module is generally followed by a new programming of the EEPROM of the fieldbus coupler with the default settings. The device operates afterwards as delivered.Via CANopen there is another option to perform a “Reset Node” to reset the device to the default settings.

5.2 *Start-Up-Operation*

Before getting started with the modular I/O system RM 200, the preferred node number and baud rate has to be selected with the DIP-switches of the RM 201 device.
Please note that every node number is to be assigned only once. Assigning the same node number to two devices will result in bus conflicts. Furthermore see to use the same baud rate for all devices of one CAN-network. The modular I/O system RM 200 provides the option to adjust the baud rate automatically at system start. To avoid communication problems mind to terminate the linear bus structure of the CAN-bus with terminal resistors at both ends. The modular I/O system RM 200 provides the option to switch in terminal resistors. Especially at high transmission rates a wrong termination can cause the communication to cease. As a matter of principle the baud rate should be selected as high as necessary and not as high as possible to minimize malfunctions. The following table indicates the maximal network expansion at different given baud rates.

Baud Rate [kBit/s]	max. Net-Extension [m]
500	100
250	250
100	800
50	1000

After switching on an entire unit RM 200 the fieldbus coupler RM 201 begins with the initialization. 5 to 10 seconds later the fieldbus coupler changes into the CANopen state pre-operational. After that the fieldbus coupler generates an emergency message by which any existing error states may be recognized. In this state it is possible to communicate with the device via SDO data transfer. Only after changing in the operational state communication via PDOs is enabled. After transition in the operational state all valid transmit PDOs of the device will be sent immediately once. During the initializing phase the RM 201 should not be reset i.e. reset node and reset communication should be avoided.

5.3 *Object Access via SDOs*

All objects of the modular I/O system RM 200 may be read via SDOs. So-called r/w-objects (read/write) allow in addition to be written via SDOs. To communicate with RM 200 via SDOs the device has be in the CANopen state operational or pre-operational. A SDO consists of 8 usable bytes. It includes the index, subindex, length and value of the object to read or to write.

The modular I/O systems RM 200 operates with an 11 bit identifier according to CAN-specification 2.0A. The following examples are easy to understand with an enhanced CAN-monitor or analyzer.
All examples assume a set node number 2 at the RM 201. So the identifier follows as: 0x602 (0x600 + 2) respectively 0x582 (0x580 + 2). In the examples all data are given in hexadecimal format.

Example 1 (Write 8 Bit Value)

Transmitter	Identifier	1.Byte	2.Byte	3.Byte	4.Byte	5.Byte	6.Byte	7.Byte	8.Byte
PC	602	2F	02	60	01	FF	00	00	00
RM 200	582	60	02	60	01	00	00	00	00

Transmitter: Message-Source

Identifier: Identifier of CAN-Message (here for SDO-Transfers)
PC to RM 200: Identifier = 0x600 + Node-ID
RM 200 to PC: Identifier = 0x580 + Node-ID

1. Byte: Contains informations about the type of data

1. Byte of PC write access
Uint8 / Int8 = 0x2F (write access 8Bit)
Uint16 / Int16 = 0x2B (write access 16Bit)
Uint32 / Int32 = 0x23 (write access 32Bit)
Float = 0x23 (write access 32Bit)

1. Byte of the RM 200 answer
Uint8 / Int8 = 0x60 (acknowledgement 8Bit)
Uint16 / Int16 = 0x60 (acknowledgement 16Bit)
Uint32 / Int32 = 0x60 (acknowledgement 32Bit)
Float = 0x60 (acknowledgement 32Bit)

2. Byte: Index of object, Low-Byte

3. Byte: Index of object, High-Byte

4. Byte: Subindex of object

5.-8. Byte: Usable data of PC write access
8Bit-transmission: 5. Byte = data, 6.,7.,8. Byte = 0x00
16Bit-transmission: 5. Byte = Low-Byte, 6. Byte = High-Byte, 7.,8. Byte = 0x00
32Bit- transmission: 5.,6. Byte = Low-Word, 7.,8. Byte = High-Word

Usable data of the RM 200 answer
At a faultless communication the RM 200 confirms a SDO-write-access by setting all useble data (5. - 8. Byte) to 0x00.

Example 2 (Read 8 Bit Value)

Transmitte	Identifier	1.Byte	2.Byte	3.Byte	4.Byte	5.Byte	6.Byte	7.Byte	8.Byte
PC	602	40	02	60	01	00	00	00	00
RM 200	582	4F	02	60	01	FF	00	00	00

Transmitter: Message-Source

Identifier: Identifier of the CAN-Message (here for SDO-Transfers)
PC to RM 200: Identifier = 0x600 + Node-ID
RM 200 an to: Identifier = 0x580 + Node-ID

1. Byte: Contains informations about the type of data

1. Byte of the PC read access
Uint8 / Int8 = 0x40 (read access)
Uint16 / Int16 = 0x40 (read access)
Uint32 / Int32 = 0x40 (read access)
Float = 0x40 (read access)

1. Byte of the RM 200 answer
Uint8 / Int8 = 0x4F (acknowledgement 8Bit)
Uint16 / Int16 = 0x4B (acknowledgement 16Bit)
Uint32 / Int32 = 0x43 (acknowledgement 32Bit)
Float = 0x43 (acknowledgement 32Bit)

2. Byte: Index of the object, Low-Byte

3. Byte: Index of the object, High-Byte

4. Byte: Subindex of the object

5.-8. Byte: Usable data of the PC request
all usable data Bytes (5.-8. Byte) are set to 0x00.

Usable data of the RM 200 answer
8Bit- transmission: 5. Byte = data, 6.,7.,8. Byte = 0x00
16Bit- transmission: 5. Byte =Low-Byte, 6. Byte = High-Byte, 7.,8. Byte = 0x00
32Bit- transmission: 5.,6. Byte = Low-Word, 7.,8. Byte = High-Word

5.4 *EEPROM-Parameter-Storage*

All relevant parameters of the modular I/O system RM 200 are saved nonvolatile in the EEPROM of the fieldbus coupler RM 201. These are communication parameters as i.e. PDO identifier as well as in/output parameter as e.g. the sensor type.
As soon as an object, which is saved nonvolatile in the EEPROM, gets rewritten, the new value is also stored in the EEPROM. Thanks to this feature it is possible to continue working with the unit as usual even after an interruption from the mains. It is not necessary to start the saving of data in the EEPROM with a command sequence as e.g. ‘SAVE’ in object 0x1010. In general a device gets parameterized only once. At the start up of the modular I/O system RM 200 the last valid settings will be read out from the EEPROM automatically. By checking the startup message (emergency message after power up) the HMI (Human-Machine-Interface) tests if the device operates accordingly or if e.g. an EEPROM read out error (checksum error) has occurred.

The defaults of the EEPROM data are to be restored at any time. To reset all EEPROM data to their default settings the command ‘Reset Node’ is used, the command ‘Reset Communication’ resets only the communication parameter to the default settings. If this command is used one has to consider that the reset of EEPROM data takes a certain amount of time. To assure safe operation one should not communicate with the node for at least 10 seconds.

⚠ A change in the device configuration of the modular I/O system RM 200, is followed by a reset of all parameters of the device to the origin. In case of trouble or a defective in/output module the device should only be restarted after replacing the defective in/output module against a new one. If the service technician pulls the defective in/output module and performs a restart without the defect in/output module to test the device, all parameters of the device are set to the default settings.

5.5 *Node-Guarding and Life-Guarding*

The failure checks of a CANopen network are performed with Node-Guarding and Life-Guarding procedures.

Node-Guarding:
With Node-Guarding a NMT master (e.g. the HMI) supervises decentral units at the periphery. With Node-Guarding the HMI recognizes the failure of an individual node.

Life-Guarding:
With Life-Guarding each CANopen node checks if the NMT-Master proceeds the once started Node-Guarding continuously within certain time limits. If the Node-Guarding telegram of the NMT-Masters fails, the decentral CAN unit at the periphery recognizes this with Life-Guarding and sets e.g. all outputs in a safe status.

Function:
With Guarding the NMT-Master as e.g. the HMI (Human-Machine-Interface) transmits remote frames (remote transmit request, message request telegrams) to the guarding-identifier of the slaves which are to be supervised. These respond with the guarding message, which has to contain the CAL-state of the slave and a toggle bit, which has to change with each message. If the status or the toggle bit does not match the masters expectation or if no answer is transmitted, the master assumes a slave failure.

The state transmitted with the guarding telegram can take on these values:

prepared / pre operational	=4
operational	=5
toggle bit	=MSB (Bit 7); Value = 0 at the first guarding telegram

If the master requests the guard message in firm cyclic order, the slave recognizes the correct function of the master. If the slave does not receive a message request from the master within the adjusted life-time (guarding-time-out) he assumes a master failure. The slave sets its outputs on error status and sends an emergency telegram. The emergency telegram is a set of 8 Bytes:
[COB-ID emergency message] with 0x10 | 0x00 | 0x01 | 0x00 | 0x10 | 0x00 | 0x00 | 0x00.
After a guarding-time-out the master can restart the procedure by sending a new guarding telegram.

The life-time is calculated with the objects guard-time (0x100C) and life-time-factor (0x100D). The unit of the life-time and guard time is ms.

life-time = guard-time x life-time-factor

If one of the parameters is zero, no supervising of the master happens (no Life-Guarding).

The guarding-identifier (COB-ID node guarding, object 0x100E) usually results from 0x0700 + Node-ID. With a write access the value of the object 0x100E can be altered according to CANopen.

6 Object directory

6.1 *General*

CANopen equipment communicates using objects. Every object has an index and a sub-index via which the object can be addressed. As part of standardisation, CiA has sub-divided the entire address range into different segments with fixed tasks. In addition to DS301 V3.0, ”CAL based Communication Profile for Industrial Systems” and the objects described there, the modular I/O system with CANopen connections also uses parts of the equipment profile WDP-404-12 ”Measuring Devices and Closed Loop Controllers”. The table below serves as a ”reference” for the object directory entries supported by the device. If required, the texts DS301 and WDP-404 can also be obtained from the CiA.

6.2 *Table of Object-Listing*

Meaning of an individual column:

1. Index — Index of the object, 16 bit, given in hexadecimal format
2. Subindex — Subindex of the object, 8 bit, given in hexadecimal format
3. Designation — Designation of the object = name of the variable
4. Type — Type of variable of the object: i8, i16, i32, ui8, ui16, ui32, float, string
5. PDO — Indicates if an object is able to be mapped in a PDO
6. Default — Value of an object at delivery
7. EEP — Indicates if the variable is saved nonvolatile in the EEPROM

Index	Subindex	Designation	Type	Access	PDO	Default	EEP
0x0002	**0x00**	**Dummy**	**ui8**	**rw**	**yes**	**0**	**no**
0x0003	**0x00**	**Dummy**	**ui16**	**rw**	**yes**	**0**	**no**
0x0004	**0x00**	**Dummy**	**ui32**	**rw**	**yes**	**0**	**no**
0x0005	**0x00**	**Dummy**	**i8**	**rw**	**yes**	**0**	**no**
0x0006	**0x00**	**Dummy**	**i16**	**rw**	**yes**	**0**	**no**
0x0007	**0x00**	**Dummy**	**i32**	**rw**	**yes**	**0**	**no**
0x0008	**0x00**	**Dummy**	**float**	**rw**	**yes**	**0.0**	**no**
0x1000	**0x00**	**Device Type**	**ui32**	**ro**	**no**	**0x000F0194**	**no**
0x1001	**0x00**	**Error Register**	**ui8**	**ro**	**no**	**0**	**no**
0x1003	**-**	**Predefined Error Field**	**-**	**-**	**-**	**-**	**-**
0x1003	0x00	Number of Errors	ui8	ro	no	10	no
0x1003	0x01	Standard Error Field 1	ui32	ro	no	0	no
0x1003	0x02	Standard Error Field 2	ui32	ro	no	0	no
0x1003	0x03	Standard Error Field 3	ui32	ro	no	0	no
0x1003	0x04	Standard Error Field 4	ui32	ro	no	0	no
0x1003	0x05	Standard Error Field 5	ui32	ro	no	0	no
0x1003	0x06	Standard Error Field 6	ui32	ro	no	0	no
0x1003	0x07	Standard Error Field 7	ui32	ro	no	0	no
0x1003	0x08	Standard Error Field 8	ui32	ro	no	0	no
0x1003	0x09	Standard Error Field 9	ui32	ro	no	0	no
0x1003	0x0A	Standard Error Field 10	ui32	ro	no	0	no
0x1004	**-**	**Number of PDOs Supported**	**-**	**-**	**-**	**-**	**-**
0x1004	0x00	Number of PDOs Supported	ui32	ro	no	0x0005000A	no
0x1004	0x01	Number of Sync PDOs	ui32	ro	no	0x0005000A	no
0x1004	0x02	Number of Async PDOs	ui32	ro	no	0x0005000A	no
0x1005	**-**	**COB-ID Sync Message**	**ui32**	**rw**	**no**	**0x00000080**	**yes**
0x1008	**-**	**Device Name**	**string**	**ro**	**no**	**MOD I/O**	**no**
0x1009	**-**	**Hardware-Version**	**string**	**ro**	**no**	**HW-V9821**	**no**
0x100A	**-**	**Software-Version**	**string**	**ro**	**no**	**SW-V01.25**	**no**
0x100B	**-**	**Node-ID**	**ui32**	**ro**	**no**	**<Switch>**	**no**
0x100C	**-**	**Guard-Time**	**ui16**	**rw**	**no**	**1000**	**yes**
0x100D	**-**	**Life-Time-Factor**	**ui8**	**rw**	**no**	**3**	**yes**
0x100E	**-**	COB-ID Node Guarding	**ui32**	**rw**	**no**	**0x700 + ID**	**yes**
0x100F	**-**	**Number of SDOs Supported**	**ui32**	**ro**	**no**	**0x00010001**	**no**
0x1014	**-**	**COB-ID Emergency Message**	**ui32**	**rw**	**no**	**0x80 + ID**	**no**

Index	Subindex	Designation	Type	Access	PDO	Default	EEP
0x1400	**-**	**Receive PDO1 Parameter**	-	-	-	-	-
0x1400	0x00	Number of Entries	ui8	ro	no	3	no
0x1400	0x01	COB-ID Receive PDO1	ui32	rw	no	0x200 + ID	yes
0x1400	0x02	Transmission-Type Receive PDO1	ui8	rw	no	0xFF	yes
0x1400	0x03	Inhibit Time Receive PDO1	ui16	rw	no	0	yes
0x1401	**-**	**Receive PDO2 Parameter**	-	-	-	-	-
0x1401	0x00	Number of Entries	ui8	ro	no	3	no
0x1401	0x01	COB-ID Receive PDO2	ui32	rw	no	0x300 + ID	yes
0x1401	0x02	Transmission-Type Receive PDO2	ui8	rw	no	0xFF	yes
0x1401	0x03	Inhibit Time Receive PDO2	ui16	rw	no	0	yes
0x1402	**-**	**Receive PDO3 Parameter**	-	-	-	-	-
0x1402	0x00	Number of Entries	ui8	ro	no	3	no
0x1402	0x01	COB-ID Receive PDO3	ui32	rw	no	0x22A + ID	yes
0x1402	0x02	Transmission-Type Receive PDO3	ui8	rw	no	0xFF	yes
0x1402	0x03	Inhibit Time Receive PDO3	ui16	rw	no	0	yes
0x1403	**-**	**Receive PDO4 Parameter**	-	-	-	-	-
0x1403	0x00	Number of Entries	ui8	ro	no	3	no
0x1403	0x01	COB-ID Receive PDO4	ui32	rw	no	0x32A + ID	yes
0x1403	0x02	Transmission-Type Receive PDO4	ui8	rw	no	0xFF	yes
0x1403	0x03	Inhibit Time Receive PDO4	ui16	rw	no	0	yes
0x1404	**-**	**Receive PDO5 Parameter**	-	-	-	-	-
0x1404	0x00	Number of Entries	ui8	ro	no	3	no
0x1404	0x01	COB-ID Receive PDO5	ui32	rw	no	0x254 + ID	yes
0x1404	0x02	Transmission-Type Receive PDO5	ui8	rw	no	0xFF	yes
0x1404	0x03	Inhibit Time Receive PDO5	ui16	rw	no	0	yes
0x1600	**-**	**Receive PDO1 Mapping**	-	-	-	-	-
0x1600	0x00	Number of Mapped Objects	ui8	rw	no	0	yes
0x1600	0x01	1. Mapped Object	ui32	rw	no	0x00000000	yes
0x1600	0x02	2. Mapped Object	ui32	rw	no	0x00000000	yes
0x1600	0x03	3. Mapped Object	ui32	rw	no	0x00000000	yes
0x1600	0x04	4. Mapped Object	ui32	rw	no	0x00000000	yes
0x1600	0x05	5. Mapped Object	ui32	rw	no	0x00000000	yes
0x1600	0x06	6. Mapped Object	ui32	rw	no	0x00000000	yes
0x1600	0x07	7. Mapped Object	ui32	rw	no	0x00000000	yes
0x1600	0x08	8. Mapped Object	ui32	rw	no	0x00000000	yes
0x1601	**-**	**Receive PDO2 Mapping**	-	-	-	-	-
0x1601	0x00	Number of Mapped Objects	ui8	rw	no	0	yes
0x1601	0x01	1. Mapped Object	ui32	rw	no	0x00000000	yes
0x1601	0x02	2. Mapped Object	ui32	rw	no	0x00000000	yes
0x1601	0x03	3. Mapped Object	ui32	rw	no	0x00000000	yes
0x1601	0x04	4. Mapped Object	ui32	rw	no	0x00000000	yes
0x1601	0x05	5. Mapped Object	ui32	rw	no	0x00000000	yes
0x1601	0x06	6. Mapped Object	ui32	rw	no	0x00000000	yes
0x1601	0x07	7. Mapped Object	ui32	rw	no	0x00000000	yes
0x1601	0x08	8. Mapped Object	ui32	rw	no	0x00000000	yes
0x1602	**-**	**Receive PDO3 Mapping**	-	-	-	-	-
0x1602	0x00	Number of Mapped Objects	ui8	rw	no	0	yes
0x1602	0x01	1. Mapped Object	ui32	rw	no	0x00000000	yes
0x1602	0x02	2. Mapped Object	ui32	rw	no	0x00000000	yes
0x1602	0x03	3. Mapped Object	ui32	rw	no	0x00000000	yes
0x1602	0x04	4. Mapped Object	ui32	rw	no	0x00000000	yes
0x1602	0x05	5. Mapped Object	ui32	rw	no	0x00000000	yes
0x1602	0x06	6. Mapped Object	ui32	rw	no	0x00000000	yes
0x1602	0x07	7. Mapped Object	ui32	rw	no	0x00000000	yes
0x1602	0x08	8. Mapped Object	ui32	rw	no	0x00000000	yes
0x1603	**-**	**Receive PDO4 Mapping**	-	-	-	-	-
0x1603	0x00	Number of Mapped Objects	ui8	rw	no	0	yes
0x1603	0x01	1. Mapped Object	ui32	rw	no	0x00000000	yes
0x1603	0x02	2. Mapped Object	ui32	rw	no	0x00000000	yes
0x1603	0x03	3. Mapped Object	ui32	rw	no	0x00000000	yes
0x1603	0x04	4. Mapped Object	ui32	rw	no	0x00000000	yes
0x1603	0x05	5. Mapped Object	ui32	rw	no	0x00000000	yes

Index	Subindex	Designation	Type	Access	PDO	Default	EEP
0x1603	0x06	6. Mapped Object	ui32	rw	no	0x00000000	yes
0x1603	0x07	7. Mapped Object	ui32	rw	no	0x00000000	yes
0x1603	0x08	8. Mapped Object	ui32	rw	no	0x00000000	yes
0x1604	**-**	**Receive PDO5 Mapping**	**-**	**-**	**-**	**-**	**-**
0x1604	0x00	Number of Mapped Objects	ui8	rw	no	0	yes
0x1604	0x01	1. Mapped Object	ui32	rw	no	0x00000000	yes
0x1604	0x02	2. Mapped Object	ui32	rw	no	0x00000000	yes
0x1604	0x03	3. Mapped Object	ui32	rw	no	0x00000000	yes
0x1604	0x04	4. Mapped Object	ui32	rw	no	0x00000000	yes
0x1604	0x05	5. Mapped Object	ui32	rw	no	0x00000000	yes
0x1604	0x06	6. Mapped Object	ui32	rw	no	0x00000000	yes
0x1604	0x07	7. Mapped Object	ui32	rw	no	0x00000000	yes
0x1604	0x08	8. Mapped Object	ui32	rw	no	0x00000000	yes
0x1800	**-**	**Transmit PDO1 Parameter**	**-**	**-**	**-**	**-**	**-**
0x1800	0x00	Numer of Entries	ui8	ro	no	3	no
0x1800	0x01	COB-ID Transmit PDO1	ui32	rw	no	0x180 + ID	yes
0x1800	0x02	Transmission-Type Transmit PDO1	ui8	rw	no	0xFF	yes
0x1800	0x03	Inhibit Time Transmit PDO1	ui16	rw	no	0	yes
0x1801	**-**	**Transmit PDO2 Parameter**	**-**	**-**	**-**	**-**	**-**
0x1801	0x00	Numer of Entries	ui8	ro	no	3	no
0x1801	0x01	COB-ID Transmit PDO2	ui32	rw	no	0x280 + ID	yes
0x1801	0x02	Transmission-Type Transmit PDO2	ui8	rw	no	0xFF	yes
0x1801	0x03	Inhibit Time Transmit PDO2	ui16	rw	no	0	yes
0x1802	**-**	**Transmit PDO3 Parameter**	**-**	**-**	**-**	**-**	**-**
0x1802	0x00	Numer of Entries	ui8	ro	no	3	no
0x1802	0x01	COB-ID Transmit PDO3	ui32	rw	no	0x1AA + ID	yes
0x1802	0x02	Transmission-Type Transmit PDO3	ui8	rw	no	0xFF	yes
0x1802	0x03	Inhibit Time Transmit PDO3	ui16	rw	no	0	yes
0x1803	**-**	**Transmit PDO4 Parameter**	**-**	**-**	**-**	**-**	**-**
0x1803	0x00	Numer of Entries	ui8	ro	no	3	no
0x1803	0x01	COB-ID Transmit PDO4	ui32	rw	no	0x2AA + ID	yes
0x1803	0x02	Transmission-Type Transmit PDO4	ui8	rw	no	0xFF	yes
0x1803	0x03	Inhibit Time Transmit PDO4	ui16	rw	no	0	yes
0x1804	**-**	**Transmit PDO5 Parameter**	**-**	**-**	**-**	**-**	**-**
0x1804	0x00	Numer of Entries	ui8	ro	no	3	no
0x1804	0x01	COB-ID Transmit PDO5	ui32	rw	no	0x1D4 + ID	yes
0x1804	0x02	Transmission-Type Transmit PDO5	ui8	rw	no	0xFF	yes
0x1804	0x03	Inhibit Time Transmit PDO5	ui16	rw	no	0	yes
0x1805	**-**	**Transmit PDO6 Parameter**	**-**	**-**	**-**	**-**	**-**
0x1805	0x00	Numer of Entries	ui8	ro	no	3	no
0x1805	0x01	COB-ID Transmit PDO6	ui32	rw	no	0x2D4 + ID	yes
0x1805	0x02	Transmission-Type Transmit PDO6	ui8	rw	no	0xFF	yes
0x1805	0x03	Inhibit Time Transmit PDO6	ui16	rw	no	0	yes
0x1806	**-**	**Transmit PDO7 Parameter**	**-**	**-**	**-**	**-**	**-**
0x1806	0x00	Numer of Entries	ui8	ro	no	3	no
0x1806	0x01	COB-ID Transmit PDO7	ui32	rw	no	0x180+ ID	yes
0x1806	0x02	Transmission-Type Transmit PDO7	ui8	rw	no	0xFF	yes
0x1806	0x03	Inhibit Time Transmit PDO7	ui16	rw	no	0	yes
0x1807	**-**	**Transmit PDO8 Parameter**	**-**	**-**	**-**	**-**	**-**
0x1807	0x00	Numer of Entries	ui8	ro	no	3	no
0x1807	0x01	COB-ID Transmit PDO8	ui32	rw	no	0x180 + ID	yes
0x1807	0x02	Transmission-Type Transmit PDO8	ui8	rw	no	0xFF	yes
0x1807	0x03	Inhibit Time Transmit PDO8	ui16	rw	no	0	yes
0x1808	**-**	**Transmit PDO9 Parameter**	**-**	**-**	**-**	**-**	**-**
0x1808	0x00	Numer of Entries	ui8	ro	no	3	no
0x1808	0x01	COB-ID Transmit PDO9	ui32	rw	no	0x180 + ID	yes
0x1808	0x02	Transmission-Type Transmit PDO9	ui8	rw	no	0xFF	yes
0x1808	0x03	Inhibit Time Transmit PDO9	ui16	rw	no	0	yes
0x1809	**-**	**Transmit PDO10 Parameter**	**-**	**-**	**-**	**-**	**-**
0x1809	0x00	Numer of Entries	ui8	ro	no	3	no
0x1809	0x01	COB-ID Transmit PDO10	ui32	rw	no	0x180 + ID	yes
0x1809	0x02	Transmission-Type Transmit PDO10	ui8	rw	no	0xFF	yes

Index	Subindex	Designation	Type	Access	PDO	Default	EEP
0x1809	0x03	Inhibit Time Transmit PDO10	ui16	rw	no	0	yes
0x1A00	-	**Transmit PDO1 Mapping**	-	-	-	-	-
0x1A00	0x00	Number of Mapped Objects	ui8	rw	no	0	yes
0x1A00	0x01	1. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A00	0x02	2. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A00	0x03	3. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A00	0x04	4. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A00	0x05	5. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A00	0x06	6. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A00	0x07	7. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A00	0x08	8. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A01	-	**Transmit PDO2 Mapping**	-	-	-	-	-
0x1A01	0x00	Number of Mapped Objects	ui8	rw	no	0	yes
0x1A01	0x01	1. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A01	0x02	2. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A01	0x03	3. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A01	0x04	4. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A01	0x05	5. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A01	0x06	6. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A01	0x07	7. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A01	0x08	8. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A02	-	**Transmit PDO3 Mapping**	-	-	-	-	-
0x1A02	0x00	Number of Mapped Objects	ui8	rw	no	0	yes
0x1A02	0x01	1. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A02	0x02	2. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A02	0x03	3. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A02	0x04	4. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A02	0x05	5. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A02	0x06	6. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A02	0x07	7. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A02	0x08	8. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A03	-	**Transmit PDO4 Mapping**	-	-	-	-	-
0x1A03	0x00	Number of Mapped Objects	ui8	rw	no	0	yes
0x1A03	0x01	1. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A03	0x02	2. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A03	0x03	3. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A03	0x04	4. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A03	0x05	5. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A03	0x06	6. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A03	0x07	7. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A03	0x08	8. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A04	-	**Transmit PDO5 Mapping**	-	-	-	-	-
0x1A04	0x00	Number of Mapped Objects	ui8	rw	no	0	yes
0x1A04	0x01	1. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A04	0x02	2. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A04	0x03	3. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A04	0x04	4. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A04	0x05	5. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A04	0x06	6. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A04	0x07	7. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A04	0x08	8. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A05	-	**Transmit PDO6 Mapping**	-	-	-	-	-
0x1A05	0x00	Number of Mapped Objects	ui8	rw	no	0	yes
0x1A05	0x01	1. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A05	0x02	2. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A05	0x03	3. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A05	0x04	4. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A05	0x05	5. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A05	0x06	6. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A05	0x07	7. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A05	0x08	8. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A06	-	**Transmit PDO7 Mapping**	-	-	-	-	-

Index	Subindex	Designation	Type	Access	PDO	Default	EEP
0x1A06	0x00	Number of Mapped Objects	ui8	rw	no	0	yes
0x1A06	0x01	1. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A06	0x02	2. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A06	0x03	3. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A06	0x04	4. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A06	0x05	5. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A06	0x06	6. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A06	0x07	7. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A06	0x08	8. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A07	**-**	**Transmit PDO8 Mapping**	**-**	**-**	**-**	**-**	**-**
0x1A07	0x00	Number of Mapped Objects	ui8	rw	no	0	yes
0x1A07	0x01	1. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A07	0x02	2. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A07	0x03	3. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A07	0x04	4. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A07	0x05	5. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A07	0x06	6. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A07	0x07	7. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A07	0x08	8. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A08	**-**	**Transmit PDO9 Mapping**	**-**	**-**	**-**	**-**	**-**
0x1A08	0x00	Number of Mapped Objects	ui8	rw	no	0	yes
0x1A08	0x01	1. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A08	0x02	2. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A08	0x03	3. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A08	0x04	4. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A08	0x05	5. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A08	0x06	6. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A08	0x07	7. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A08	0x08	8. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A09	**-**	**Transmit PDO10 Mapping**	**-**	**-**	**-**	**-**	**-**
0x1A09	0x00	Number of Mapped Objects	ui8	rw	no	0	yes
0x1A09	0x01	1. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A09	0x02	2. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A09	0x03	3. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A09	0x04	4. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A09	0x05	5. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A09	0x06	6. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A09	0x07	7. Mapped Object	ui32	rw	no	0x00000000	yes
0x1A09	0x08	8. Mapped Object	ui32	rw	no	0x00000000	yes
0x5000	**-**	**Error_Reset**	**ui16**	**rw**	**yes**	**0x0000**	**no**
0x5001	**-**	**Alarm_Output**	**ui16**	**rw**	**no**	**0x0000**	**yes**
0x5002	**-**	**Slot_IDs**	**-**	**-**	**-**	**-**	**-**
0x5002	0x00	Number of Entries	ui8	ro	no	9	no
0x5002	0x01	Slot_ID_1	ui8	ro	no	configuration	no
0x5002	0x02	Slot_ID_2	ui8	ro	no	configuration	no
0x5002	0x03	Slot_ID_3	ui8	ro	no	configuration	no
0x5002	0x04	Slot_ID_4	ui8	ro	no	configuration	no
0x5002	0x05	Slot_ID_5	ui8	ro	no	configuration	no
0x5002	0x06	Slot_ID_6	ui8	ro	no	configuration	no
0x5002	0x07	Slot_ID_7	ui8	ro	no	configuration	no
0x5002	0x08	Slot_ID_8	ui8	ro	no	configuration	no
0x5002	0x09	Slot_ID_9	ui8	ro	no	configuration	no
0x6000	**-**	**DI_Read_State_8_Input_Lines**	**-**	**-**	**-**	**-**	**-**
0x6000	0x00	Number of Entries	ui8	ro	no	configuration	no
0x6000	0x01	DI_Read_State_8_Input_Lines_1	ui8	ro	yes	0	no
0x6000	0x02	DI_Read_State_8_Input_Lines_2	ui8	ro	yes	0	no
0x6000	0x03	DI_Read_State_8_Input_Lines_3	ui8	ro	yes	0	no
0x6000	0x04	DI_Read_State_8_Input_Lines_4	ui8	ro	yes	0	no
0x6000	0x05	DI_Read_State_8_Input_Lines_5	ui8	ro	yes	0	no
0x6000	0x06	DI_Read_State_8_Input_Lines_6	ui8	ro	yes	0	no
0x6000	0x07	DI_Read_State_8_Input_Lines_7	ui8	ro	yes	0	no
0x6000	0x08	DI_Read_State_8_Input_Lines_8	ui8	ro	yes	0	no

Index	Subindex	Designation	Type	Access	PDO	Default	EEP
0x6000	0x09	DI_Read_State_8_Input_Lines_9	ui8	ro	yes	0	no
0x6002	**-**	**DI_Polarity_8_Input_Lines**	-	-	-	-	-
0x6002	0x00	Number of Entries	ui8	ro	no	configuration	no
0x6002	0x01	DI_Polarity_8_Input_Lines_1	ui8	rw	no	0x00	yes
0x6002	0x02	DI_Polarity_8_Input_Lines_2	ui8	rw	no	0x00	yes
0x6002	0x03	DI_Polarity_8_Input_Lines_3	ui8	rw	no	0x00	yes
0x6002	0x04	DI_Polarity_8_Input_Lines_4	ui8	rw	no	0x00	yes
0x6002	0x05	DI_Polarity_8_Input_Lines_5	ui8	rw	no	0x00	yes
0x6002	0x06	DI_Polarity_8_Input_Lines_6	ui8	rw	no	0x00	yes
0x6002	0x07	DI_Polarity_8_Input_Lines_7	ui8	rw	no	0x00	yes
0x6002	0x08	DI_Polarity_8_Input_Lines_8	ui8	rw	no	0x00	yes
0x6002	0x09	DI_Polarity_8_Input_Lines_9	ui8	rw	no	0x00	yes
0x6200	**-**	**DO_Write_State_8_Output_Lines**	-	-	-	-	-
0x6200	0x00	Number of Entries	ui8	ro	no	configuration	no
0x6200	0x01	DO_Write_State_8_Output_Lines_1	ui8	rw	yes	0	no
0x6200	0x02	DO_Write_State_8_Output_Lines_2	ui8	rw	yes	0	no
0x6200	0x03	DO_Write_State_8_Output_Lines_3	ui8	rw	yes	0	no
0x6200	0x04	DO_Write_State_8_Output_Lines_4	ui8	rw	yes	0	no
0x6200	0x05	DO_Write_State_8_Output_Lines_5	ui8	rw	yes	0	no
0x6200	0x06	DO_Write_State_8_Output_Lines_6	ui8	rw	yes	0	no
0x6200	0x07	DO_Write_State_8_Output_Lines_7	ui8	rw	yes	0	no
0x6200	0x08	DO_Write_State_8_Output_Lines_8	ui8	rw	yes	0	no
0x6200	0x09	DO_Write_State_8_Output_Lines_9	ui8	rw	yes	0	no
0x6202	**-**	**DO_Polarity_8_Output_Lines**	-	-	-	-	-
0x6202	0x00	Number of Entries	ui8	ro	no	configuration	no
0x6202	0x01	DO_Polarity_8_Output_Lines_1	ui8	rw	no	0x00	yes
0x6202	0x02	DO_Polarity_8_Output_Lines_2	ui8	rw	no	0x00	yes
0x6202	0x03	DO_Polarity_8_Output_Lines_3	ui8	rw	no	0x00	yes
0x6202	0x04	DO_Polarity_8_Output_Lines_4	ui8	rw	no	0x00	yes
0x6202	0x05	DO_Polarity_8_Output_Lines_5	ui8	rw	no	0x00	yes
0x6202	0x06	DO_Polarity_8_Output_Lines_6	ui8	rw	no	0x00	yes
0x6202	0x07	DO_Polarity_8_Output_Lines_7	ui8	rw	no	0x00	yes
0x6202	0x08	DO_Polarity_8_Output_Lines_8	ui8	rw	no	0x00	yes
0x6202	0x09	DO_Polarity_8_Output_Lines_9	ui8	rw	no	0x00	yes
0x6206	**-**	**DO_Fault_Mode_8_Output_Lines**	-	-	-	-	-
0x6206	0x00	Number of Entries	ui8	ro	no	configuration	no
0x6206	0x01	DO_Fault_Mode_8_Output_Lines_1	ui8	rw	no	0x00	yes
0x6206	0x02	DO_Fault_Mode_8_Output_Lines_2	ui8	rw	no	0x00	yes
0x6206	0x03	DO_Fault_Mode_8_Output_Lines_3	ui8	rw	no	0x00	yes
0x6206	0x04	DO_Fault_Mode_8_Output_Lines_4	ui8	rw	no	0x00	yes
0x6206	0x05	DO_Fault_Mode_8_Output_Lines_5	ui8	rw	no	0x00	yes
0x6206	0x06	DO_Fault_Mode_8_Output_Lines_6	ui8	rw	no	0x00	yes
0x6206	0x07	DO_Fault_Mode_8_Output_Lines_7	ui8	rw	no	0x00	yes
0x6206	0x08	DO_Fault_Mode_8_Output_Lines_8	ui8	rw	no	0x00	yes
0x6206	0x09	DO_Fault_Mode_8_Output_Lines_9	ui8	rw	no	0x00	yes
0x6207	**-**	**DO_Fault_State_8_Output_Lines**	-	-	-	-	-
0x6207	0x00	Number of Entries	ui8	ro	no	configuration	no
0x6207	0x01	DO_Fault_State_8_Output_Lines_1	ui8	rw	no	0x00	yes
0x6207	0x02	DO_Fault_State_8_Output_Lines_2	ui8	rw	no	0x00	yes
0x6207	0x03	DO_Fault_State_8_Output_Lines_3	ui8	rw	no	0x00	yes
0x6207	0x04	DO_Fault_State_8_Output_Lines_4	ui8	rw	no	0x00	yes
0x6207	0x05	DO_Fault_State_8_Output_Lines_5	ui8	rw	no	0x00	yes
0x6207	0x06	DO_Fault_State_8_Output_Lines_6	ui8	rw	no	0x00	yes
0x6207	0x07	DO_Fault_State_8_Output_Lines_7	ui8	rw	no	0x00	yes
0x6207	0x08	DO_Fault_State_8_Output_Lines_8	ui8	rw	no	0x00	yes
0x6207	0x09	DO_Fault_State_8_Output_Lines_9	ui8	rw	no	0x00	yes
0x5200	**-**	**DO_Status_8_Output_Lines**	-	-	-	-	-
0x5200	0x00	Number of Entries	ui8	ro	no	configuration	no
0x5200	0x01	DO_Status_8_Output_Lines_1	ui8	ro	yes	0x00	no
0x5200	0x02	DO_Status_8_Output_Lines_2	ui8	ro	yes	0x00	no
0x5200	0x03	DO_Status_8_Output_Lines_3	ui8	ro	yes	0x00	no
0x5200	0x04	DO_Status_8_Output_Lines_4	ui8	ro	yes	0x00	no

Index	Subindex	Designation	Type	Access	PDO	Default	EEP
0x5200	0x05	DO_Status_8_Output_Lines_5	ui8	ro	yes	0x00	no
0x5200	0x06	DO_Status_8_Output_Lines_6	ui8	ro	yes	0x00	no
0x5200	0x07	DO_Status_8_Output_Lines_7	ui8	ro	yes	0x00	no
0x5200	0x08	DO_Status_8_Output_Lines_8	ui8	ro	yes	0x00	no
0x5200	0x09	DO_Status_8_Output_Lines_9	ui8	ro	yes	0x00	no
0x5201	**-**	**DO_Error_Mask_8_Output_Lines**	**-**	**-**	**-**	**-**	**-**
0x5201	0x00	Number of Entries	ui8	ro	no	configuration	no
0x5201	0x01	DO_Error_Mask_8_Output_Lines_1	ui8	rw	no	0x0F	yes
0x5201	0x02	DO_Error_Mask_8_Output_Lines_2	ui8	rw	no	0x0F	yes
0x5201	0x03	DO_Error_Mask_8_Output_Lines_3	ui8	rw	no	0x0F	yes
0x5201	0x04	DO_Error_Mask_8_Output_Lines_4	ui8	rw	no	0x0F	yes
0x5201	0x05	DO_Error_Mask_8_Output_Lines_5	ui8	rw	no	0x0F	yes
0x5201	0x06	DO_Error_Mask_8_Output_Lines_6	ui8	rw	no	0x0F	yes
0x5201	0x07	DO_Error_Mask_8_Output_Lines_7	ui8	rw	no	0x0F	yes
0x5201	0x08	DO_Error_Mask_8_Output_Lines_8	ui8	rw	no	0x0F	yes
0x5201	0x09	DO_Error_Mask_8_Output_Lines_9	ui8	rw	no	0x0F	yes
0x5202	**-**	**DO_Module_Error**	**ui16**	**ro**	**yes**	**-**	**no**
0x6100	**-**	**AI_Input_Field_Value**	**-**	**-**	**-**	**-**	**-**
0x6100	0x00	Number of Entries	ui8	ro	no	configuration	no
0x6100	0x01	AI_Input_Field_Value_1	ui16	ro	yes	0x00	no
0x6100	0x02	AI_Input_Field_Value_2	ui16	ro	yes	0x00	no
0x6100	0x03	AI_Input_Field_Value_3	ui16	ro	yes	0x00	no
0x6100	0x04	AI_Input_Field_Value_4	ui16	ro	yes	0x00	no
0x6100	0x05	AI_Input_Field_Value_5	ui16	ro	yes	0x00	no
0x6100	0x06	AI_Input_Field_Value_6	ui16	ro	yes	0x00	no
0x6100	0x07	AI_Input_Field_Value_7	ui16	ro	yes	0x00	no
0x6100	0x08	AI_Input_Field_Value_8	ui16	ro	yes	0x00	no
0x6100	0x09	AI_Input_Field_Value_9	ui16	ro	yes	0x00	no
0x6100	0x0A	AI_Input_Field_Value_10	ui16	ro	yes	0x00	no
0x6100	0x0B	AI_Input_Field_Value_11	ui16	ro	yes	0x00	no
0x6100	0x0C	AI_Input_Field_Value_12	ui16	ro	yes	0x00	no
0x6100	0x0D	AI_Input_Field_Value_13	ui16	ro	yes	0x00	no
0x6100	0x0E	AI_Input_Field_Value_14	ui16	ro	yes	0x00	no
0x6100	0x0F	AI_Input_Field_Value_15	ui16	ro	yes	0x00	no
0x6100	0x10	AI_Input_Field_Value_16	ui16	ro	yes	0x00	no
0x6110	**-**	**AI_Sensor_Type**	**-**	**-**	**-**	**-**	**-**
0x6110	0x00	Number of Entries	ui8	ro	no	configuration	no
0x6110	0x01	AI_Sensor_Type_1	ui16	rw	no	configuration	yes
0x6110	0x02	AI_Sensor_Type_2	ui16	rw	no	configuration	yes
0x6110	0x03	AI_Sensor_Type_3	ui16	rw	no	configuration	yes
0x6110	0x04	AI_Sensor_Type_4	ui16	rw	no	configuration	yes
0x6110	0x05	AI_Sensor_Type_5	ui16	rw	no	configuration	yes
0x6110	0x06	AI_Sensor_Type_6	ui16	rw	no	configuration	yes
0x6110	0x07	AI_Sensor_Type_7	ui16	rw	no	configuration	yes
0x6110	0x08	AI_Sensor_Type_8	ui16	rw	no	configuration	yes
0x6110	0x09	AI_Sensor_Type_9	ui16	rw	no	configuration	yes
0x6110	0x0A	AI_Sensor_Type_10	ui16	rw	no	configuration	yes
0x6110	0x0B	AI_Sensor_Type_11	ui16	rw	no	configuration	yes
0x6110	0x0C	AI_Sensor_Type_12	ui16	rw	no	configuration	yes
0x6110	0x0D	AI_Sensor_Type_13	ui16	rw	no	configuration	yes
0x6110	0x0E	AI_Sensor_Type_14	ui16	rw	no	configuration	yes
0x6110	0x0F	AI_Sensor_Type_15	ui16	rw	no	configuration	yes
0x6110	0x10	AI_Sensor_Type_16	ui16	rw	no	configuration	yes
0x7130	**-**	**AI_Input_Process_Value**	**-**	**-**	**-**	**-**	**-**
0x7130	0x00	Number of Entries	ui8	ro	no	configuration	no
0x7130	0x01	AI_Input_Process_Value_1	i16	ro	yes	0	no
0x7130	0x02	AI_Input_Process_Value_2	i16	ro	yes	0	no
0x7130	0x03	AI_Input_Process_Value_3	i16	ro	yes	0	no
0x7130	0x04	AI_Input_Process_Value_4	i16	ro	yes	0	no
0x7130	0x05	AI_Input_Process_Value_5	i16	ro	yes	0	no
0x7130	0x06	AI_Input_Process_Value_6	i16	ro	yes	0	no
0x7130	0x07	AI_Input_Process_Value_7	i16	ro	yes	0	no

Index	Subindex	Designation	Type	Access	PDO	Default	EEP
0x7130	0x08	AI_Input_Process_Value_8	i16	ro	yes	0	no
0x7130	0x09	AI_Input_Process_Value_9	i16	ro	yes	0	no
0x7130	0x0A	AI_Input_Process_Value_10	i16	ro	yes	0	no
0x7130	0x0B	AI_Input_Process_Value_11	i16	ro	yes	0	no
0x7130	0x0C	AI_Input_Process_Value_12	i16	ro	yes	0	no
0x7130	0x0D	AI_Input_Process_Value_13	i16	ro	yes	0	no
0x7130	0x0E	AI_Input_Process_Value_14	i16	ro	yes	0	no
0x7130	0x0F	AI_Input_Process_Value_15	i16	ro	yes	0	no
0x7130	0x10	AI_Input_Process_Value_16	i16	ro	yes	0	no
0x6131	**-**	**AI_Physical_Unit_Process_Value**	**-**	**-**	**-**	**-**	**-**
0x6131	0x00	Number of Entries	ui8	ro	no	configuration	no
0x6131	0x01	AI_Physical_Unit_Process_Value_1	ui16	rw	no	configuration	yes
0x6131	0x02	AI_Physical_Unit_Process_Value_2	ui16	rw	no	configuration	yes
0x6131	0x03	AI_Physical_Unit_Process_Value_3	ui16	rw	no	configuration	yes
0x6131	0x04	AI_Physical_Unit_Process_Value_4	ui16	rw	no	configuration	yes
0x6131	0x05	AI_Physical_Unit_Process_Value_5	ui16	rw	no	configuration	yes
0x6131	0x06	AI_Physical_Unit_Process_Value_6	ui16	rw	no	configuration	yes
0x6131	0x07	AI_Physical_Unit_Process_Value_7	ui16	rw	no	configuration	yes
0x6131	0x08	AI_Physical_Unit_Process_Value_8	ui16	rw	no	configuration	yes
0x6131	0x09	AI_Physical_Unit_Process_Value_9	ui16	rw	no	configuration	yes
0x6131	0x0A	AI_Physical_Unit_Process_Value_10	ui16	rw	no	configuration	yes
0x6131	0x0B	AI_Physical_Unit_Process_Value_11	ui16	rw	no	configuration	yes
0x6131	0x0C	AI_Physical_Unit_Process_Value_12	ui16	rw	no	configuration	yes
0x6131	0x0D	AI_Physical_Unit_Process_Value_13	ui16	rw	no	configuration	yes
0x6131	0x0E	AI_Physical_Unit_Process_Value_14	ui16	rw	no	configuration	yes
0x6131	0x0F	AI_Physical_Unit_Process_Value_15	ui16	rw	no	configuration	yes
0x6131	0x10	AI_Physical_Unit_Process_Value_16	ui16	rw	no	configuration	yes
0x7138	**-**	**AI_Tare_Zero**	**-**	**-**	**-**	**-**	**-**
0x7138	0x00	Number of Entries	ui8	ro	no	configuration	no
0x7138	0x01	AI_Tare_Zero_1	i16	rw	no	0	yes
0x7138	0x02	AI_Tare_Zero_2	i16	rw	no	0	yes
0x7138	0x03	AI_Tare_Zero_3	i16	rw	no	0	yes
0x7138	0x04	AI_Tare_Zero_4	i16	rw	no	0	yes
0x7138	0x05	AI_Tare_Zero_5	i16	rw	no	0	yes
0x7138	0x06	AI_Tare_Zero_6	i16	rw	no	0	yes
0x7138	0x07	AI_Tare_Zero_7	i16	rw	no	0	yes
0x7138	0x08	AI_Tare_Zero_8	i16	rw	no	0	yes
0x7138	0x09	AI_Tare_Zero_9	i16	rw	no	0	yes
0x7138	0x0A	AI_Tare_Zero_10	i16	rw	no	0	yes
0x7138	0x0B	AI_Tare_Zero_11	i16	rw	no	0	yes
0x7138	0x0C	AI_Tare_Zero_12	i16	rw	no	0	yes
0x7138	0x0D	AI_Tare_Zero_13	i16	rw	no	0	yes
0x7138	0x0E	AI_Tare_Zero_14	i16	rw	no	0	yes
0x7138	0x0F	AI_Tare_Zero_15	i16	rw	no	0	yes
0x7138	0x10	AI_Tare_Zero_16	i16	rw	no	0	yes
0x7140	**-**	**AI_Net_Process_Value**	**-**	**-**	**-**	**-**	**-**
0x7140	0x00	Number of Entries	ui8	ro	no	configuration	no
0x7140	0x01	AI_Net_Process_Value_1	i16	ro	yes	0	no
0x7140	0x02	AI_Net_Process_Value_2	i16	ro	yes	0	no
0x7140	0x03	AI_Net_Process_Value_3	i16	ro	yes	0	no
0x7140	0x04	AI_Net_Process_Value_4	i16	ro	yes	0	no
0x7140	0x05	AI_Net_Process_Value_5	i16	ro	yes	0	no
0x7140	0x06	AI_Net_Process_Value_6	i16	ro	yes	0	no
0x7140	0x07	AI_Net_Process_Value_7	i16	ro	yes	0	no
0x7140	0x08	AI_Net_Process_Value_8	i16	ro	yes	0	no
0x7140	0x09	AI_Net_Process_Value_9	i16	ro	yes	0	no
0x7140	0x0A	AI_Net_Process_Value_10	i16	ro	yes	0	no
0x7140	0x0B	AI_Net_Process_Value_11	i16	ro	yes	0	no
0x7140	0x0C	AI_Net_Process_Value_12	i16	ro	yes	0	no
0x7140	0x0D	AI_Net_Process_Value_13	i16	ro	yes	0	no
0x7140	0x0E	AI_Net_Process_Value_14	i16	ro	yes	0	no
0x7140	0x0F	AI_Net_Process_Value_15	i16	ro	yes	0	no

Index	Subindex	Designation	Type	Access	PDO	Default	EEP
0x7140	0x10	AI_Net_Process_Value_16	i16	ro	yes	0	no
0x6150	-	**AI_Status**	-	-	-	-	-
0x6150	0x00	Number of Entries	ui8	ro	no	configuration	no
0x6150	0x01	AI_Status_1	ui8	ro	yes	0	no
0x6150	0x02	AI_Status_2	ui8	ro	yes	0	no
0x6150	0x03	AI_Status_3	ui8	ro	yes	0	no
0x6150	0x04	AI_Status_4	ui8	ro	yes	0	no
0x6150	0x05	AI_Status_5	ui8	ro	yes	0	no
0x6150	0x06	AI_Status_6	ui8	ro	yes	0	no
0x6150	0x07	AI_Status_7	ui8	ro	yes	0	no
0x6150	0x08	AI_Status_8	ui8	ro	yes	0	no
0x6150	0x09	AI_Status_9	ui8	ro	yes	0	no
0x6150	0x0A	AI_Status_10	ui8	ro	yes	0	no
0x6150	0x0B	AI_Status_11	ui8	ro	yes	0	no
0x6150	0x0C	AI_Status_12	ui8	ro	yes	0	no
0x6150	0x0D	AI_Status_13	ui8	ro	yes	0	no
0x6150	0x0E	AI_Status_14	ui8	ro	yes	0	no
0x6150	0x0F	AI_Status_15	ui8	ro	yes	0	no
0x6150	0x10	AI_Status_16	ui8	ro	yes	0	no
0x5100	-	**AI_In_Filter**	-	-	-	-	-
0x5100	0x00	Number of Entries	ui8	ro	no	configuration	no
0x5100	0x01	AI_In_Filter_1	ui8	rw	no	51	yes
0x5100	0x02	AI_In_Filter_2	ui8	rw	no	51	yes
0x5100	0x03	AI_In_Filter_3	ui8	rw	no	51	yes
0x5100	0x04	AI_In_Filter_4	ui8	rw	no	51	yes
0x5100	0x05	AI_In_Filter_5	ui8	rw	no	51	yes
0x5100	0x06	AI_In_Filter_6	ui8	rw	no	51	yes
0x5100	0x07	AI_In_Filter_7	ui8	rw	no	51	yes
0x5100	0x08	AI_In_Filter_8	ui8	rw	no	51	yes
0x5100	0x09	AI_In_Filter_9	ui8	rw	no	51	yes
0x5100	0x0A	AI_In_Filter_10	ui8	rw	no	51	yes
0x5100	0x0B	AI_In_Filter_11	ui8	rw	no	51	yes
0x5100	0x0C	AI_In_Filter_12	ui8	rw	no	51	yes
0x5100	0x0D	AI_In_Filter_13	ui8	rw	no	51	yes
0x5100	0x0E	AI_In_Filter_14	ui8	rw	no	51	yes
0x5100	0x0F	AI_In_Filter_15	ui8	rw	no	51	yes
0x5100	0x10	AI_In_Filter_16	ui8	rw	no	51	yes
0x5103	-	**AI_Comp_Pro**	-	-	-	-	-
0x5103	0x00	Number of Entries	ui8	ro	no	configuration	no
0x5103	0x01	AI_Comp_ Pro _1	i16	ro	no	0	no
0x5103	0x02	AI_Comp_ Pro _2	i16	ro	no	0	no
0x5103	0x03	AI_Comp_ Pro _3	i16	ro	no	0	no
0x5103	0x04	AI_Comp_ Pro _4	i16	ro	no	0	no
0x5103	0x05	AI_Comp_ Pro _5	i16	ro	no	0	no
0x5103	0x06	AI_Comp_ Pro _6	i16	ro	no	0	no
0x5103	0x07	AI_Comp_ Pro _7	i16	ro	no	0	no
0x5103	0x08	AI_Comp_ Pro _8	i16	ro	no	0	no
0x5104	-	**AI_Comp_Filter**	-	-	-	-	-
0x5104	0x00	Number of Entries	ui8	ro	no	configuration	no
0x5104	0x01	AI_Comp_ Filter _1	ui8	rw	no	26	yes
0x5104	0x02	AI_Comp_ Filter _2	ui8	rw	no	26	yes
0x5104	0x03	AI_Comp_ Filter _3	ui8	rw	no	26	yes
0x5104	0x04	AI_Comp_ Filter _4	ui8	rw	no	26	yes
0x5104	0x05	AI_Comp_ Filter _5	ui8	rw	no	26	yes
0x5104	0x06	AI_Comp_ Filter _6	ui8	rw	no	26	yes
0x5104	0x07	AI_Comp_ Filter _7	ui8	rw	no	26	yes
0x5104	0x08	AI_Comp_ Filter _8	ui8	rw	no	26	yes
0x5105	-	**AI_Comp_Stat**	-	-	-	-	-
0x5105	0x00	Number of Entries	ui8	ro	no	configuration	no
0x5105	0x01	AI_Comp_ Stat _1	ui8	ro	no	0	no
0x5105	0x02	AI_Comp_ Stat _2	ui8	ro	no	0	no
0x5105	0x03	AI_Comp_ Stat _3	ui8	ro	no	0	no

Index	Subindex	Designation	Type	Access	PDO	Default	EEP
0x5105	0x04	AI_Comp_ Stat _4	ui8	ro	no	0	no
0x5105	0x05	AI_Comp_ Stat _5	ui8	ro	no	0	no
0x5105	0x06	AI_Comp_ Stat _6	ui8	ro	no	0	no
0x5105	0x07	AI_Comp_ Stat _7	ui8	ro	no	0	no
0x5105	0x08	AI_Comp_ Stat _8	ui8	ro	no	0	no
0x5106	**-**	**AI_In_Comp_En**	**-**	**-**	**-**	**-**	**-**
0x5106	0x00	Number of Entries	ui8	ro	no	configuration	no
0x5106	0x01	AI_In_Comp_En_1	ui8	rw	no	1	yes
0x5106	0x02	AI_In_Comp_En_2	ui8	rw	no	1	yes
0x5106	0x03	AI_In_Comp_En_3	ui8	rw	no	1	yes
0x5106	0x04	AI_In_Comp_En_4	ui8	rw	no	1	yes
0x5106	0x05	AI_In_Comp_En_5	ui8	rw	no	1	yes
0x5106	0x06	AI_In_Comp_En_6	ui8	rw	no	1	yes
0x5106	0x07	AI_In_Comp_En_7	ui8	rw	no	1	yes
0x5106	0x08	AI_In_Comp_En_8	ui8	rw	no	1	yes
0x5106	0x09	AI_In_Comp_En_9	ui8	rw	no	1	yes
0x5106	0x0A	AI_In_Comp_En_10	ui8	rw	no	1	yes
0x5106	0x0B	AI_In_Comp_En_11	ui8	rw	no	1	yes
0x5106	0x0C	AI_In_Comp_En_12	ui8	rw	no	1	yes
0x5106	0x0D	AI_In_Comp_En_13	ui8	rw	no	1	yes
0x5106	0x0E	AI_In_Comp_En_14	ui8	rw	no	1	yes
0x5106	0x0F	AI_In_Comp_En_15	ui8	rw	no	1	yes
0x5106	0x10	AI_In_Comp_En_16	ui8	rw	no	1	yes
0x5107	**-**	**AI_Channel_Error**	**ui16**	**ro**	**yes**	**-**	**no**
0x5108	**-**	**AI_Comp_Error**	**ui8**	**ro**	**yes**	**-**	**no**
0x7300	**-**	**AO_Output_Process_Value**	**-**	**-**	**-**	**-**	**-**
0x7300	0x00	Number of Entries	ui8	ro	no	configuration	no
0x7300	0x01	AO_Output_Process_Value_1	i16	rw	yes	0	no
0x7300	0x02	AO_Output_Process_Value_2	i16	rw	yes	0	no
0x7300	0x03	AO_Output_Process_Value_3	i16	rw	yes	0	no
0x7300	0x04	AO_Output_Process_Value_4	i16	rw	yes	0	no
0x7300	0x05	AO_Output_Process_Value_5	i16	rw	yes	0	no
0x7300	0x06	AO_Output_Process_Value_6	i16	rw	yes	0	no
0x7300	0x07	AO_Output_Process_Value_7	i16	rw	yes	0	no
0x7300	0x08	AO_Output_Process_Value_8	i16	rw	yes	0	no
0x7300	0x09	AO_Output_Process_Value_9	i16	rw	yes	0	no
0x7300	0x0A	AO_Output_Process_Value_10	i16	rw	yes	0	no
0x7300	0x0B	AO_Output_Process_Value_11	i16	rw	yes	0	no
0x7300	0x0C	AO_Output_Process_Value_12	i16	rw	yes	0	no
0x7300	0x0D	AO_Output_Process_Value_13	i16	rw	yes	0	no
0x7300	0x0E	AO_Output_Process_Value_14	i16	rw	yes	0	no
0x7300	0x0F	AO_Output_Process_Value_15	i16	rw	yes	0	no
0x7300	0x10	AO_Output_Process_Value_16	i16	rw	yes	0	no
0x6310	**-**	**AO_Output_Type**	**-**	**-**	**-**	**-**	**-**
0x6310	0x00	Number of Entries	ui8	ro	no	configuration	no
0x6310	0x01	AO_Output_Type_1	ui16	rw	no	configuration	yes
0x6310	0x02	AO_Output_Type_2	ui16	rw	no	configuration	yes
0x6310	0x03	AO_Output_Type_3	ui16	rw	no	configuration	yes
0x6310	0x04	AO_Output_Type_4	ui16	rw	no	configuration	yes
0x6310	0x05	AO_Output_Type_5	ui16	rw	no	configuration	yes
0x6310	0x06	AO_Output_Type_6	ui16	rw	no	configuration	yes
0x6310	0x07	AO_Output_Type_7	ui16	rw	no	configuration	yes
0x6310	0x08	AO_Output_Type_8	ui16	rw	no	configuration	yes
0x6310	0x09	AO_Output_Type_9	ui16	rw	no	configuration	yes
0x6310	0x0A	AO_Output_Type_10	ui16	rw	no	configuration	yes
0x6310	0x0B	AO_Output_Type_11	ui16	rw	no	configuration	yes
0x6310	0x0C	AO_Output_Type_12	ui16	rw	no	configuration	yes
0x6310	0x0D	AO_Output_Type_13	ui16	rw	no	configuration	yes
0x6310	0x0E	AO_Output_Type_14	ui16	rw	no	configuration	yes
0x6310	0x0F	AO_Output_Type_15	ui16	rw	no	configuration	yes
0x6310	0x10	AO_Output_Type_16	ui16	rw	no	configuration	yes
0x5300	**-**	**AO_Out_Status**	**-**	**-**	**-**	**-**	**-**

Index	Subindex	Designation	Type	Access	PDO	Default	EEP
0x5300	0x00	Number of Entries	ui8	ro	no	configuration	no
0x5300	0x01	AO_Out_Status_1	ui8	ro	yes	0x00	no
0x5300	0x02	AO_Out_Status _2	ui8	ro	yes	0x00	no
0x5300	0x03	AO_Out_Status _3	ui8	ro	yes	0x00	no
0x5300	0x04	AO_Out_Status _4	ui8	ro	yes	0x00	no
0x5300	0x05	AO_Out_Status _5	ui8	ro	yes	0x00	no
0x5300	0x06	AO_Out_Status _6	ui8	ro	yes	0x00	no
0x5300	0x07	AO_Out_Status _7	ui8	ro	yes	0x00	no
0x5300	0x08	AO_Out_Status _8	ui8	ro	yes	0x00	no
0x5300	0x09	AO_Out_Status _9	ui8	ro	yes	0x00	no
0x5300	0x0A	AO_Out_Status _10	ui8	ro	yes	0x00	no
0x5300	0x0B	AO_Out_Status _11	ui8	ro	yes	0x00	no
0x5300	0x0C	AO_Out_Status _12	ui8	ro	yes	0x00	no
0x5300	0x0D	AO_Out_Status _13	ui8	ro	yes	0x00	no
0x5300	0x0E	AO_Out_Status _14	ui8	ro	yes	0x00	no
0x5300	0x0F	AO_Out_Status _15	ui8	ro	yes	0x00	no
0x5300	0x10	AO_Out_Status _16	ui8	ro	yes	0x00	no
0x5302	**-**	**AO_Channel_Error**	**ui16**	**ro**	**yes**	**-**	**no**

7 Description of Individual Objects

7.1 *Structure of Object list according to WDP-404*

Index	Type of Data
5000 ... 5FFF	Manufacturer Specific Range
6000 ... 6FFF	Float, Unsigned Integers
7000 ... 7FFF	Integer 16
8000 ... 8FFF	Integer 24
9000 ... 9FFF	Integer 32

Index	Type of Data
X000 ... X0FF	Digital Input Block
X100 ... X1FF	Analog Input Block
X200 ... X2FF	Digital Output Block
X300 ... X3FF	Analog Output Block
X400 ... X4FF	Controller Block
X500 ... X5FF	Alarm Function Block
X600 ... XEFF	reserved
XF00 ... XFFF	Device Function Block

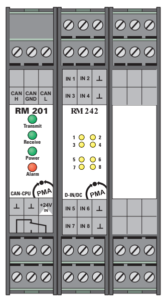
7.2 *General Hints*

The modular I/O system RM 200 can bear up to 10 modules as maximum, that is 1 fieldbus coupler and 9 in/output modules. Per unit up to 4 analog input modules and up to 4 analog output modules with 4 channels each may be plugged in. Limitations are 16 analog inputs and 16 analog outputs. The number of digital in/outputs is not restricted. (see chapter General)

The object list printed in this manual contains for every object the maximum number of all possible subindexes. For the actual application not all subindexes are needed to address the available in/outputs.

The following examples illustrate this situation.

1. Example: 3-fold unit RM 211 with 1 x RM 201 and 1 x RM 242



This minimal application with only one digital input module provides the following objects (index|subindex) for communication purpose:

digital inputs:

0x6000|0x00 number of digital input modules = 1 (number of subindexes)
0x6000|0x01 ucDI_Input_8Bit[1]

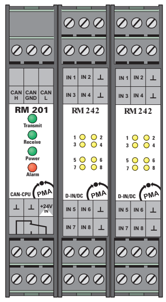
0x6002|0x00 number of digital input modules = 1 (number of subindexes)
0x6002|0x01 ucDI_Polarity_8Bit [1]

All other objects as there are for digital outputs, analog inputs and analog outputs are not available in this configuration.

With the particular number of subindexes one can find out the number of the available digital in/output modules and the corresponding number of in/output-channels.

2. Example: 3-fold unit RM 211 with 1 x RM 201 and 2 x RM 242

This unit with two digital input module provides the following objects (index|subindex) for communication purpose:



digital inputs:

0x6000|0x00 number of digital input modules = 2 (number of subindexes)
0x6000|0x01 ucDI_Input_8Bit[1]
0x6000|0x02 ucDI_Input_8Bit[2]

0x6002|0x00 number of digital input modules = 2 (number of subindexes)
0x6002|0x01 ucDI_Polarity_8Bit [1]
0x6002|0x02 ucDI_Polarity_8Bit [2]

All other objects for digital outputs, analog inputs and analog outputs are not available in this configuration. With the particular number of subindexes one can find out the number of the available digital in/output modules and the corresponding number of in/output-channels.

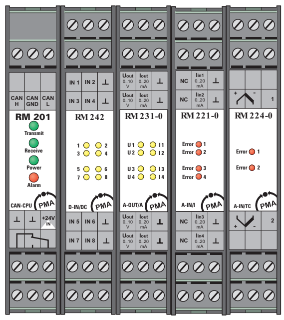
As a matter of principle for the allocation of modules/channels to the particular subindexes applies the following rule:

The IN/OUTPUT-modules are numbered beginning with the fieldbus coupler from the left to the right. The numbering has to be done separately for the different types of in/output modules digital in, digital out, analog in and analog out.

In this example the first digital input module (directly besides the fieldbus coupler) is addressed with subindex 1 and the second digital input module (at the utter right position in the unit) with subindex 2.

3. Example: 5-fold unit RM 212 with 1 x RM 201, 1 x RM 242, 1 x RM 231-0, 1 x RM 221-0, 1 x RM 224-0

This unit with one digital input module, one analog output module and two analog input modules provides the following objects (index|subindex) for communication purpose:



digital inputs:

0x6000|0x00 number of digital input modules = 1 (number of subindexes)
0x6000|0x01 ucDI_Input_8Bit[1]

0x6002|0x00 number of digital input modules = 1 (number of subindexes)
0x6002|0x01 ucDI_Polarity_8Bit [1]

analog outputs:

0x7300|0x00 number of analog output channels = 4 (number of subindexes)
0x7300|0x01 iAO_Output_Pro[1]
0x7300|0x02 iAO_Output_Pro[2]
0x7300|0x03 iAO_Output_Pro[3]
0x7300|0x04 iAO_Output_Pro[4]

0x6310|0x00 number of analog output channels = 4 (number of subindexes)
0x6310|0x01 uiAO_Output_Type[1]
0x6310|0x02 uiAO_Output_Type[2]
0x6310|0x03 uiAO_Output_Type[3]
0x6310|0x04 uiAO_Output_Type[4]

0x6330|0x00 number of analog output channels = 4 (number of subindexes)

0x6330|0x01	uiAO_Out_Fld[1]	
0x6330|0x02	uiAO_Out_Fld[2]	
0x6330|0x03	uiAO_Out_Fld[3]	
0x6330|0x04	uiAO_Out_Fld[4]	
0x5300|0x00	number of analog output channels = 4 (number of subindexes)	
0x5300|0x01	ucAO_Out_Status[1]	
0x5300|0x02	ucAO_Out_Status[2]	
0x5300|0x03	ucAO_Out_Status[3]	
0x5300|0x04	ucAO_Out_Status[4]	

analog inputs:

0x6100|0x00	number of analog input channels = 6 (number of subindexes)	
0x6100|0x01	uiAI_Input_Fld[1]	(RM 221-0, channel 1, Slot 4
0x6100|0x02	uiAI_Input_Fld[2]	(RM 221-0, channel 2, Slot 4
0x6100|0x03	uiAI_Input_Fld[3]	(RM 221-0, channel 3, Slot 4
0x6100|0x04	uiAI_Input_Fld[4]	(RM 221-0, channel 4, Slot 4
0x6100|0x05	uiAI_Input_Fld[5]	(RM 224-0, channel 1, Slot 5
0x6100|0x06	uiAI_Input_Fld[6]	(RM 224-0, channel 2, Slot 5
0x6110|0x00	number of analog input channels = 6 (number of subindexes)	
0x6110|0x01	uiAI_Sensor_Type[1]	(RM 221-0, channel 1, Slot 4
0x6110|0x02	uiAI_Sensor_Type[2]	(RM 221-0, channel 2, Slot 4
0x6110|0x03	uiAI_Sensor_Type[3]	(RM 221-0, channel 3, Slot 4
0x6110|0x04	uiAI_Sensor_Type[4]	(RM 221-0, channel 4, Slot 4
0x6110|0x05	uiAI_Sensor_Type[5]	(RM 224-0, channel 1, Slot 5
0x6110|0x06	uiAI_Sensor_Type[6]	(RM 224-0, channel 2, Slot 5

…

All other objects for digital outputs and analog inputs are not available in this configuration. With the particular number of subindexes one can find out the number of the available digital in/output modules and the corresponding number of in/output channels.

☞ **Attention: In contrast to digital in/outputs analog in/output modules have 4 channels. That’s why 4 subindexes per in/output module are needed to address each channel.**

☞ **With a combination of RM 221-x, RM 222-x, RM 224-1 and RM 224-0 one should bear in mind, that modules RM 224-0 have to be placed right from the modules RM 221-x, RM 222-x repectively RM 224-1. This procedure makes it easier to allocate the analog channels to the particular modules. Please note that the maximal possible number of 16 analog input channels per unit is not exceeded.**

ⓘ **If the position of the module RM 221-0 and RM 224-0 are exchanged (slot 4: RM 224-0, slot 5: RM 221-0) then there is no change of the channel sequence. At first the modules with 4 channels are addressed, after that the modules with 2 channels.**

7.3 *Digital Inputs*

0x6000 **ucDI_Input_8Bit[9]**

Value	=	state of digital inputs XOR polarity register
Type	=	ui8 / ro
Default	=	none
EEP	=	no
PDO	=	yes, typically mapped

0x6002 **ucDI_Polarity_8Bit[9]**

Value	=	polarity register for interconnection with digital inputs
Type	=	ui8 / rw
Default	=	0x00
EEP	=	yes
PDO	=	no

7.4 *Digital Outputs*

0x6200 **ucDO_Output_8Bit[9]**

Output	=	value XOR polarity register
Type	=	ui8 / rw
Default	=	0x00
EEP	=	no storage
PDO	=	yes, typically mapped

0x6202 **ucDO_Polarity_8Bit[9]**

Value	=	polarity register for interconnection with digital outputs
Type	=	ui8 / rw
Default	=	0x00
EEP	=	yes
PDO	=	no

0x6206 **ucDO_Fault_Mode_8Bit[9]**

Value = Bit set, if the value in ucDO_Fault_State_8Bit[9] shall be given out at a fault condition

The following error-events are possible:

1. The communication via CAN-Bus is disturbed.
   As soon as the CAN Controller changes into the state ‘Bus-Off’ or during the Life-Guarding process a failure is recognized, the value, defined through the objects 0x6206 and 0x6207 is given out. The outputs keep their values until the object 0x6200 or 0x6202 is written with a new value.
2. There is a short-circuit or an open-circuit at at least one digital output and the mask ucDO_Error_Mask allows the failure recognition. All outputs change to the value which is defined by the objects 0x6206 and 0x6207, until the object 0x6200 or 0x6202 is written with a new value.
   The error status can be reset via object 0x5000.

Type	=	ui8 / rw
Default	=	0x00
EEP	=	yes
PDO	=	no

0x6207 **ucDO_Fault_State_8Bit[9]**

Value	=	state of outputs during fault-event, if the particular bit is set in ucDO_Fault_Mode_8Bit[9]. The value is given directly to the output, without interconnection with the polarity register
Type	=	ui8 / rw
Default	=	0x00
EEP	=	yes
PDO	=	no

0x5200 **ucDO_Status[9]**

Value = present status of the digital outputs

meaning of an individual bit

0: short-circuit at channel 1 (1 & 2)
1: short-circuit at channel 2 (3 & 4)
2: short-circuit at channel 3 (5 & 6)
3: short-circuit at channel 4 (7 & 8)
4: open-circuit at channel 1 (1 & 2)
5: open-circuit at channel 2 (3 & 4)
6: open-circuit at channel 3 (5 & 6)
7: open-circuit at channel 4 (7 & 8)

Modules with 4 channels, each channel is allocated to 1 bit.
Modules with 8 channels, two channels are combined to 1 bit.

Type = ui8 / ro
Default = none
EEP = no
PDO = yes

0x5201 **ucDO_Error_Mask[9]**

Value = bitmask for interconnection with ucDO_status.
With the ucDO_Error_Mask it is determined, if a short-circuit respectively an open-circuit is interpreted as failure.
In case of failure an appropriate emergency message is sent via the CAN-Bus and the outputs are set in dependence of the objects 0x6206 and 0x6207.
The clearing of a bit is recommended e.g. if a not wired output (open-circuit) should not trigger a failure state (default). Typically a short-circuit at the outputs leads to a failure message (bit is set).

meaning of an individual bit:

0: short-circuit at channel 1 (1 & 2)
1: short-circuit at channel 2 (3 & 4)
2: short-circuit at channel 3 (5 & 6)
3: short-circuit at channel 4 (7 & 8)
4: open-circuit at channel 1 (1 & 2)
5: open-circuit at channel 2 (3 & 4)
6: open-circuit at channel 3 (5 & 6)
7: open-circuit at channel 4 (7 & 8)

Modules with 4 channels, each channel is allocated to 1 bit.
Modules with 8 channels, two channels are combined to 1 bit.

Type = ui8 / rw
Default = 0x0F, that means, only short-circuits shall lead to a failure message.
EEP = yes
PDO = no

0x5202 uiDO_Module_Error

Value	=	If a digital output module has an error, the bit, which is allocated to the particular module in uiDO_Module_Error gets set. A module is defined as faulty, if at least one bit in ucDO_Status[] of the allocated module is set and the error mask ucDO_Error_Mask[] masks this bit. Bit = 1, if (ucDO_Status[] & ucDO_Error_Mask[] != 0x00) Bit = 0, if (ucDO_Status[] & ucDO_Error_Mask[] == 0x00) meaning of an individual bit: 0: failure in 1. digital output module 1: failure in 2. digital output module 2: failure in 3. digital output module 3: failure in 4. digital output module 4: failure in 5. digital output module 5: failure in 6. digital output module 6: failure in 7. digital output module 7: failure in 8. digital output module 8: failure in 9. digital output module 9: not used, always 0 10: not used, always 0 11: not used, always 0 12: not used, always 0 13: not used, always 0 14: not used, always 0 15: not used, always 0
Type	=	ui16 / ro
Default	=	none
EEP	=	no
PDO	=	yes

☞ **Notes to the digital output module RM 251**:

The digital output module RM 251 recognizes open-circuits and short-circuits for two neighbouring outputs each. The following errors can be recognized:

- Not connected output supply and outputs ‘LOW’: Open-circuit
- Not connected output supply and outputs ‘HIGH’: Short-circuit
- Open-circuit at at least one output and outputs ‘LOW’: Open-circuit
- Short-circuit at at least one output and outputs ‘HIGH’: Short circuit

The module RM 251 does not provide greater detail on which one of the two neighbouring channels are faulty. If more precise error localisation is required, an 8-channel digital input module (RM 242) can be used to monitor the outputs. In addition, it is possible to switch two neighbouring channels in parallel in order to be able to evaluate the obtained error messages better.

In order that the error flags which have been set are automatically deleted after the error occurred, the outputs must be reset to the status they were at when the error was recognized. As this is not always possible whilst a process is under way, the error flags of faulty RM 251 modules can be deleted by writing the object 0x5000 (Error_Reset) with the value 0x0002 (digital output module).

The minimum load which does not result in being interpreted as an open-circuit, is usually 50 kOhm (with 24 VDC supply and 25 °C ambient temperature). The status LEDs of the RM 251 indicate a fault by blinking at a steady rate. The object ucDO_Status[9] (0x5299) together with the object ucDO_Error_Mask[9] (0x5201), serves as error information.

7.5 *Analog Inputs*

0x6100 **uiAI_Input_Fld[16]**

Value	=	ADC value, unprocessed and not normalized(scaled and formatted)
Type	=	ui16 / ro
Default	=	none
EEP	=	no
PDO	=	yes

0x6110 **uiAI_Sensor_Type[16]**

Value = valid values are:

1	(0x01):	TC Type J:	-210.0 °C	...	+1200.0 °C
2	(0x02):	TC Type K:	-270.0 °C	...	+1370.0 °C
3	(0x03):	TC Type L:	-200.0 °C	...	+900.0 °C
4	(0x04):	TC Type E:	-270.0 °C	...	+1000.0 °C
5	(0x05):	TC Type T:	-270.0 °C	...	+400.0 °C
6	(0x06):	TC Type S:	-50.0 °C	...	+1760.0 °C
7	(0x07):	TC Type R:	-50.0 °C	...	+1760.0 °C
8	(0x08):	TC Type B:	+25.0 °C	...	+1820.0 °C
9	(0x09):	TC Type N:	-196.0 °C	...	+1299.6 °C
10	(0x0A):	TC Type W:	0.0 °C	...	+2299.3 °C
30	(0x1E):	RTD(Pt100):	-200.0 °C	...	+850.0 °C
40	(0x28):	0..10 V			
41	(0x29):	-10..+10 V			
51	(0x33):	4..20 mA			
52	(0x34):	0..20 mA			

Bit 13: determines the behaviour at range overflow (e.g. Sensor break for thermocouple)
0: the upper limit value is transmitted (default)
1: the lower limit value is transmitted

Bit 14: 0: interference pulses get suppressed (default)
1: no interference pulse suppression (for high speed signal processing)

Bit 15: 0: channel active (default)
1: channel inactive, process value always 0

Type = ui16 / rw

Default =	temperature:	30	(0x1E)	=	RTD(Pt100) (for RM 224-1)
		4	(0x04)	=	TC type E (for RM 224-0)
	voltage:	41	(0x29)	=	-10 ... +10 V
	current:	52	(0x34)	=	0 ... 20 mA

EEP = yes
PDO = no

Bits 13 and 15 of the objects uiAI_Sensor_Type[] can be set and cleared independently of the selected type of sensor. It is e.g. possible to deactivate a channel, by interconnecting 0x8000 (Bit 15) with object uiAI_Sensor_Type[] to OR. By clearing of Bit 14 (0x4000) individual interference pulses are suppressed (default). If high speed signals are processed it is recommended to set bit 14, otherwise quick signal changes may be interpreted as failure.

Hints on interference pulse suppression:
An alteration of more than 5 % of the ADC range within 25 ms up to 200 ms (depending on the number and types of analog inputs) is interpreted as an interference pulse. With activated interference pulse suppression a square-wave signal would be recognized and processed but every signal slope would be interpreted as an interference pulse.

0x7130 iAI_Input_Pro[16]

Value	=	process value, processed and normalized (scaled and formatted) physical unit see uiAI_Phy_Unit_Pro[16]
Type	=	i16 / ro
Default	=	none
EEP	=	no
PDO	=	yes, typically mapped

Normalization:
The process value is normalized (scaled and formatted) in different ways according to the measured physical unit. At delivery the following values are valid: the number of decimal places is fixed and can not be altered.
Normierung:

Temperature (unit = °C, 1 decimal place, RTD,Pt100)
-200,0 ... +850 °C = -2000 ... +8500

Voltage (unit = V, 3 decimal places)
0 ... 10,000 V = 0 ... 10000
-10,000 V ... +10,000 V = -10000 ... +10000

Current (unit = mA, 3 decimal places)
0 ... 20 mA = 0 ... 20000
4 ... 20 mA = 0 ... 16000

Hint:
In case of sensor breakage or short-circuit the allocated bit in object 0x6150 ucAI_Status[16] is set. The process value takes on the highest respectively the lowest values in case of failure.

0x6131 uiAI_Phy_Unit_Pro[16]

Value = physical unit of the process value
extract from the possible units:

0x301*:	°C
0x302*:	°F
0x303*:	K
0x601*:	V
0x611*:	A

* = Factor (least significant 4 Bit)

C:	0.000001 (µ)
D:	0.001 (m)
E:	0.01 (c)
F:	0.1 (d)
0:	1
1:	10 (da)
2:	100 (h)

Type = ui16 / rw
Default =
temperature: 0x3010 → factor = 1 [°C]
voltage: 0x6010 → factor = 1 [V]
current: 0x611D → factor = 0.001 [mA]
EEP = yes
PDO = no

Beyond the indicated default the following values are also possible:
temperature: 0x3020 → factor = 1 [°F] (see display in Fahrenheit)
0x3030 → factor = 1 [K]

Hint:
be altered to any whatever value. The normalization of the process values is always done as described in 0x7130 iAI_Input_Pro[].

display in Fahrenheit:
The thermocouples of the types S, R, B and W can capture temperatures, which cannot be displayed in Int16-format with the unit 1/10 ° Fahrenheit. That's why the real temperature measured with the types S, R, B and W is displayed reduced by 2000 °F. A real temperature of 2513.4 °F would be transmitted as 5314 ((2513.4 - 2000.0) x 10 = 5314).

0x7138 **iAI_Tare_Zero[16]**

Value	=	free selectable offset for the calculation of iAI_Net_Pro[16]
Type	=	i16 / rw
Default	=	0
EEP	=	yes
PDO	=	no

0x7140 **iAI_Net_Pro[16]**

Value	=	iAI_Input_Pro[] - iAI_Tare_Zero[]
Typ	=	i16 / ro
Default	=	none
EEP	=	no
PDO	=	yes

0x6150 **ucAI_Status[16]**

Value = status of the analog inputs

meaning of individual bits:

0:	invalid measuring result, event see bits 1 to 7
1:	overflow of measured value (> highest calibrated value)
2:	underflow of measured value (< lowest calibrated value)
3:	calibration failure (calibration data incorrect)
4:	fault counting limit (to many faults per time unit)
5:	reserved
6:	reserved
7:	reserved

Type	=	ui8 / ro
Default	=	none
EEP	=	no
PDO	=	yes

Hint:
The fault-counting-limit (to many faults per time unit) is only effective, if the interference pulse suppression is activated.

0x5100 **ucAI_In_Filter[16]**

Value	=	filter constant (FK)
Type	=	ui8 / rw
Default	=	51
EEP	=	yes
PDO	=	no

Averaging:
The measured analog values may processed as sliding average. It applies the following equation:

$\alpha = (FK+1) / 256$
$Y[n+1] = \alpha * X + (1 - \alpha) * Y[n]$

For ucAI_In_Filter[]=255 (means $\alpha = 1$)the analog value is not submitted to averaging.
The maximal averaging is calculated with ucAI_In_Filter[]=0 (means $\alpha = 1/256$).

The cut-off frequency of the low-pass filter of 1. order is calculated with Ta (scanning time) from 25 ms to 200 ms. The exact scanning time depends on the types and numbers of the plugged input modules.

0x5103 iAI_Comp_Pro[8]

Value	=	temperature of the terminals 1/10 °C
Type	=	i16 / ro
Default	=	none
EEP	=	no
PDO	=	no

0x5104 ucAI_Comp_Filter[8]

Value	=	filter constant , see objekt 0x5100
Type	=	ui8 / rw
Default	=	26
EEP	=	yes
PDO	=	none

0x5105 ucAI_Comp_Stat[8]

Value = status of cold junction compensation

meaning of individual bits:

0:	invalid measuring result, event see bits 1 to 7
1:	overflow of measured value (> highest calibrated value)
2:	underflow of measured value (< lowest calibrated value)
3:	calibration failure (calibration data incorrect)
4:	fault counting limit (to many faults per time unit)
5:	communication error
6:	reserved
7:	reserved

Type	=	ui8 / ro
Default	=	none
EEP	=	no
PDO	=	no

0x5106 ucAI_Comp_En[16]

Value	=	activation / deactivation cold junction compensation 0: cold junction compensation deactivated 1: cold junction compensation activated
Type	=	ui8 / rw
Default	=	1 (cold junction compensation active)
EEP	=	yes
PDO	=	no

0x5107	**uiAI_Channel_Error**		
	Value	=	If an analog input channel shows an error, the bit which is allocated to the module is set in uiAI_Channel_Error. A channel is valued as faulty, if the LSB in ucAI_Status[] of the allocated channel is set.

Meaning of individual bits:

0:	failure of 1. analog input channel
1:	failure of 2. analog input channel
2:	failure of 3. analog input channel
3:	failure of 4. analog input channel
4:	failure of 5. analog input channel
5:	failure of 6. analog input channel
6:	failure of 7. analog input channel
7:	failure of 8. analog input channel
8:	failure of 9. analog input channel
9:	failure of 10. analog input channel
10:	failure of 11. analog input channel
11:	failure of 12. analog input channel
12:	failure of 13. analog input channel
13:	failure of 14. analog input channel
14:	failure of 15. analog input channel
15:	failure of 16. analog input channel

Type	=	ui16 / ro
Default	=	none
EEP	=	no
PDO	=	yes

0x5108	**ucAI_Comp_Error**		
	Wert	=	If the cold junction compensation of a module shows an error, the bit which is allocated to the module is set in ucAI_Comp_Error. A module is valued as faulty, if the LSB in ucAI_Comp_Stat[] of the allocated module is set.

Meaning of individual bits:

0:	failure of 1. analog input channel
1:	failure of 2. analog input channel
2:	failure of 3. analog input channel
3:	failure of 4. analog input channel
4:	failure of 5. analog input channel
5:	failure of 6. analog input channel
6:	failure of 7. analog input channel
7:	failure of 8. analog input channel

Type	=	ui8 / ro
Default	=	none
EEP	=	no
PDO	=	yes

7.6 *Analog Outputs*

0x7300 iAO_Output_Pro[16]

Value	=	process value to be displayed, processed and normalized
Type	=	i16 / rw
Default	=	0
EEP	=	no
PDO	=	yes, typically mapped

Normalization:
The process value is normalized (scaled and formatted) in different ways according to the unit to be displayed. At delivery the following values are set

Voltages (unit = V, 3 decimal places)

0 ... 10,000 V	=	0 ... 10000
-10,000 V ... +10,000 V	=	-10000 ... +10000

Currents (unit = mA, 3 decimal places)

0 ... 20 mA	=	0 ... 20000
4 ... 20 mA	=	0 ... 16000

Hint:
If the CAN-controller changes into the bus-off state (e.g. in case of a short-circuit on the CAN-bus) or an Life-Guarding-Time-Out error during the Life-Guarding procedure is detected, all analog outputs are set depending on bit 15 of the value of the output type either to the process value 0 or to the value before the error occurred (See object 0x6310).

0x6310 uiAO_Output_Type[16]

Value = valid values are:

10:	0 ... 10 V
11:	-10 ... +10 V
20:	0 ... 20 mA
21:	4 ... 20 mA

Bit 15 defines the behaviour in case of a bus error:
0: output of process value 0 (default)
1: keep the output value before the error occurred.

Bit 15 of object uiAO_Output_Type[] can be set or reset independent of the selected output format

Type	=	ui16 / rw
Default	=	voltages: 10 = 0 ... 10 V
EEP	=	yes
PDO	=	no

0x5300 **ucAO_Out_Status[16]**

Value	=	status of analog outputs	
		meaning of individual bits	
		0:	invalid measuring result, event see bits 1 to 7
		1:	calibration failure (calibration data incorrect)
		2:	reserved
		3:	failure (failure at data transmission to the DAC)
		4:	reserved
		5:	reserved
		6:	reserved
		7:	reserved
Type	=	ui8 / ro	
Default	=	none	
EEP	=	no	
PDO	=	yes	

☞ Hint:
All written bits in the DAC(Digital-Analog-Converter) are read back by the micro-controller as routine check. If a deviation is detected (e.g. a bit has toggled) Bit 3 of ucAO_Out_Status[] is set.
Bit 0 is set, as soon as one bit is set between 1 and 7.

0x5302 **uiAO_Channel_Error**

Value	=	If an analog output channel shows an error, the bit which is allocated to the module is set in uiAO_Channel_Error. A channel is valued as faulty, if the LSB in ucAO_Out_Status[] of the allocated channel is set	
		meaning of individual bits:	
		0:	failure of 1. analog output channel
		1:	failure of 2. analog output channel
		2:	failure of 3. analog output channel
		3:	failure of 4. analog output channel
		4:	failure of 5. analog output channel
		5:	failure of 6. analog output channel
		6:	failure of 7. analog output channel
		7:	failure of 8. analog output channel
		8:	failure of 9. analog output channel
		9:	failure of 10. analog output channel
		10:	failure of 11. analog output channel
		11:	failure of 12. analog output channel
		12:	failure of 13. analog output channel
		13:	failure of 14. analog output channel
		14:	failure of 15. analog output channel
		15:	failure of 16. analog output channel
Type	=	ui16 / ro	
Default	=	none	
EEP	=	no	
PDO	=	yes	

7.7 *Manufacturer Specific Objects, 0x5000 range*

0x5000 **Error_Reset**

Value	=	errors to clear (bit masked)
Type	=	i16 / rw
Default	=	0x0000
EEP	=	no
PDO	=	yes

This objects serves to reset certain error states. To reset a certain error, the particular bit has to be reset.

Bit	error state to be reset
0	digital input modules
1	digital output modules
2	analog input modules
3	analog output modules
4	-
5	-
6	-
7	-
8	faulty linearization table in EEPROM
9	EEPROM recently replaced or defect
10	EEPROM can not be written correct
11	EEPROM can not be read correct
12	CANopen can not be initialized correct
13	application error
14	IDs of slots are not clearly recognized
15	a new module configuration has been detected

☞ **Hint**:

With object 0x5000 Error_Reset (ui16) the error bits of the ‘Additional Information’ can be reset. This is recommended, if an certain error is indicated through the particular status-objects and the device operates correct again. A recognized error is typically not reset by the device itself.

Writing the value 0xFFFF to object 0x5000|0x00 all error bits are reset, also recognized CAN bus communication errors are part of this.

0x5001 **Alarm_Output**

Value= mask to set the alarm output (RM 201)
Type = i16 / rw
Default = 0x0000
EEP = yes
PDO = no

This object determines, which errors should set the alarm output of the fieldbus coupler RM 201

Bit	Error type to activate the alarm relay
0	fault in digital input modules
1	fault in digital output modules
2	fault in analog input modules
3	fault in analog output modules
4	CAN bus error (Bus-Off)
5	CAN bus error (Life-Guarding)
6	CAN bus error (NMT-Error)
7	CAN transmission disturbed (incl. all messages)
8	faulty linearization table in EEPROM
9	EEPROM recently replaced or defect (*)
10	EEPROM can not be written correct
11	EEPROM can not be read correct
12	CANopen can not be initialized correct
13	application error
14	IDs of slots are not clearly recognized
15	a new module configuration has been detected (*)

Hint:

If the cause of trouble was identified and repaired, the particular error flag should be cleared by writing to the object 0x5000 Error_Reset. The alarm relay can be deactivated only by clearing the corresponding error flags. This is particular true for CAN bus interferences. To clear the error flags triggered by CAN bus errors, the object 0x5000 has to be written with the value 0xFFFF.

(*)
Bit 9 and Bit 15 have no significance, because in this cases the EEPROM is rewritten with the default values. The alarm-output-mask is also rewritten with the default value 0x0000, then.

0x5002 **Slot_IDs[9]**

Value	=	present device configuration identified via module-IDs
Type	=	ui8 / ro
Default	=	none
EEP	=	no
PDO	=	no

Every in/output-module has a definite module-ID. The subindexes 1 to 9 correspond with the plug-in positions 1 to 9. By read-out of the e.g. subindex 4 the actual utilized module type in position 4 is detected. Plug-in position 1 is the first in/output module slot next to the fieldbus coupler.

ID	I/O-Modules
0x00	no I/O module plugged
0x01	RM 251 / digital output, 24 V DC, 8 channel
0x02	RM 241 / digital input, sensor, 4 channel
0x04	RM 221-0 / analog input, standard, 4 channel, 12 bit, galvanic isolation, 4 x I
0x44	RM 221-1 / analog input, standard, 4 channel, 12 bit, galvanic isolation, 4 x U
0x84	RM 221-2 / analog input, standard, 4 channel, 12 bit, galvanic isolation, 2 x I; 2 x U
0x05	RM 231-0 / analog output, standard, 4 channel, 12 bit, spec. A: 4 x I; 4 x 0/10 V
0x45	RM 231-2 / analog output, standard, 4 channel, 12 bit, spec. C: 4 x I; 4 x -10/10 V
0x85	RM 231-1 / ana. output, stand., 4 ch., 12 bit, spec. B, 4 x I; 2 x 0/10 V; 2 x -10/10 V
0x06	RM 242 / digital input, 24 VDC, 8 channel
0x07	RM 252 / digital output, relay, 4 channel, change-over contact
0x08	RM 224-1 / analog input, temperature, 4 channel, 16 bit, full range
0x09	RM 243 / digital input, 230 V AC, 4 channel
0x0B	RM 222-0 / analog input, standard, 4 channel, 12 bit, with transducer supply, 4 x I
0x4B	RM 222-1 / analog input, standard, 4 channel, 12 bit, w. tr. sup., potentiometer, 4 x U
0x8B	RM 222-2 / analog input, standard, 4 channel, 12 bit, w. tr. sup. , pot., 2 x I and 2 x U
0x0E	RM 224-0 / analog input, T/C, 2 channel, galvanic isolation, 16 bit, full range
0x0F ...0x1B	Customer specific

8 Emergency Messages

8.1 *Start-Up Messages*

The modular I/O system RM 200 generates the appropriate error message for different error states. The transmission of an emergency message is possible in the ‘operational’ as well as in the ‘pre-operational’ mode. The device transmits the emergency message always with the identifier 0x080 + Node-ID. The error register, index 0x1001, subindex 0x00 contains always the latest error state. The Predefined Error Field, index 0x1003, subindex 0x00...0x0A contains the last 10 error states.

At start-up of the device the first emergency message is generated. If the device operates correct and the configuration has not changed the following emergency message is transmitted:

Identifier	1. Byte	2. Byte	3.Byte
0x80 + Node-ID	0x00	0x00	0x00

If the device configuration has changed, but operates correct, following emergency message is transmitted:

Identifier	1. Byte	2. Byte	3. Byte	4. Byte	5. Byte
0x80 + Node-ID	0x10	0x00	0x01	0x80	0x00

☞ Due to this event new default values are calculated and stored in the EEPROM of the RM 201. Attention: the former EEPROM data get overwritten.

8.2 *Meaning of Individual Bytes*

With an emergency message up to maximal 5 data bytes are sent. The bytes have the following meaning:

1. Byte: Error Code, high Byte
2. Byte: Error Code, low Byte
3. Byte: Error Register, Object 0x1001, see DS301, chapter 10.3
4. Byte: Additional Information 1 (high Byte) = ‘CPU’
5. Byte: Additional Information 2 (low Byte) = ‘Module’

Error Code:

0x0000: No Error
0x1000: Generic Error

Error Register:

Bit	Meaning
0	generic error
1	current
2	voltage
3	temperature
4	communication error
5	device profile specific
6	reserved
7	manufacturer specific

Additional Information 1 (CPU)

Bit	Meaning
0	faulty linearization table in EEPROM
1	EEPROM recently replaced or defect
2	EEPROM can not be written correct
3	EEPROM can not be read correct
4	CANopen can not be initialized correct
5	application error (data from EEPROM not suitable
6	IDs of slots are not clearly recognized
7	a new module configuration has been detected

Additional Information 2 (I/O-Module)

Bit	Meaning
0	Error occurred in digital input modules
1	Error occurred in digital output modules
2	Error occurred in analog input modules
3	Error occurred in analog output modules
4	Life-Guarding-Time-Out
5	
6	
7	

The object 0x1001 ‘Error Register’ always contains the latest occurred error.
To enable a closer investigation, the last 10 error states are saved in object 0x1003 ‘Predefined Error Field’. The latest error takes the highest position in the error register(Subindex 0x01). The ‘Predefined Error Field’ (32 bit value) has the following structure:
Example: An ul32 value of 0x12131415 in the Predefined-Error-Field means:
1. 12 = Additional Information 1 (high Byte) (CPU)
2. 13 = Additional Information 2 (low Byte) (Module)
3. 14 = Error Code, high Byte
4. 15 = Error Code, low Byte

8.3 *Reset of Error-Messages*

Via the object 0x5000 Error_Reset (ui16) the error bits of the ‘Additional Information’ can be cleared. This is recommended, if an certain error is indicated by the particular status-objects and the device operates correct again.

Writing the value 0xFFFF to object 0x5000|0x00 all error bits are cleared, also recognized CAN bus communication errors are included. CAN bus errors are only to be cleared together with all other errors through writing the value 0xFFFF to the object 0x5000.

For more informations see the description of the objects 0x5000 and 0x5001.

9 PDO-processing

9.1 *General*

All objects of the modular I/O system with the CANopen field bus coupler RM 201 can be addressed directly via an SDO data channel. This way any object can be read out and overwritten in the case of read/write entries. However, in general, communication via SDOs is used only for setting the parameters of the device. For example SDOs can be used to set the required temperature sensors for an analog input module RM 224-1. After the parameterization phase of the device, the process values of the decentral unit are of greatest importance. However, these process values can be exchanged between the devices far more effectively using PDOs rather than SDOs. To exchange data using PDOs a few presettings must be made. For example a valid identifier must be specified for every PDO. In addition, the relevant data of the decentral unit must be mapped in a PDO, i.e. they must be assigned to a PDO. The objects which can be mapped in such a PDO are identified in the object directory.

9.2 *Default-Mapping*

Every fieldbus node of the RM 200 family can calculate default mapping independently for transmit and receive PDOs. With the calculated default mapping, all analog and digital in/outputs of a module can be addressed via a PDO, and Transmit PDOs can be requested via RTR. This way, extensive (depending on the size of the system) mapping calculations when planning the system, are no longer necessary. Due to this method, the cyclical data exchange required for example for PLCs is facilitated considerably using an RM 200 module, since no point to point connection in the form of an SDO must be made.

A module supports 5 receive and 10 transmit PDOs as standard. Of the 10 transmit PDOs, the first 5 can be requested via RTR.

An analog in/output module has up to 4 channels with a resolution of a maximum of 16 bits per channel. This results in 1 complete PDO with 8 bytes having to be made available for such type of module. Digital modules have a maximum of 8 in/outputs each with 1 bit. To map a digital module 1 byte, i.e. 1/8th of a PDO is necessary so.

As the identifier range for PDOs is very limited - one usually assumes a maximum of 2 transmit and 2 receive PDOs - the following compromise must be made when calculating a default-mappping. The possible number of CANopen nodes should be reduced to 42. All CANopen nodes must have a node ID between 1 and 42.

Receive PDO-Identifier:

PDO1:	0x0200 (512)	+ Node-ID	(typically = digital outputs)
PDO2:	0x0300 (768)	+ Node-ID	(typically = analog outputs)
PDO3:	0x022A (554)	+ Node-ID	
PDO4:	0x032A (810)	+ Node-ID	
PDO5:	0x0254 (596)	+ Node-ID	
(PDO6:	0x0354 (852)	+ Node-ID)	not used

Transmit PDO-Identifier:

PDO1:	0x0180 (384)	+ Node-ID	(typically = digital inputs)
PDO2:	0x0280 (640)	+ Node-ID	(typically = analog inputs)
PDO3:	0x01AA (426)	+ Node-ID	
PDO4:	0x02AA (682)	+ Node-ID	
PDO5:	0x01D4 (468)	+ Node-ID	
PDO6:	0x02D4 (724)	+ Node-ID	can not be requested per RTC !

Note:
Unused PDOs can be deactivated by setting the MSB (Bit31) of the PDO identifier. When default mapping, unused PDOs are deactivated by means of the MSB of the PDO identifier.

9.2.1 Calculating the Default-Mapping for Receive-PDOs

9.2.1.1 Default-Mapping for Receive-PDOs (only digital outputs)

Fill Receive PDO1 with digital outputs starting from the field bus coupler (always 1 byte entries). When filling, only those slots which contain a digital output module, are taken into consideration. If more than 8 digital output modules have been plugged in, the ninth module is entered into the Receive PDO2

9.2.1.2 Default-Mapping for Receive-PDOs (only analog outputs)

The slots are searched for analog output modules starting from the field bus coupler. For every analog output module, a Receive PDO is set up starting at Receive PDO2. Receive PDO1 is deactivated for digital output. Hence, a PDO contains a maximum of 4 analog output modules each with 16 bit. As not more than 4 analog output modules are permitted, additional analog output modules are not taken into consideration during default mapping.

9.2.1.3 Default-Mapping for Receive-PDOs (digital and analog outputs)

In mixed operation mode, the maximum 8 digital output modules have sufficient space in the Receive-PDO1 (see 9.2.1.1). The analog output modules are mapped as described in 9.2.1.2, starting at the receive PDO2. A maximum total of 4 analog output modules can be taken into consideration in default mapping.

9.2.2 Calculation of the default mapping for transmit PDOs

9.2.2.1 Default mapping for transmit PDOs (only digital inputs)

Like 9.2.1.1 but for digital inputs.

9.2.2.2 Default mapping for transmit PDOs (only analog inputs)

Like 9.2.1.2 but for analog inputs.

☞ With a combination of RM 221-x, RM 222-x, RM 224-1 and RM 224-0 one should bear in mind, that modules RM 224-0 have to be placed right from the modules RM 221-x, RM 222-x repectively RM 224-1. This procedure makes it easier to allocate the analog channels to the particular modules. Please note that the maximal possible number of 16 analog input channels per unit is not exceeded.

ⓘ **If the position of the module RM 221-0 and RM 224-0 are exchanged (slot 4: RM 224-0, slot 5: RM 221-0) then there is no change of the channel sequence. At first the modules with 4 channels are addressed, after that the modules with 2 channels.**

9.2.2.3 Default mapping for transmit PDOs (digital and analog inputs)

Like 9.2.1.3 but for digital and analog inputs.

9.2.2.4 Transmit PDO6

The transmit PDO6 can not be requested per RTR. Typically this PDO is used for error diagnostic purpose.

The following default mapping is used:

1. object = 0x5202	uiDO_Module_Error	length = 2 Bytes
2. object = 0x5108	ucAI_Comp_Error	length = 1 Byte
3. object = 0x5107	uiAI_Channel_Error	length = 2 Byte
4. object = 0x5302	uiAO_Channel_Error	length = 2 Byte

If the transmit PDO6 is automatically sent after changes (default), by interpretation of one single PDO the error state of all digital and analog outputs and for all analog inputs is supervised.

9.3 *Transmission types*

The transmission types on sub-index 2 of the respective parameter index (0x1400 ... 0x1404 and 0x1800 ... 0x1809) can be set to a range between 0 and 255. The value 0 to 240 mean which ratio is used between SYNC telegram and PDO message. A 3 means that every 3 SYNC telegrams 1 PDO message is transmitted. A 0 means that the sampled input values are only sent in the case of changes once the SYNC has been received. Values between 1 and 240 mean that the PDO is transmitted once the required number of SYNC messages has been received. The COB-ID of the SYNC message is always specified via the index 0x1005. The values 241 to 251 are reserved. Types 252 and 253 are only intended for remote objects. In the case of type 252, the data is updated when the SYNC has been received, but it is not transmitted; in the case of 253 the data is updated when the remote request has been received. Types 254 and 255 stand for asynchronous PDOs, i.e. a PDO is transmitted as soon as at least one mapped value has changed.

PDO - Transmission Types						
Type No.		**cyclic**	**acyclic**	**synchronous**	**asynchronous**	**RTR only**
0			x	x		
1-240	(1)	x		x		
241-251				reserved		
252	(2)			x		x
253	(3)				x	x
254	(4)				x	
255	(5)				x	

(1) the type indicates the number of SYNC objects between two PDO transmissions
(2) data is updated (but not sent) immediately after reception of the SYNC
(3) data is updated at the reception of the RTR
(4) application event is device-specific
(5) application event is defined in the device profile

10 CAN Glossary

CAN ‘Controller Area Network’

CAN is a serial bus system which origins from the automobile industry. The signals are transmitted via twisted-pair wires. The noise immunity of CAN networks is especially high thanks to a number of provisions which have been taken e.g. CRC-Checks, use of differential signals, etc. CAN describes the physical bus concept incl. data link layer. The application layer, i.e. the protocol which is used is not described by CAN. Therefor one has to distinguish between CAN (physical bus) and CANopen (protocol, application layer).

CAL ‘CAN Application Layer’

CAL describes a collection of communication services. CAL specifies the application layer and not the physical bus like CAN. An exact description of CAL specifications can be found in the Draft Standards CiA DS 201...207. CAL is the basic concept for CANopen, but is useable without the CANopen-specification. A CAL device only needs to support the services it actually requires. Therefore the software of a CAL node may be simpler than of a CANopen-node. It has to be noticed that different manufacturers implement different services in their devices.

CANopen

CANopen describes the standardized use of communication services and establishes a communication profil. With CANopen, devices of different manufacturers can be used in one CAN network. Differences may be found in the number of supported communication objects. In contrast to PROFIBUS-DP, CANopen provides the advantage of real multi-master-capability.

CiA ‘CAN in Automation‘

The international association of manufacturers and applicators, CAN in Automation was founded in 1992. The registered association currently with more than 280 member corporations was and is a strong factor in the fast and wide distribution of CAN knowledge.

Address: Am Weichselgarten 26, D-91058 Erlangen
Tel. +49-9131-69086-0, Fax. +49-9131-69086-79
CiA-Homepage: http://www.can-cia.de

Device profiles

Specification of functions and interpretation of variables for the various device families.
The device profiles are described by ‘DS 4xx’ (Draft Standard).

DS 401:	digital and analog in/outputs, e.g. Modular I/O system RM 200
DS 402:	drives
DS 403:	HMI, control and monitor
DS 404:	MSR, measure-control-regulate
DS 405:	programmable devices
DS 406:	Encoder
DS 4xx:	additional device profiles are being worked on

SDO ‘Service Data Object’

SDOs serve the exchange of system parameters as are e.g. limit switch values, baud rate settings, PDO mappings, etc. SDOs are of great significance in the initializing phase of a CAN-Network, during the normal operation they play a minor role.

PDO ‘Process Data Object’

PDOs serve the exchange of process data e.g. setting and reading of analog or digital inputs, setting of outputs, etc. After the initializing phase of the CAN-networks PDOs serve the fast data transfer between the CAN bus participants. The contents of the messages is relatively high.

PDO-Mapping

PDO-Mapping means to link objects together to one CAN-message of 8 bytes maximum. The application engineer can “pack” the data relevant to him (e.g. digital outputs) in one PDO, i.e. he can map them and so guarantee a fast data exchange of relevant data. PDO mapping needs only to be carried out, if the default values of the PDOs do not comply with the requirements of the respective application.

Communication Objects

In addition to SDOs and PDOs other communication objects have been specified:

- boot-up:	specifies starting up the CAN network
- dyn. identifier distribution:	automatic identifier distribution per software
- node guarding/life guarding:	supervising the functionality of the CAN network
- synchronization:	synchronizing of input / output, e.g. for drives
- emergency:	emergency telegrams at failures

Node-ID

Each CAN device has its own node number by which it is identified. PDOs communicate with a COB-ID of ‘address + offset’ on the CAN bus. The ‘offset’ is equivalent to the allocated Node-ID of the respective device. This results in the necessity of allocating a unique node number to each device to avoid bus conflicts. Valid node numbers are 0 to 127, where 0 is reserved for the ‘Bus-Master’.

Baud Rate

CAN is a serial bus system where the data transmission rate is given in bits per second (baud). Valid baud rates are 10k, 20k, 50k, 100k, 125k, 250k, 500k, 800k and 1000 kBaud and are set e.g. with a BCD rotating switch. RM 201 automatically recognize the baud rate which means that it is not always necessary to set the baud rate manually.

EDS files ‘electronic data sheet’

EDS files describe a CANopen device and are required by the system configuration tools such as ProCANopen. They are part of the Engineering Sets 9407-999-103x1.

10.1 *Node States / Minimum Boot-Up*

The Minimum Boot-Up supports **four node states**. State transitions are either triggered automatically or by a command initiated by the NMT master.

(1) Initialization

In this state the node is initialized. Three sub-states can be distinguished:

- **Reset Application**

Before the automatic jump into the state ‘Reset Communication’, the manufacturer specific and device profile specific part of the object index are initialized with the default values. This state is also run through first after the node has been switched on.

- **Reset Communication**

Before the automatic jump into the state ‘Init’, the communication profile specific part of the object index is initialized with the default values.

- **Init**

In this state the rest of node initialization follows. Then the device automatically jumps into the state ‘Pre-Operational’.

(2) Pre-Operational

After ‘Initialization’, this state is achieved automatically. This state serves to parameterize the node. Node-guarding can be switched active or not active. SDO transfers are possible, PDO transfers are not supported. The SYNC telegram can be parameterized, but is not transmitted. The device can jump into every other state except ‘Init’.

(3) Operational

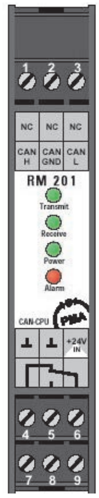
This is the normal operational state. Node-guarding can be activated or deactivated. SDO and PDO transfers are possible. If it has been parameterized beforehand, the node sends SYNC telegrams to the bus in this state. If the settings for the PDOs or SYNC telegrams are changed in the object index in this state, i.e. whilst operation, then to keep the data consistent, it must jump once into the state ‘Pre-operational’ or ‘Prepared’ until the new settings become valid. It can jump into every other state except ‘Init’.
Sometimes the jump to state ‘Operational’ is also called ‘start node’.

(4) Prepared / (Stopped)

In this state neither SDO or PDO transfers are possible, nor SYNC telegrams can be sent. If the node monitoring had been activated previously, it is the only service which is executed. It can jump into every other state except ‘Init’.
Sometimes the jump to state ‘Prepared’ is also called ‘stop node’.

11 Hardware / Technical data

11.1 *Connections*

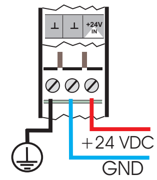


11.1.1 24 V/DC- supply

terminal 4,5	=	GND mass
terminal 6	=	+24 V/DC

The terminals 4 and 5 are internally connected.

The GND of the 24V power supply has to be connected to protective earth (PE).



11.1.2 CAN - connection

terminal 1	=	CAN_H
terminal 2	=	CAN_GND
terminal 3	=	CAN_L

11.1.3 Alarm-relay

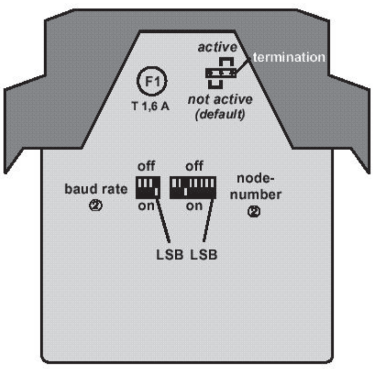
Change-over relay

terminal 7	=	NC
terminal 8	=	NO
terminal 9	=	C

The maximum working voltage for a safe protective insulation according to EN 61010-1 is 150 V for pollution degree 2 and overvoltage category II.

11.1.4 Bus termination

A CAN-bus - termination resistance can be switched on via jumper.



11.2 *Replacement of the fuse on the RM 201*

If the green ‘Power’-Led does not light up with the connection of the voltage supply, the fuse should be checked.
The fuse on the RM 201 protects the 24V/DC supply voltage. With defectice I/O modules, bus boards or the coupler module a short-circuit of supply vlotage within the module is possible. The current is limited to max. 1.6 ampere by the fuse. After repairs of the error the defective fuse can be replaced by an identically type with 1.6 A / slow-acting.

11.3 *Transmit- / Receive - LED*

The yellow ‘Transmit- / Receive’ - LEDs light up during transmitting and receiving of CANopen messages.

11.4 *Alarm-LED*

The red ‘Alarm’-LED shows the state of the alarm relay.

11.5 *Technical Data RM 201*

Application: central unit of the modular fieldbus system

Power supply: +24 V DC (±10 %), max. power consumption 1750 mW (only RM 201)
The GND (⊥) of the 24 V DC supply has to be connected to protective earth.(PE)
The module supplies all I/O modules with the required voltages; the max. current consumption is 1.5 A (depending on the I/O modules used).

Microprocessor: SAB-C505C with 20 MHz

Memory:
- 32 kByte static RAM
- 64 kByte EPROM
- 8 kByte EEPROM

CAN-Bus:
- Full-CAN-Controller according to CAN-specification V2.0 A
- physical connection according to ISO 11898
- galvanic isolation via High-Speed-Opto-coupler
- Transmission data rate: 10, 20, 50, 100, 125, 250, 500, 800 and 1000 kBaud
- automatic baud rate scanning
- Range of node numbers: 0...127 (1...42 in use of default mappings)
- switchable termination resistance
- Process-Data-Objects (PDOs):
  - Receive ≤ 5
  - Transmit ≤ 10, max. 5 requestable per ‘Remote Transmit Request’

CAN-Protocol: The device operates according to the regulations DS301 and parts of DSP404 passed by the CiA as a CANopen slave.

Protection: The noise immunity of the CAN bus is considerably improved by a current-compensated choke.
The power supply connection is protected against external interferences such as voltage peaks by different EMC sources.

Alarm output: The module has an alarm relay output to release for example an emergency stop in case of defined events. These events can be parameterized via CANopen.
The max. working voltage for a safe protective insulation according to EN61010-1 with pollution degree 2 and overvoltage category II : 150 V
Relay: change-over, AC: Pmax = 750 W, 5 A
DC: Pmax = 120 W, 120 V, 5 A

LED displays:
- 1x ‘Transmit’ (yellow): transmission of a message via CANopen
- 1x ‘Receive’ (yellow): receipt of a CANopen message
- 1x ‘Power’ (green): state of the supply voltage
- 1x ‘Alarm’ (red): state of the alarm relays

Galvanic isolation: The power supply, CAN bus and logic areas are galvanic-isolated from each other (isolation voltage 500 V DC).

Temperature range:
- Storage temperature: -20 ... +70 °C
- Ambient temperature: 0 ... +50 °C

Humidity:
- 75% rel. humidity, no condensation

Shock sensitivity: DIN 40046 IEC68-2-69

EMC:
- DIN EN 50081 Part 2
- DIN EN 50082 Part 2

Electrical connections: screw-/plug-in-terminals, line cross-section max. 2.5 mm²
Class of protection: IP 20
Dimensions: 99 x 17.5 x 114.5 mm (h x w x d)
Weight: 100 g
Housing: Polyamid PA 6.6, combustibility class V0 according to UL 94
Assembly: plugged-in and locked in front of base module
Usage position: vertical

Subject to technical alterations !

12 Appendix

12.1 *Definitions*

AVS	Abbr. for power supply
Basic module	Unit for installation of the modules of the RM 200 - system (RM 211, RM 212, RM 213)
CANopen	Protocol based on CAN-Bus, specified by user organization CiA
CiA	CAN in Automation user organization
EEP	Abbr. for EEPROM
Fail Safe	Behaviour of an output value if communication to bus master fails
ID	Abbr. for ident number
I/O	Abbr.for input / output
HW	Abbr. for hardware
Coupler	(Fieldbus-)Coupler to connect the selected fieldbus; main module of the RM 200 system
LSB	Least significant bit
MSB	Most significant bit
Octet	8 continuous bits
PDO	Abbr. for Process Data Object
RC-combination	Combination from resistance and capacity
RS485	Standardized two wire connection, half duplex, (EIA RS 485)
SDO	Abbr. for Service Data Object
SW	Abbr. for software
SYNCH	Synchronization message
TC	Abbr. for thermocouple

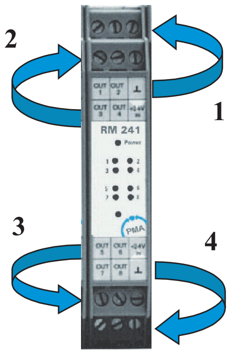
12.2 *FAQ - RM 200 Modules - General*

❑ **Execeeding measuring range**
In order to achieve the highest possible resolution in the specified measuring range, the RM 200 modules only have very small limits for exceeding the measuring range, for example, only some 70 µA with the current input modules RM 221-0 and RM 222-0. A larger deviation will set the Fail bit.

❑ **Error detection for RM 251**
The digital output module RM 251 can detect an open or short-circuited input for **two adjacent outputs.** This is indicated by both LEDs blinking under the following conditions:
<u>Open circuit detection</u>: Supply voltage is connected and at least one output "Low", or no supply voltage and both outputs "Low".
<u>Short circuit detection</u>: Supply voltage is connected and at least one output "High", or no supply voltage and both outputs "High".
After a disturbance, set error flags can only be reset if the outputs return to the status they had when the fault was detected. If the object "Fault_Mode" (0x6206) is used to reset an error flag, the output value must also be re-written. Alternatively, the error flag can be reset by overwriting the datum "Error_Reset" (0x5000) with the value 0x0002.
Recommendation for KS 98+ (only uses the short circuit detection): Set the "Fmode" behaviour on error for output Out_i to "none" = disabled.

❑ **Lower limit for thermocouple**
With the temperature module RM 224-1, the lowest possible limit with thermocouple measurement depends on the CJC measurement value. Therefore, the enclosed data sheet specifies two values for the lowest limit (0 °C and 50 °C), which can be also defined in the Engineering of the KS 98plus.

❑ **Assignment of terminal descriptions to terminals**



❑ **Calculation of cycle time for CANopen coupler module RM 201 (worst case)**
The calculation of the internal cycle time depends on the number of inserted (analog) modules and the external load on the CANbus. Main internal times of the RM 200:
– digital signals (1 to 9 modules): ≤ 10 ms
– 4-channel analog module (per module): ≤ 50 ms
– 2-channel analog module (per module): ≤ 20 ms
<u>Examples:</u>
A) 4 x RM 224-1 (4 channels TC/Pt100) + 4 x RM 231-0 (4 channels AO) + 1x RM 242 (8 DI) : ≤ **400 ms**
B) 9 x RM 242 (8 DI) : ≤ **10 ms**

❑ **Sensor break RM 224-1**
Starting delivering in June 2000, all the modules are fitted with break detection for all 3 leads.
Exception: If the equalizing lead (e.g. pin 3) breaks, no error is detected, but the input value goes to a defined value of less than –150 °C.

❑ **Upscale / downscale**
With the analog input modules (RM 221-x, RM 222-x, RM 224-x) it is possible to configure upscale (max. value) or downscale (min. value) action per channel when an error is detected. The default setting is upscale.

❑ **Output hold**
With analog output modules (RM 231-x) it is possible to configure "output hold" (last value) or zero (fail safe) per channel when a bus error is detected.

❑ **Spike detection**
The CAN coupler software has been fitted with a spike detection function, which eliminates freak values. Furthermore, the function has been modified so that no fail signal is generated when a spike is detected.

12.3 *FAQ - RM 200 Modules and KS98+*

❑ **Identification RM 221 and RM 222**
Previously, the current input module with transmitter supply RM 222-0 identified itself to the CAN coupler module as a RM 221-0 (current input without transmitter supply). This error can be remedied by means of an exchange in the KS 98 Engineering (no functional difference).
Beginning with software Version 4.1.101 of the KS 98plus, the identification of the RM 221-0 instead of the expected RM 222-0 will be accepted.

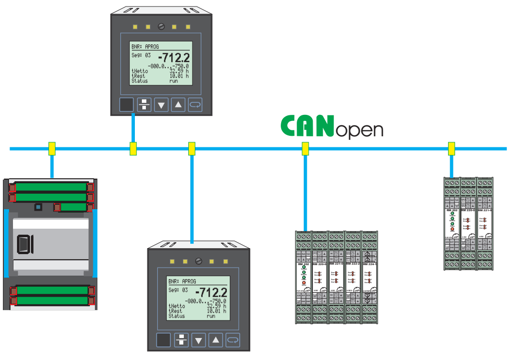
❑ **KS 98plus and changed address for RM 201**
If the address of an RM 201 module is changed in an automation system with a KS 98plus after the KS 98-Engineering has been uploaded, but no change is made in the module's position in the RM basic module, proceed as follows for the KS 98plus (software Version 4.3):

1. Disconnect supply voltage, and remove or install a RM 200 module.
2. Reconnect the supply voltage, and wait until the node initialization has been completed.
3. Disconnect the supply voltage, and remove or install a RM 200 module. Reconnect supply voltage.

From KS 98plus Version V4.4 onwards, a CAN node reset for a new RM 200 node can be carried out in this case, in order to read a changed configuration or address from the RM 200 node.

In the menu "Status CAN bus" the entry ”Node Reset” has been added. The sub-menu displays all available RM 200 nodes. A reset can then be initiated for the selected node.

12.4 *Connection between RM 200 and KS98+ with CANopen interface*

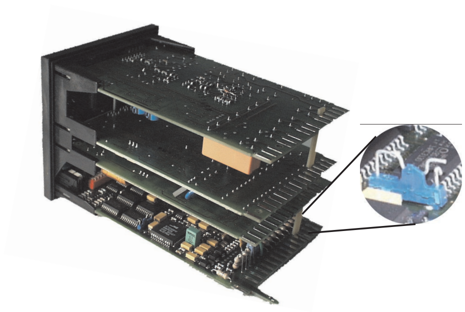


The additional CANopen interface extends the multifunction unit functionality of KS98+already in the basic version by

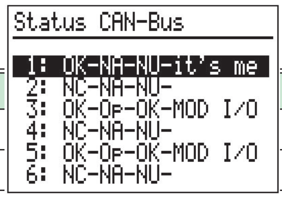
- Extension of the number of local I/O by means of the modular PMA RM 200 I/O system
- connection of PMA multi-temperature controllers KS800 / KS 816 with CANopen interface
- on-site data exchange with other KS98+ units (cross crommunication)

These functions are available only in KS98+ versions from operating version 5.

BUS terminating resistor
Both ends (first and last unit) of the CANopen bus must be fitted with a bus terminating resistor. For this purpose, the bus terminating resistor provided in each KS98+ can be used.
With the S.I.L. switch closed, the terminating resistor is connected.
By default , the S.I.L. switch is open (see opposite).



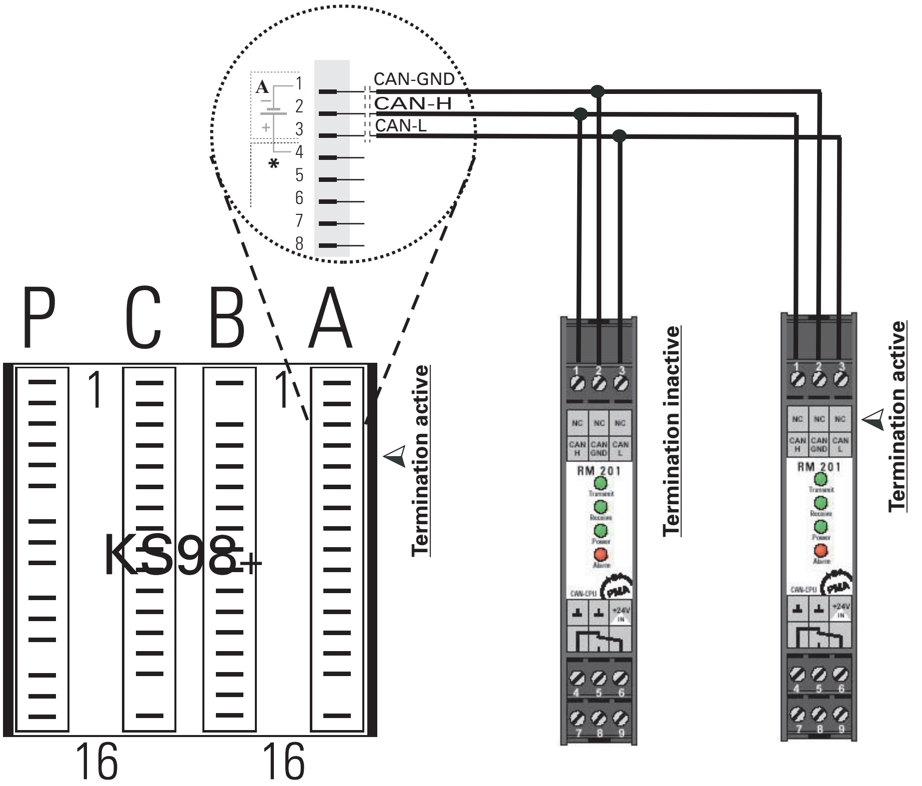
Status display : CAN bus status



Character	Value	Signification
1, 2	1...42	Node number
3, 4	:	Separator
5, 6	NC	NoCheck: Node existence so far unchecked / node not provided.
	Ck	Check: Check for node existence is busy.
	NR	NoResponse: No response from this node. However, node is required.
	OK	Ready: Node has responded and was identified.
	ES	EmStart: Node has output an emergency message.
7, 10, 13	-	Separator
8, 9	NA	NotAvailable: Node status is unknown.
	PO	PreOperation: Node is in status PreOperational.
	Er	Error: Node is in error condition.
	Op	Operational: Node is in operational condition.
11, 12	NU	NotUsed: Node is not required by an own lib function.
	Wa	Waiting: Lib function waits for identification of this node
	Pa	Parameter setting: Lib function is busy setting the node parameters
	OK	Ready: Lib function has finished parameter setting
14...21	String	Determined node name

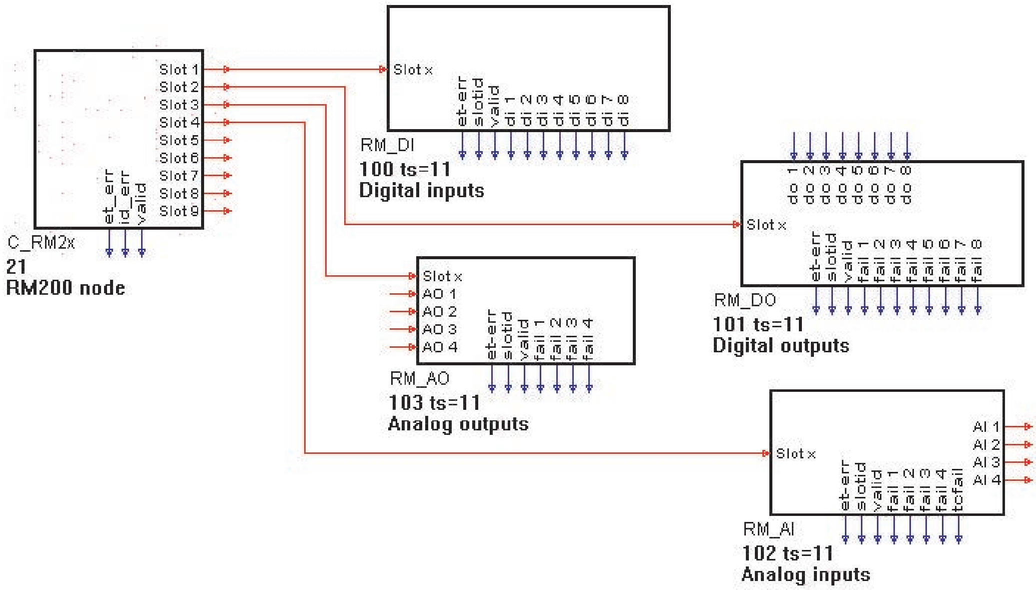
12.4.1 Cable connection KS98+ and RM 200 modules

The following figure shows the example of a cable connection between a KS98+ and two RM 201 nodes .



12.4.2 Partial engineering for communication with a RM 200 node.

Data access to the RM 200 nodes is performed by using predefined function blocks in KS98 engineering.



Further details on KS98+ engineering see operating manual 9407-040-44311.

CANopen Coupler Module RM 201

Safety Instructions

ESD !

- contains electro-statically sensitive components
- Original packing protects against electrostatic discharge (ESD)
- Transporting only in the original packing
- during mounting rules for protection against ESD must be followed

Connections

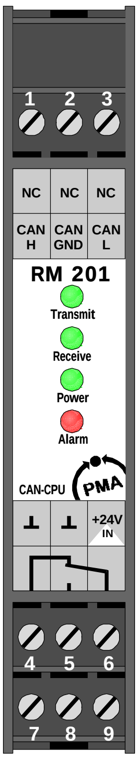
- Wiring must be conform to local standards (e.g. VDE 0100 in Germany) !
- Input leads must be kept separate from signal and mains leads !
- The protective earth must be connected to the relevant terminal (in the instrument carrier) !
- The cable screening must be connected to the terminal for grounded measurement !
- Usage of twisted and screened input leads prevent stray electric interference !
- Connections must be made according to the connecting diagrams !

Maintenance / Repair

Instrument needs no particular maintenance.
When opening the instrument live parts or terminals can be exposed.
Before carrying out the instrument must be disconnected from all voltage sources.
The instrument contains electrostatically sensitive components.
The following work may be carried out only by trained, authorized persons.

Fuse tripped:
- Cause must be determined and removed !
- Only fuses of the same type and current rating as the original fuse must be used.
- Using repaired fuses or short-circuiting the fuse socket is inadmissible !

Pin Assignment



Pin	Assignment	
	NC	
	NC	
	NC	
1	CAN H	CAN-Bus
2	CAN GND	
3	CAN L	
4	GND	Power supply
5	GND	
6	+24 V IN	
7		Alarm relay
8		
9		
Art.-No.	9407-738-20101	

① The positions of the switches are shown in binary-code. The number at the right position corresponds to the LSB (DIP-switch-position 1), the number at the left position corresponds to the MSB (DIP-switch-position 4 or 8). To use the default-mapping of the modular fieldbus-system in full effect a node number ≤ 42 should be chosen.

② Factory settings

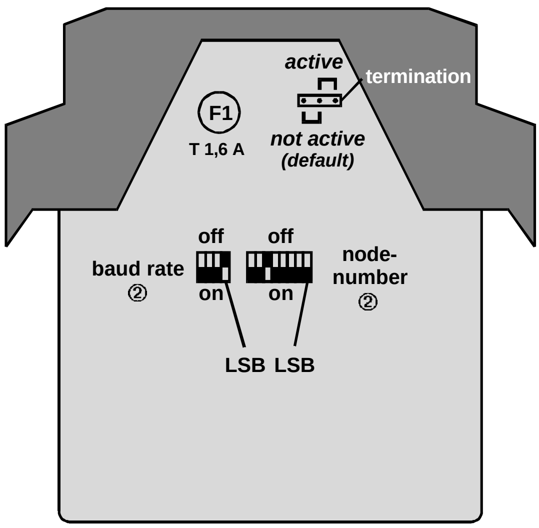
DIP switches / Jumper

4 Bit DIP switch

DIP ①	Baud rate
0000	10 kBit
0001	20 kBit ②
0010	50 kBit
0011	100 kBit
0100	125 kBit
0101	250 kBit
0110	500 kBit
0111	800 kBit
1000	1000 kBit
1001	Auto Scan
4321	Switch-Pos.

8 Bit DIP switch

DIP ①	Node-No.
0000 0000	invalid
0000 0001	1
0000 0010	2
0000 0011	3
...	...
0010 0000	32 ②
...	...
0111 1110	126
0111 1111	127
8765 4321	Switch-Pos.



Art.-Nr.: 9499-040-58841 • 22.02.01

Technical Data RM 201

Application: central unit of the modular fieldbus system

Power supply: +24 V DC (±10 %), max. power consumption 1750 mW (only RM 201)
The GND (⊥) of the 24 V DC supply has to be connected to the protective earth(PE).

The module supplies all I/O modules with the required voltages; the max. current consumption is 1.5 A (depending on the I/O modules used).

Microprocessor: SAB-C505C with 20 MHz

Memory:
- 32 kByte static RAM
- 64 kByte EPROM
- 8 kByte EEPROM

CAN-Bus:
- Full-CAN-Controller according to CAN-specification V2.0 A (CAN-specification V2.0 B on request)
- physical connection according to ISO 11898
- galvanic isolation via High-Speed-Opto-coupler
- Transmission data rate: 10, 20, 50, 100, 125, 250, 500, 800 and 1000 kBaud
- automatic baud rate scanning
- Range of node numbers: 0...127 (1...42 in use of default mappings)
- switchable termination resistor
- Process-Data-Objects (PDOs):
  - Receive ≤ 5
  - Transmit ≤ 10, max. 5 requestable per 'Remote Transmit Request'

CAN-Protocol: The device operates according to the regulations DS301 and parts of DSP404 passed by the CiA as a CANopen slave.

Protection: The noise immunity of the CAN bus is considerably improved by a current-compensated choke.

The power supply connection is protected against external interferences such as voltage peaks by different EMC sources.

Alarm output: The module has an alarm relay output to release for example an emergency stop in case of defined events. These events can be parameterized via CANopen.

Alarm relay: max. working voltage for a safe protective insulation according to EN61010-1 with pollution degree 2 and overvoltage category II: 150 V
change-over-contact rating: AC: Pmax = 750 W, 5 A
DC: Pmax = 120 W, 120 V, 5 A

LED displays:
- 1x ‘Transmit’ (yellow): transmission of a message via CANopen
- 1x ‘Receive’ (yellow): receipt of a CANopen message
- 1x ‘Power’ (green): state of the supply voltage
- 1x ‘Alarm’ (red): state of the alarm relays

Galvanic isolation: The power supply, CAN bus and logic areas are galvanic-isolated from each other (isolation voltage 500 V DC).

Temperature range:
- Storage temperature: -20 ... +70 °C
- Ambient temperature: 0 ... +50 °C

Humidity: ≤ 75% rel. humidity, no condensation

Shock sensitivity: DIN 40046 IEC68-2-69

EMC:
- DIN EN 50081 Part 2
- DIN EN 50082 Part 2
- DIN EN 61326

Electrical connections: screw-/plug-in-terminals, line cross-section max. 2.5 mm²

Class of protection: IP 20

Dimensions: 99 x 17.5 x 114.5 mm (h x w x d)

Weight: 100 g

Housing: Polyamid PA 6.6, combustibility class V0 according to UL 94

Assembly: plugged-in and locked in front of base module

Usage position: vertical

Subject to technical alterations !

Basic Modules RM 211 / RM 212 / RM 213

Safety Instructions

ESD !

- contains electro-statically sensitive components
- Original packing protects against electrostatic discharge (ESD)
- Transporting only in the original packing
- during mounting rules for protection against ESD must be followed

Connections

- Wiring must be conform to local standards (e.g. VDE 0100 in Germany) !
- Input leads must be kept separate from signal and mains leads !
- The protective earth must be connected to the relevant terminal (in the instrument carrier) !
- The cable screening must be connected to the terminal for grounded measurement !
- Usage of twisted and screened input leads prevent stray electric interference !
- Connections must be made according to the connecting diagrams !

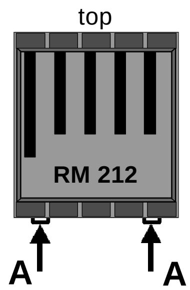
Maintenance / Repair

Instrument needs no particular maintenance.
When opening the instrument live parts or terminals can be exposed.
Before carrying out the instrument must be disconnected from all voltage sources.
The instrument contains electrostatically sensitive components.
The following work may be carried out only by trained, authorized persons.

Fuse tripped:
- Cause must be determined and removed !
- Only fuses of the same type and current rating as the original fuse must be used.
- Using repaired fuses or short-circuiting the fuse socket is inadmissible !

Mounting on DIN-Rail

The basic modules are intended for DIN-rail mounting according to EN 50022. The mounting is carried out by locking the metal ledge (**A**) on the back side below. For dismantling a basic module the metal ledge (**A**) must be released.



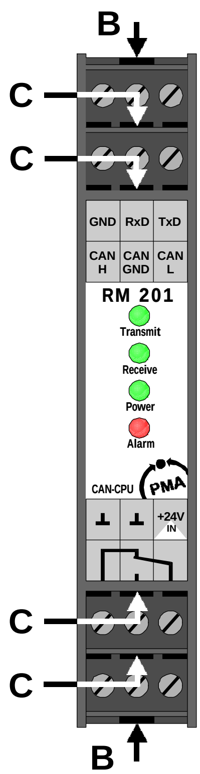
Installation / Removal the Modules

Module installation into a basic module: Slide in the module at the respective place. Listen to the 'click' for proper enganging.

The installation of the modules **RM 201** or **RM 202** (fieldbus coupler) always must be placed at the absolutely left position. All other modules can be installed at any position.

For removing: Release the two ledges (**B**) and pull out the module.

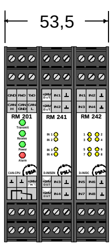
To keep the specified protection degree (IP20) emty slots must be protected by slot covers RM 214.



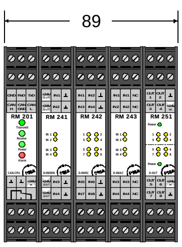
Screw-/ Plug-in-Terminals

The screw-/plug-in-terminals can be plugged in from above or below into the module housing (audible locking). Removing the screw-/plug-in-terminals takes place by levering out at position (**C**), e.g. with a screwdriver.

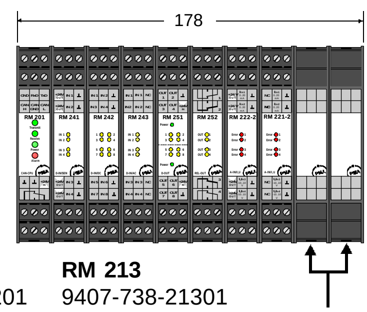
Due to contact-voltage proof not connected terminals should remain in the respective places.



RM 211
9407-738-21101

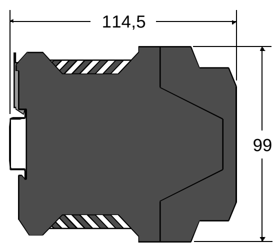


RM 212
9407-738-21201



RM 213
9407-738-21301

slot cover
RM 214
9407-738-21401



side view

Subject to technical alterations!

PMA Prozeß- und Maschinen-Automation GmbH ◆ Postfach 310229 ◆ 34058 Kassel ◆ Germany
http://www.pma-online.de ◆ E-Mail: mailbox@pma-online.de

Analog Input Module RM 221 / 222

Safety Instructions

ESD !

- contains electro-statically sensitive components
- Original packing protects against electrostatic discharge (ESD)
- Transporting only in the original packing
- during mounting rules for protection against ESD must be followed

Connections

- Wiring must be conform to local standards (e.g. VDE 0100 in Germany) !
- Input leads must be kept separate from signal and mains leads !
- The protective earth must be connected to the relevant terminal (in the instrument carrier) !
- The cable screening must be connected to the terminal for grounded measurement !
- Usage of twisted and screened input leads prevent stray electric interference !
- Connections must be made according to the connecting diagrams !

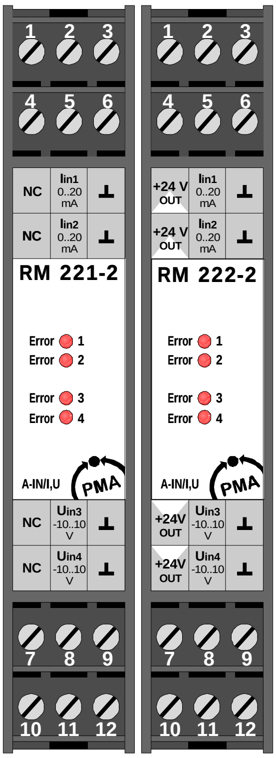
Maintenance / Repair

Instrument needs no particular maintenance.
When opening the instrument live parts or terminals can be exposed.
Before carrying out the instrument must be disconnected from all voltage sources.
The instrument contains electrostatically sensitive components.
The following work may be carried out only by trained, authorized persons.

Fuse tripped:

- Cause must be determined and removed !
- Only fuses of the same type and current rating as the original fuse must be used.
- Using repaired fuses or short-circuiting the fuse socket is inadmissible !

Pin Assignment



RM 221   RM 222

Pin	RM221-0	RM221-1	RM221-2	RM222-0	RM222-1	RM222-2
1				24 V OUT	5/24 V OUT	24 V OUT
2	0...20 mA	-10...10 V	0...20 mA	0...20 mA	-10...10 V	0...20 mA
3	GND	GND	GND	GND	GND	GND
4				24 V OUT	5/24 V OUT	24 V OUT
5	0...20 mA	-10...10 V	0...20 mA	0...20 mA	-10...10 V	0...20 mA
6	GND	GND	GND	GND	GND	GND
7				24 V OUT	5/24 V OUT	5/24 V OUT
8	0...20 mA	-10...10 V	-10...10 V	0...20 mA	-10...10 V	-10...10 V
9	GND	GND	GND	GND	GND	GND
10				24 V OUT	5/24 V OUT	5/24 V OUT
11	0...20 mA	-10...10 V	-10...10 V	0...20 mA	-10...10 V	-10...10 V
12	GND	GND	GND	GND	GND	GND
Art.-Nr.	9407-738-22101	9407-738-22111	9407-738-22121	9407-738-22201	9407-738-22211	9407-738-22221
	4x I	4x U	2x I, 2x U	4x I	4x U	2x I, 2x U
	without transducer supply			with transducer supply		

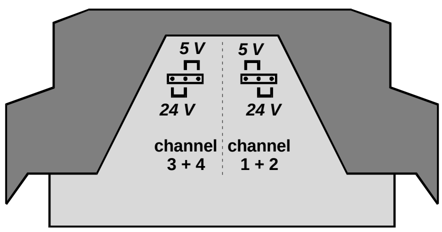
Remark:

The -10...+10 V input can be switched to the range 0...+10 V via software.

The 0...20 mA input can be switched to the range 4...20 mA via software.

For 2 channels each the transducer supply can be switched from 24 V DC to controlled 5 V DC, so that there is a 5 V DC supply with max. 20 mA available for potentiometric transmitters.

RM 222



Technical Data RM 221 / 222

Application:
4 analog standard-signal inputs with the measuring ranges:
0..20 mA or 4..20 mA and 0..10 V or -10..10 V

The module version 'with transducer supply' (RM 222) enables a direct connection of transducers or potentiometric transmitters.

Resolution:
12 bit

Configuration:
The 4 inputs can be designed for any combination of current or voltage measurement by the respective assembling of the module.

Standard: 4x current, 4x voltage or 2x current / 2x voltage

The desired measuring range is parameterized via the fieldbus.

Characteristic curve deviation: (maximum)
- 0(4)..20 mA: ±30 µA
- 0..10 V: ±15 mV
- -10..10 V: ±30 mV

Deviation by temperature:
- 0(4)..20 mA: ±5 µA / 10 K
- 0..10 V: ±8 mV / 10 K
- -10..10 V: ±11 mV / 10 K

Overload protection:
Overvoltage protection by 2 varistors (20 V and 48 V / 0.4 J).

A/D-converter:
- Process: 'successive-approximation'
- Resolution: approx. 2.5 or 5.0 mV / Digit or approx. 4.1 or 5.1 µA / Digit

Filter:
- Analog: low pass 2. order, cutoff frequency = 100 Hz
- Digital: low pass 1. order (parameterizable average processing)

Deviation by auxiliary power:
negligible at 24 V DC ± 10%

Power supply:
The module is supplied with the necessary voltages via the bus board.

Power consumption:
- RM 221: max. 1.7 W
- RM 222: max. 1.5 W (without load at transducer supply)

Transducer supply: (only RM 222)
- The module version 'with transducer supply' (RM 222) provides each input with 24 V DC(10%), with a max. current of 25 mA.
  Condition: voltage supply of 24 V DC (±10 %), connected to the fieldbus coupler
- For 2 channels each the transducer supply can be switched from 24 V DC to controlled 5 V DC, so that there is a 5 V DC supply with max. (total) 20 mA available for potentiometric transmitters.

Input impedance:
- Current input: approx. 47 Ω (with ground reference)
- Voltage input: approx. 730 kΩ (with ground reference)

Cycle times:
Each channel is scanned with at least 10 Hz. A filtering of the input values can be parameterized via the fieldbus.

LED-Displays:
Errors are displayed directly on the module by means of 4 red LEDs.

Galvanic isolation:
The logic-part is galvanic isolated from the inputs. The module version 'without voltage supply' (RM 221) also has an isolation between the power supply and the inputs.
(Isolation voltage 500 V DC)
The inputs are not isolated from each other.

Temperature range:
- Ambient temperature: 0 ... +50 °C
- Storage temperature: -20 ... +70 °C

Humidity:
≤ 75% humidity, no condensation

Shock sensitivity:
DIN 40046 IEC68-2-69

EMC:
- DIN EN 50081 part 2
- DIN EN 50082 part 2

Electrical connection:
screw-/plug-in-terminals, line cross-section max. 2.5 mm^2

Class of protection:
IP 20

Dimensions:
99 x 17.5 x 114.5 mm (h x w x d)

Weight:
88 g / 84 g (HE 5930-1 / HE 5930-3)

Housing:
Polyamid PA 6.6, combustibility class V0 according to UL 94

Assembly:
plugged-in and locked in front of base module

Usage position:
vertical

Subject to technical alterations!

Analog Input Module RM 224-0

Safety Instructions

ESD !

- contains electro-statically sensitive components
- Original packing protects against electrostatic discharge (ESD)
- Transporting only in the original packing
- during mounting rules for protection against ESD must be followed

Connections

- Wiring must be conform to local standards (e.g. VDE 0100 in Germany) !
- Input leads must be kept separate from signal and mains leads !
- The protective earth must be connected to the relevant terminal (in the instrument carrier) !
- The cable screening must be connected to the terminal for grounded measurement !
- Usage of twisted and screened input leads prevent stray electric interference !
- Connections must be made according to the connecting diagrams !

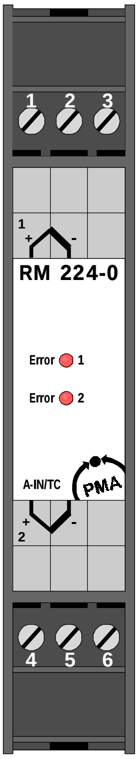
Maintenance / Repair

Instrument needs no particular maintenance.
⚠ When opening the instrument live parts or terminals can be exposed.
Before carrying out the instrument must be disconnected from all voltage sources.
The instrument contains electrostatically sensitive components.
The following work may be carried out only by trained, authorized persons.

Fuse tripped:

- Cause must be determined and removed !
- Only fuses of the same type and current rating as the original fuse must be used.
- Using repaired fuses or short-circuiting the fuse socket is inadmissible !

Pin Assignment



Pin	Assignment	
1	+	Input 1
2	-	
3	NC	
4	+	Input 2
5	-	
6	NC	
Art.-No.	9407-738-22401	

Art.-No.: 9499-040-59741 ◆ 05.06.00

Technical Data RM 224-0

Application: 2 galvanically isolated inputs for the direct connection of thermocouples (type J, K, L, E, T, S, R, B, N, W)

Resolution: 16 bits / successive approximation

Measuring range: -9.835... +76.357 mV

Temperature ranges:

	Measuring range	Resolution	Error
Thermocouple type J:	-210.0 °C ... +1200.0 °C	0.03 K	≤ 1 K
Thermocouple type K:	-2700 °C ... +1370.0 °C	0.04 K	≤ 1 K
Thermocouple type L:	-200.0 °C ... +900.0 °C	0.03 K	≤ 1 K
Thermocouple type E:	-270.0 °C ... +1000.0 °C	0.02 K	≤ 1 K
Thermocouple type T:	-270.0 °C ... +400.0 °C	0.04 K	≤ 1 K
Thermocouple type S:	-50.0 °C ... +1760.0 °C	0.13 K	≤ 2 K
Thermocouple type R:	-50.0 °C ... +1760.0 °C	0.12 K	≤ 2 K
Thermocouple type B: 1)	+25.0 °C ... +1820.0 °C	0.15 K	≤ 2 K
Thermocouple type N:	-196.0 °C ... +1299.6 °C	0.04 K	≤ 1 K
Thermocouple type W:	0.0 °C ... +2299.3 °C	0.09 K	≤ 1 K

1) specification applies above 400°C

Unit °C, °F, K selectable via software / number of post decimal places = 1

Cold junction compensation: additional error ≤0.15% of the respective measuring range

Linearization: Linearity error negligible

Differential input: yes

Input resistance: ca. 1 MΩ

Sensor current: ca. 5 µA (sensor breakage detection)

Overflow of measuring range: Alarm message if value overflows 160 digits

Overload-protection: Overload-protected by varistors (5 V/ 0.4 J)

Filter:
- Analog: Low-pass, $f_{cut\text{-}off}$ < 10 Hz
- Digital: Low-pass of 1st order (adjustable averaging process)

Configuration: The type of the used thermocouple is selected via the fieldbus.

Power supply: The module is supplied with necessary voltages via the bus board.

Power consumption: max. 1400 mW

Cycle times: Each channel is scanned with 50 ms. Filters for the input values can be parameterized via the fieldbus.

LED-Displays: Errors are indicated for each channel via 2 LEDs.

Galvanic isolation: The logic-part is galvanically isolated from the inputs. Additionally, there is a galvanic isolation between the power supply and the inputs. The inputs are also galvanically isolated from each other.

Ambient temperature:
- Operation: 0... +50 °C
- Storage: -20... +70 °C
- Effect: ≤0.05% / 10 K

Climatic Application Class: KUF DIN 40040 (≤ 75% rel. humidity, no condensation)

Shock sensitivity: DIN 40046 IEC68-2-69

EMC:
- DIN EN 50081 Part 2
- DIN EN 50082 Part 2
- HF-effect: ≤0.1%

Electrical connections: Screw-/plug-in terminal blocks, line cross-section max. 2.5 mm²

Class of protection: IP 20 of the completely equipped device

Dimensions: 99 x 17,5 x 114,5 mm (h x w x d)

Weight: 68 g

Housing: Material: Polyamid PA 6.6, combustibility class V0 according to UL 94

Assembly: plugged-in and locked from the front of base module

Usage position: vertical

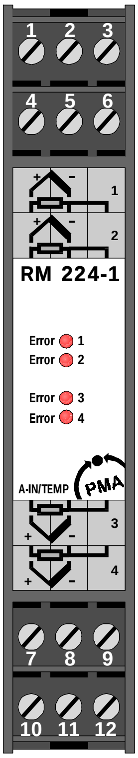
Subject to technical alterations!

Analog Input Module RM 224-1

Safety Instructions

ESD !	Connections	Maintenance / Repair
• contains electro-statically sensitive components • Original packing protects against electrostatic discharge (ESD) • Transporting only in the original packing • during mounting rules for protection against ESD must be followed	• Wiring must be conform to local standards (e.g. VDE 0100 in Germany) ! • Input leads must be kept separate from signal and mains leads ! • The protective earth must be connected to the relevant terminal (in the instrument carrier) ! • The cable screening must be connected to the terminal for grounded measurement ! • Usage of twisted and screened input leads prevent stray electric interference ! • Connections must be made according to the connecting diagrams !	Instrument needs no particular maintenance. ⚠ When opening the instrument live parts or terminals can be exposed. Before carrying out the instrument must be disconnected from all voltage sources. The instrument contains electrostatically sensitive components. The following work may be carried out only by trained, authorized persons. **Fuse tripped**: • Cause must be determined and removed ! • Only fuses of the same type and current rating as the original fuse must be used. • Using repaired fuses or short-circuiting the fuse socket is inadmissible !

Pin Assignment



Pin	Assignment	
1	+	Input 1
2	-	
3		
4	+	Input 2
5	-	
6		
7	+	Input 3
8	-	
9		
10	+	Input 4
11	-	
12		
Art.-No.	9407-738-22411	

PMA Prozeß- und Maschinen-Automation GmbH ◆ Postfach 310229 ◆ 34058 Kassel ◆ Germany
http://www.pma-online.de ◆ E-Mail: mailbox@pma-online.de

Technical Data RM 224-1

Application: 4 analog inputs for the direct connection of RTD (Pt 100) or thermocouples (T/C) (Type J, K, L, E, T, S, R, B, N, W)

Resolution: 16 bit / successive approximation

Measuring range: -9.835 ... +76.357 mV (Thermocouple) / 18.49 Ω ... 390.26 Ω (RTD, Pt100)

Temperature ranges:

	Measuring range	Resolution	Error
Pt100:	-200.0°C ... +850.0°C	0.02 K	≤ 1 K
Thermocouple type J:	-210.0°C / -120.0°C ... +1200.0°C	0.03 K	≤ 1 K
Thermocouple type K:	-270.0°C / -130.0°C ... +1370.0°C	0.04 K	≤ 1 K
Thermocouple type L:	-200.0°C / -120.0°C ... +900.0°C	0.03 K	≤ 1 K
Thermocouple type E:	-270.0°C / -130.0°C ... +1000.0°C	0.02 K	≤ 1 K
Thermocouple type T:	-270.0°C / -130.0°C ... +400.0°C	0.04 K	≤ 1 K
Thermocouple type S:	-50.0°C / +12.0°C ... +1760.0°C	0.13 K	≤ 2 K
Thermocouple type R:	-50.0°C / +13.0°C ... +1760.0 °C	0.12 K	≤ 2 K
Thermocouple type B: **1)**	+25.0°C / +50.0°C ... +1820.0 °C	0.15 K	≤ 2 K
Thermocouple type N:	-196.0°C / -109.0°C ... +1299.6 °C	0.04 K	≤ 1 K
Thermocouple type W: **2)**	0.0°C / +50.0°C ... +2299.3 °C	0.09 K	≤ 1 K

1) specification applies above 400C °   **2)** W5Re/W26Re

The measuring ranges are related to terminal temperature 0°C / 50°C.

Unit: °C, °F, K selectable by software / number of decimal places= 1

Cold junction compensation: additional error ≤0.4% of the respective measuring range (after a warming-up phase of the device of max. 20 minutes)

Linearization: Linearity error negligible

Differential input:
- Pt100: no
- T/C: high resitiv at mass (ca. 1 MΩ)

Input resistance: ca. 1 MΩ (T/C)

Sensor current:
- Pt100: ca. 1 mA (short-circuit protected)
- T/C: ca. 5 µA (sensor breakage detection)

Overflow / underflow of measuring range: Alarm message if value overflows 160 digits

Open/Break sensor Detection: Short-circuit and interruption with Pt100 sensors are detected as well as interruptions with thermocouples.
! With a break of the compensation line (Pt100) a temperature of ≤ -150C° is indicated. !

Overload-protection: Overload-protected by varistors (5 V/ 0.4 J)

Filter:
- Analog: Low-pass, $f_{cut-off}$ < 10 Hz
- Digital: Low-pass of 1st order (adjustable averaging process)

Configuration: The inputs may be configured via the fieldbus for application with a RTD (Pt100) or thermocouples.

Power supply: The module is supplied with necessary voltages via the bus board.

Power consumption: max. 1200 mW

Cycle times: Each channel is scanned with at least 100 ms. Filters for the input values can be parameterized via the fieldbus.

LED-Displays: Errors are indicated for each channel via the 4 LEDs .

Galvanic isolation: The logic-part is galvanically isolated from the inputs. Additionally, there is a galvanic isolation between the power supply and the inputs, while the inputs are not galvanically isolated from each other.

Ambient temperature:
- Operation: 0... +50 °C
- Storage: -20... +70 °C
- Effect: ≤0.05% / 10 K

Humidity: ≤ 75% relative humidity, no condensation

Shock sensitivity: DIN 40046 IEC68-2-69

EMC:
- DIN EN 50081 part 2
- DIN EN 50082 part 2
- HF-effect: ≤1% RTD (Pt100); ≤5% (T/C)

Electrical connections: Screw-/plug-in terminal blocks, line cross-section max. 2.5 mm²

Class of protection: IP 20, in the completely equipped device

Dimensions: 99 x 17,5 x 114,5 mm (h x w x d)

Weight: 95 g

Housing: Material: Polyamid PA 6.6, combustibility class V0 according to UL 94

Assembly: plugged-in and locked in from the front of base module

Usage position: vertical

Subject to technical alterations!

Analog Output Module RM 231

Safety Instructions

ESD !

- contains electro-statically sensitive components
- Original packing protects against electrostatic discharge (ESD)
- Transporting only in the original packing
- during mounting rules for protection against ESD must be followed

Connections

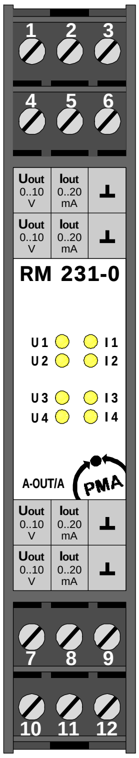
- Wiring must be conform to local standards (e.g. VDE 0100 in Germany) !
- Input leads must be kept separate from signal and mains leads !
- The protective earth must be connected to the relevant terminal (in the instrument carrier) !
- The cable screening must be connected to the terminal for grounded measurement !
- Usage of twisted and screened input leads prevent stray electric interference !
- Connections must be made according to the connecting diagrams !

Maintenance / Repair

Instrument needs no particular maintenance.
⚠ When opening the instrument live parts or terminals can be exposed.
Before carrying out the instrument must be disconnected from all voltage sources.
The instrument contains electrostatically sensitive components.
The following work may be carried out only by trained, authorized persons.

Fuse tripped:
- Cause must be determined and removed !
- Only fuses of the same type and current rating as the original fuse must be used.
- Using repaired fuses or short-circuiting the fuse socket is inadmissible !

Anschlußbelegung



Pin	RM 231-0	RM 231-1	RM 231-2	
1	0...10 V	0...10 V	-10...10 V	
2	0...20 mA	0...20 mA	0...20 mA	Output 1
3	GND	GND	GND	
4	0...10 V	0...10 V	-10...10 V	
5	0...20 mA	0...20 mA	0...20 mA	Output 2
6	GND	GND	GND	
7	0...10 V	-10...10 V	-10...10 V	
8	0...20 mA	0...20 mA	0...20 mA	Output 3
9	GND	GND	GND	
10	0...10 V	-10...10 V	-10...10 V	
11	0...20 mA	0...20 mA	0...20 mA	Output 4
12	GND	GND	GND	
Art.-No.	9407-738-23101	9407-738-23111	9407-738-23121	

Remark: The outputs -10...+10 V can be switched to the range 0...+10 V via software.

The outputs 0...20 mA can be switched to the range 4...20 mA via software.

Technical Data RM 231

Application: 4 analog norm-signal outputs with 0(4)...20 mA and 0...10 V or -10...10 V

Standard versions:

	RM 231-0	RM 231-1	RM 231-2
0(4)...20 mA	4x	4x	4x
0...10 V	4x	2x	--
-10...10 V	--	2x	4x

Resolution: The used DA-converters have a resolution of 12 bit.

Scaling:

- Starting-value: 0 mA = 0 / 4 mA = 4000 / 0 V = 0 / -10 V = -10000
- End-value: 20 mA = 20000 / 10 V = 10000

Configuration: The desired output signal can be modified by the used fieldbus.
The non active output signal (current or voltage) may not be used.

Power supply: The module is supplied with the necessary voltages via the bus board.

Power consumption: max. 3310 mW

Output impedance:

- Current output: working resistance max. 500 Ω
- Voltage output: max. current delivery 10 mA

Cycle times: The maximum cycle time for describtion of the 4 outputs is 50 ms.

Total error:

- 0...10 V = 0.25% full scale
- -10...10 V = 0.6% f. s.
- 0...20 mA = 0.63% f. s.

Protection: All outputs are short-circuit proof.

LED-Display: Each of the 4 output channels is provided with 1 yellow LED for the current output and 1 yellow LED for the voltage output.

These LEDs display the selection (current or voltage) for each output.
Errors are displayed by blinking LEDs.

Galvanic isolation: The logic part is galvanic isolated from the outputs. Additional there is a galvanic isolation between the power supply and the outputs.
(Testing voltage 2 kV DC, Isolation voltage 500 V DC)
The outputs are not isolated from each other.

Temperature range:

- Ambient temperature: 0 ... +50 °C
- Storage temperature: -20 ... +70 °C

Humidity: ≤ 75% humidity, no condensation

Shock sensitivity: DIN 40046 IEC68-2-69

Influence factors:

- Temperature: 0.01 % / 10 K
- Burden: 0...10 V = 0.01% / mA
  -10...10 V = 0.025% / mA
  0...20 mA = 0.1% / 100 Ohm
- Auxiliary energy: neglible 24 V DC ± 10%

EMC:

- DIN EN 50081 part 2
- DIN EN 50082 part 2

CE

Electrical connection: screw-/plug-in-terminals, line cross-section max. 2.5 mm²

Class of protection: IP 20

Dimensions: 99 x 17.5 x 114.5 mm (h x w x d)

Weight: 88 g

Housing: Polyamid PA 6.6, combustibility class V0 according to UL 94

Assembly: plugged-in and locked in front of base module

Usage position: vertical

Subject to technical alterations!

Digital Input Module RM 241

Safety Instructions

ESD !

- contains electro-statically sensitive components
- Original packing protects against electrostatic discharge (ESD)
- Transporting only in the original packing
- during mounting rules for protection against ESD must be followed

Connections

- Wiring must be conform to local standards (e.g. VDE 0100 in Germany) !
- Input leads must be kept separate from signal and mains leads !
- The protective earth must be connected to the relevant terminal (in the instrument carrier) !
- The cable screening must be connected to the terminal for grounded measurement !
- Usage of twisted and screened input leads prevent stray electric interference !
- Connections must be made according to the connecting diagrams !

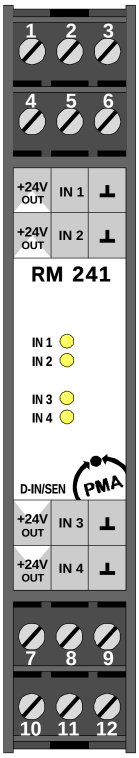
Maintenance / Repair

Instrument needs no particular maintenance.
When opening the instrument live parts or terminals can be exposed.
Before carrying out the instrument must be disconnected from all voltage sources.
The instrument contains electrostatically sensitive components.
The following work may be carried out only by trained, authorized persons.

Fuse tripped:

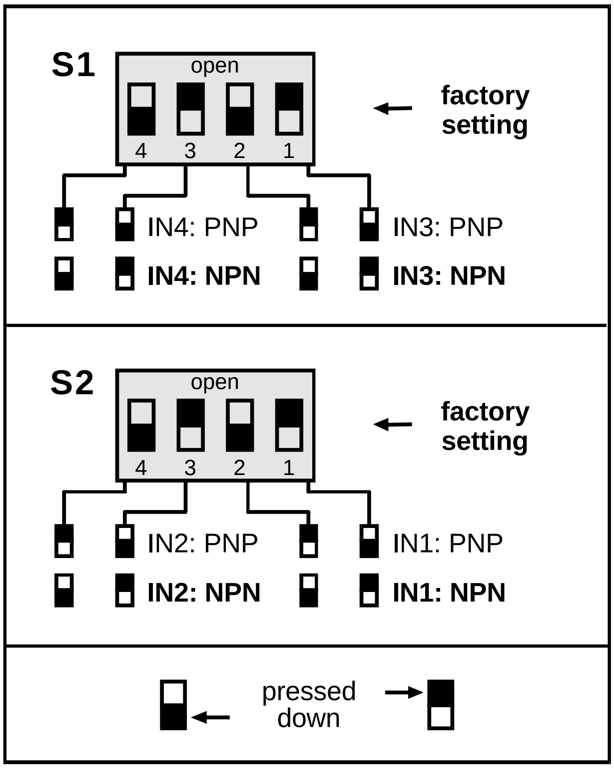
- Cause must be determined and removed !
- Only fuses of the same type and current rating as the original fuse must be used.
- Using repaired fuses or short-circuiting the fuse socket is inadmissible !

Pin Assignment



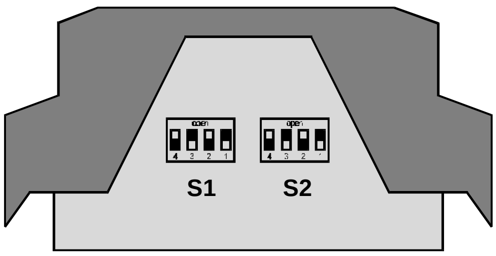
Pin	Assignment	
1	+24 V OUT	Input 1
2	IN 1	
3	GND	
4	+24 V OUT	Input 2
5	IN 2	
6	GND	
7	+24 V OUT	Input 3
8	IN3	
9	GND	
10	+24 V OUT	Input 4
11	IN4	
12	GND	
Art.-No.	9407-738-24101	

DIP switches S1 and S2



The **NPN-input** is suitable for direct connection of switches with NPN-output. The collector is be connected with the respective transducer supply, the emitter with the respective input (**factory setting**)

The **PNP-input** is suitable for direct connection of switches with NPN-output transitors. The collector is be connected with the respective ground, the emitter with the respective input.



PMA Prozeß- und Maschinen-Automation GmbH ◆ Postfach 310229 ◆ 34058 Kassel ◆ Germany
http://www.pma-online.de ◆ E-Mail: mailbox@pma-online.de

Technical Data RM 241

Application:	4-channel input module for 3-wire-sensors or floating / unfloating contacts
Configuration:	• suitable for PNP and NPN output stages • configuration selectable for each channel via DIP switch • connection of simple switches between input and +24 V or GND is possible
Power supply:	The module is supplied with the necessary voltages via the bus board.
Power consumption:	max. 384 mW (all channels on)
Transducer supply:	A transducer supply of 24 V DC (±10 %) for each channel with a maximum of 25 mA is available. All four channels of a module are jointly protected against short-circuit via a 200 mA multi-fuse.
Input impedance:	The input impedance per channel is 6.8 kΩ.
Analog-filter:	Low-pass, cutoff frequency = 1 kHz
Switching thresholds:	Level for High / Low according to IEC 1131: • Low = -3..5 V • High = 15..30 V
Cycle times:	Every channel is scanned with at least 100 Hz.
Protection:	• Every input is protected from overvoltages by 2 varistors (60 V DC / 250 mW). • Possible RF interferences are damped for every channel by a choke. • The sensor supply is protected against short-circuit.
LED displays:	Each of the 4 inputs has an yellow LED for the display of the input status.
Galvanic isolation:	The logic part is galvanic isolated from the input area of the module (isolation voltage 500 V DC).
Temperature range:	• Storage temperature: -20 ... +70 °C • Ambient temperature: 0 ... +50 °C
Humidity:	≤ 75% rel. humidity, no condensation
Shock sensitivity:	DIN 40046 IEC68-2-69
EMC:	• DIN EN 50081 Part 2 • DIN EN 50082 Part 2 CE
Electrical connections:	screw-/plug-in-terminals, line cross-section max. 2.5 mm^2
Class of protection:	IP 20
Dimensions:	99 x 17.5 x 114.5 mm (h x w x d)
Weight:	80 g
Housing:	Polyamid PA 6.6, combustibility class V0 according to UL 94
Assembly:	plugged-in and locked in front of base module
Usage position:	vertical

Subject to technical alterations !

Digital Input Module RM 242

Safety Instructions

ESD !

- contains electro-statically sensitive components
- Original packing protects against electrostatic discharge (ESD)
- Transporting only in the original packing
- during mounting rules for protection against ESD must be followed

Connections

- Wiring must be conform to local standards (e.g. VDE 0100 in Germany) !
- Input leads must be kept separate from signal and mains leads !
- The protective earth must be connected to the relevant terminal (in the instrument carrier) !
- The cable screening must be connected to the terminal for grounded measurement !
- Usage of twisted and screened input leads prevent stray electric interference !
- Connections must be made according to the connecting diagrams !

Maintenance / Repair

Instrument needs no particular maintenance.

When opening the instrument live parts or terminals can be exposed.

Before carrying out the instrument must be disconnected from all voltage sources.

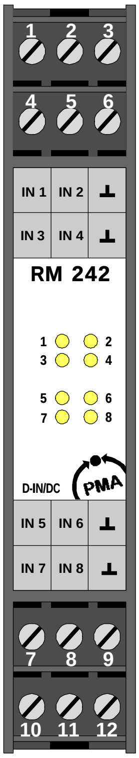
The instrument contains electrostatically sensitive components.

The following work may be carried out only by trained, authorized persons.

Fuse tripped:

- Cause must be determined and removed !
- Only fuses of the same type and current rating as the original fuse must be used.
- Using repaired fuses or short-circuiting the fuse socket is inadmissible !

Pin Assignment



Pin	Assignment	
1	IN 1	Input 1
2	IN 2	Input 2
3	GND	Signal ground A
4	IN 3	Input 3
5	IN 4	Input 4
6	GND	Signal ground B
7	IN 5	Input 5
8	IN 6	Input 6
9	GND	Signal ground C
10	IN 7	Input 7
11	IN 8	Input 8
12	GND	Signal ground D
Art.-No.	9407-738-24201	

PMA Prozeß- und Maschinen-Automation GmbH ◆ Postfach 310229 ◆ 34058 Kassel ◆ Germany
http://www.pma-online.de ◆ E-Mail: mailbox@pma-online.de

Technical Data RM 242

Application:	digital 8-channel input module for 24 V DC-signals
Power supply:	The module is supplied with the necessary voltages via the bus board.
Power consumption:	max. 600 mW (all channels on)
Input impedance:	The input impedance per channel is 6.8 kΩ.
Input filter:	Low-pass, cutoff frequency = 1 kHz
Switching thresholds:	Level for High / Low according to IEC 1131: ● Low = -3 ... 5 V ● High = 15 ... 30 V
Cycle times:	Every channel is scanned with at least 100 Hz.
Protection:	The inputs are protected from overvoltages by 2 varistors (60 V DC / 250 mW).
LED displays:	Each of the 8 inputs has a yellow LED for the display of the input status.
Galvanic isolation:	The logic part is galvanic isolated from the input area of the module. Additional there is a galvanic isolation between the 4 input groups with each 2 inputs. (Testing voltage 2 kV DC, isolation voltage 500 V DC)
Temperature range:	● Storage temperature: -20 ... +70 °C ● Ambient temperature: 0 ... +50 °C
Humidity:	≤ 75% rel. humidity, no condensation
Shock sensitivity:	DIN 40046 IEC68-2-69
EMC:	● DIN EN 50081 Part 1 ● DIN EN 50082 Part 2
Electrical connections:	screw-/plug-in-terminals, line cross-section max. 2.5 mm²
Class of protection:	IP 20
Dimensions:	99 x 17.5 x 114.5 mm (h x w x d)
Weight:	82 g
Housing:	Polyamid PA 6.6, combustibility class V0 according to UL 94
Assembly:	plugged-in and locked in front of base module
Usage position:	vertical

Subject to technical alterations!

Digital Input Module RM 243

Safety Instructions

ESD !

- contains electro-statically sensitive components
- Original packing protects against electrostatic discharge (ESD)
- Transporting only in the original packing
- during mounting rules for protection against ESD must be followed

Connections

- Wiring must be conform to local standards (e.g. VDE 0100 in Germany) !
- Input leads must be kept separate from signal and mains leads !
- The protective earth must be connected to the relevant terminal (in the instrument carrier) !
- The cable screening must be connected to the terminal for grounded measurement !
- Usage of twisted and screened input leads prevent stray electric interference !
- Connections must be made according to the connecting diagrams !

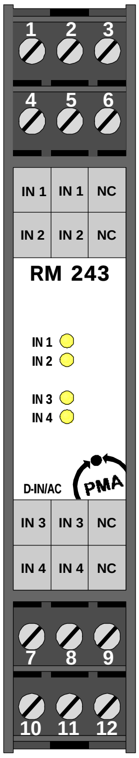
Maintenance / Repair

Instrument needs no particular maintenance.
When opening the instrument live parts or terminals can be exposed.
Before carrying out the instrument must be disconnected from all voltage sources.
The instrument contains electrostatically sensitive components.
The following work may be carried out only by trained, authorized persons.

Fuse tripped:

- Cause must be determined and removed !
- Only fuses of the same type and current rating as the original fuse must be used.
- Using repaired fuses or short-circuiting the fuse socket is inadmissible !

Pin Assignment



Pin	Assignment	
1	IN 1	Input 1
2	IN 1	
3		not connected
4	IN 2	Input 2
5	IN 2	
6		not connected
7	IN 5	Input 3
8	IN 6	
9		not connected
10	IN 7	Input 4
11	IN 8	
12		not connected
Art.-No.	9407-738-24301	

Technical Data RM 243

Application:	digital 4-channel input module for 230 V AC signals (also suitable for 110 V systems)
Power supply:	The module is supplied with the necessary voltages via the bus board.
Power consumption:	max. 490 mW (all channels on)
Input impedance:	240 kΩ per channel (at 50 Hz)
Switching thresholds:	Level for High / Low: ● Low = 0...50 V ● High = 90...250 V
Input filter:	Input delay per channel ≤ 50 ms
Protection:	The inputs are protected from overvoltages by VDR (300 V DC / 250 mW).
LED displays:	4x LEDs (yellow): status for each input
Galvanic isolation:	The logic part is galvanic isolated from the input area of the module. In addition, the inputs are also galvanic isolated from each other. (testing voltage 2 kV DC, isolation voltage 500 V DC)
Ambient temperature:	● Storage temperature: -20 ... +70 °C ● Operation temperature: 0 ... +50 °C
Humidity:	≤ 75% rel. humidity, no condensation
Shock sensitivity:	DIN 40046 IEC68-2-69
EMC:	● DIN EN 50081, Part 2 ● DIN EN 50082, Part 2 CE
Electrical connections:	Screw-/plug-in-terminals, line cross-section max. 2.5 mm²
Class of protection:	IP 20
Dimensions:	99 x 17.5 x 114.5 mm (h x w x d)
Weight:	76 g
Housing:	Material: Polyamid PA 6.6, combustibility class V0 according to UL 94
Assembly:	plugged-in and locked in from the front of the base module
Usage position:	vertical

Subject to technical alterations!

Digital Output Module RM 251

Safety Instructions

ESD !

- contains electro-statically sensitive components
- Original packing protects against electrostatic discharge (ESD)
- Transporting only in the original packing
- during mounting rules for protection against ESD must be followed

Connections

- Wiring must be conform to local standards (e.g. VDE 0100 in Germany) !
- Input leads must be kept separate from signal and mains leads !
- The protective earth must be connected to the relevant terminal (in the instrument carrier) !
- The cable screening must be connected to the terminal for grounded measurement !
- Usage of twisted and screened input leads prevent stray electric interference !
- Connections must be made according to the connecting diagrams !

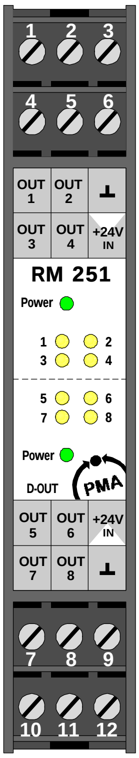
Maintenance / Repair

Instrument needs no particular maintenance.
When opening the instrument live parts or terminals can be exposed.
Before carrying out the instrument must be disconnected from all voltage sources.
The instrument contains electrostatically sensitive components.
The following work may be carried out only by trained, authorized persons.

Fuse tripped:

- Cause must be determined and removed !
- Only fuses of the same type and current rating as the original fuse must be used.
- Using repaired fuses or short-circuiting the fuse socket is inadmissible !

Pin Assignment



Pin	Assignment	
1	OUT 1	Output 1
2	OUT 2	Output 2
3	GND	Supply ground **A**
4	OUT 3	Output 3
5	OUT 4	Output 4
6	+24 V IN	Supply voltage **A**
7	OUT 5	Output 5
8	OUT 6	Output 6
9	+24 V IN	Supply voltage **B**
10	OUT 7	Output 7
11	OUT 8	Output 8
12	GND	Supply ground **B**
Art.-No.	9407-738-25101	

Explanatory Note on the Status-LEDs:

The 8 yellow LEDs serve to indicate the output-states:

- LED illuminated: output is switched
- LED flashing: error-state

Short-circuits or open-circuits are detected for two neighbouring outputs.

The following errors can be detected:

- open-circuit: not applied output-supply and outputs on low
- short-circuit: not applied output-supply and outputs on high
- open-circuit: open-circuit on at least one output and outputs on low
- short-circuit: short-circuit on at least one output and outputs on high

So that the setted error-flags can be cleared automatically after the failure, the outputs have to take on the status which they had at the detection of the failure.

The minimal load that would not be interpreted as an open-circuit has to be less than 50 kOhm (with the supply-voltage 24 V DC and the ambient temperature of 25° C).

PMA Prozeß- und Maschinen-Automation GmbH ◆ Postfach 310229 ◆ 34058 Kassel ◆ Germany
http://www.pma-online.de ◆ E-Mail: mailbox@pma-online.de

Technical Data RM 251

Application:	8-channel output module, 24 V DC, high side driver, e.g. for direct connection of 24 V valves
Power supply:	The module is supplied with the necessary voltages via the bus board.
Power consumption:	max. 850 mW (all channels on)
Output voltage:	The output voltages (12 V DC and 24 V DC systems) to be switched are applied for a group of 4 outputs to the module. A max. operating range from 8 V to 34 V is permissible for the output voltage.
Output current:	• 1.5 A per ouput • 3 A per group of 4 outputs • 6 A per module Condition: an output voltage of 24 V DC and an ambient temperature of 25°C At max. ambient temperature (50°C) a current of 1 A per output and a total current of 2 A per group of 4 outputs is permissible. In the powered state, the resistance of an output driver is max. 400 mΩ (typically 200 mΩ).
Protection:	• outputs: protected against short-circuits, overvoltage, overcurrent, excess temperature and reverse polarity • inductive load: external protective network necessary
Cycle times:	The maximum write cycle time of the 8 outputs is 10 ms.
Diagnostics:	The software checks automatically whether a short-circuit, line breakage or excess temperature has occurred. Any defect or error can be displayed for two outputs at a time via the status LEDs and can be processed according to the protocol.
LED displays:	• 8x LEDs (yellow): status for each output • 2x LEDs (green): states of the output voltages applied externally
Galvanic isolation:	The logic part is galvanic isolated from the two output areas of the module. In addition, the two output groups with each 4 outputs are also galvanic isolated from each other (testing voltage 2 kV DC, isolation voltage 500 V DC).
Ambient temperature:	• Storage temperature: -20 ... +70 °C • Operation temperature: 0 ... +50 °C
Humidity:	≤ 75% rel. humidity, no condensation
Shock sensitivity:	DIN 40046 IEC68-2-69
EMC:	• DIN EN 50081 Part 2 • DIN EN 50082 Part 2 CE
Electrical connections:	screw-/plug-in-terminals, line cross-section max. 2.5 mm²
Class of protection:	IP 20
Dimensions:	99 x 17.5 x 114.5 mm (h x w x d)
Weight:	76 g
Housing:	Material: Polyamid PA 6.6, combustibility class V0 according to UL 94
Assembly:	plugged-in and locked in from the front of the base module
Usage position:	vertical

Subject to technical alterations!

Relay Module RM 252

Safety Instructions

ESD !

- contains electrostatically sensitive components
- Original packing protects against electrostatic discharge (ESD)
- Transporting only in the original packing
- during mounting rules for protection against ESD must be followed

Connections

- Wiring must be conform to local standards (e.g. VDE 0100 in Germany) !
- Input leads must be kept separate from signal and mains leads !
- The protective earth must be connected to the relevant terminal (in the instrument carrier) !
- The cable screening must be connected to the terminal for grounded measurement !
- Usage of twisted and screened input leads prevent stray electric interference !
- Connections must be made according to the connecting diagrams !

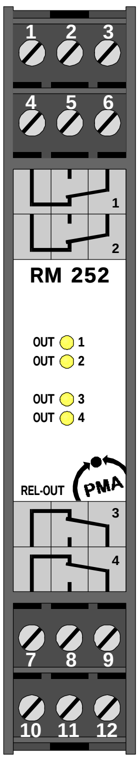
Maintenance / Repair

Instrument needs no particular maintenance.
When opening the instrument live parts or terminals can be exposed.
Before carrying out the instrument must be disconnected from all voltage sources.
The instrument contains electrostatically sensitive components.
The following work may be carried out only by trained, authorized persons.

Fuse tripped:

- Cause must be determined and removed !
- Only fuses of the same type and current rating as the original fuse must be used.
- Using repaired fuses or short-circuiting the fuse socket is inadmissible !

Pin Assignment



Pin	Assignment	
1		Relay 1
2		
3		
4		Relay 2
5		
6		
7		Relay 3
8		
9		
10		Relay 4
11		
12		
Art.-No.	9407-738-25201	

Technical Data RM 252

Application:	4-change-over-contacts for AC- and DC-signals
Power supply:	The module is supplied with the necessary voltages via the bus board.
Power consumption:	max. 2600 mW (all channels on)
Contact rating:	• AC-signals: Pmax. = 1250 W, Umax. = 250 V, Imax. = 5 A • DC-signals: Pmax. = 120 W, Umax. = 120 V, Imax. = 5 A
Protective measures:	external protective network necessary
Cycle times:	The maximum cycle time for describtion of the 4 outputs is 10 ms.
LED displays:	Each of the 4 outputs has a yellow LED to display the output status.
Galvanic isolation:	The logic part is galvanic isolated from the output area of the module. Additional the outputs are isolated from each other. (Testing voltage 2 kV DC, isolation voltage 500 V DC).
Ambient temperature:	• Operation temperature: 0 ... +50 °C • Storage temperature: -20 ... +70 °C
Humidity:	≤ 75% rel. humidity, no condensation
Shock sensitivity:	DIN 40046 IEC68-2-69
EMC:	• DIN EN 50081, Part 2 • DIN EN 50082, Part 2
Electrical connections:	screw-/plug-in-terminals, line cross-section max. 2.5 mm²
Class of protection:	IP 20
Dimensions:	99 x 17.5 x 114.5 mm (h x w x d)
Weight:	94 g
Housing:	Material: Polyamid PA 6.6, combustibility class V0 according to UL 94
Assembly:	plugged-in and locked in from the front of the base module
Usage position:	vertical

Subject to technical alterations!

13 Index

Index
0x5000 Error_Reset 45
0x5001 Alarm_Output 46
0x5002 Slot_IDs 47
0x5100 ucAI_In_Filter 40
0x5103 iAI_Comp_Pro 41
0x5104 ucAI_Comp_Filter 41
0x5105 ucAI_Comp_Stat 41
0x5106 ucAI_Comp_En 41
0x5107 uiAI_Channel_Error 42
0x5108 ucAI_Comp_Error 42
0x5200 ucDO_Status 36
0x5201 ucDO_Error_Mask 36
0x5202 uiDO_Module_Error 37
0x5300 ucAO_Out_Status 44
0x5302 uiAO_Channel_Error 44
0x6000 ucDI_Input 34
0x6002 ucDI_Polarity 34
0x6100 uiAI_Input_Fld 38
0x6110 uiAI_Sensor_Type 38
0x6131 uiAI_Phy_Unit_Pro 39
0x6150 ucAI_Status 40
0x6200 ucDO_Output 35
0x6202 ucDO_Polarity 35
0x6206 ucDO_Fault_Mode 35
0x6207 ucDO_Fault_State. 35
0x6310 uiAO_Output_Type 43
0x7130 iAI_Input_Pro 39
0x7138 iAI_Tare_Zero 40
0x7140 iAI_Net_Pro. 40
0x7300 iAO_Output_Pro 43
Address settings 11
Analog Inputs 38
Analog Outputs 43
Cable connection KS98+ and RM 200 modules63
Commissioning . . . . 13 - 19
Default-Mapping. 50
Digital Inputs 34
Digital Outputs. 35
DIP-Switch-Settings 13
EEPROM-Parameter-Storage 18
Emergency Messages . . . . 48 - 49
Error Register 49
FAQ - RM 200 Modules - General 60
FAQ - RM 200 Modules and KS98+ 61
Hardware / Technical data . . . . 56 - 58
Installation of cables 11
Interface connection 10
Life-Guarding 18
Manufacturer Specific Objects 45
Node States / Minimum Boot-Up 55
Node-Guarding 18
Object Access via SDOs. 15
Object directory . . . . 20 - 30
Tabel of Object-Listing. 20
PDO-processing. . . . . 50 - 52
Safety Instructions general . . . . 7 - 9
Service-Settings 14
Start-Up Messages 48
Start-Up-Operation 15
Supported I/O-modules 12
Transmission types 52

Notes:

9499-040-62411

© PMA Prozeß- und Maschinen-Automation GmbH
Postfach 310 229, D - 34058 Kassel
Printed in Germany 9499 040 62411 (0103)

A4