PMA Prozeß- und Maschinen-Automation GmbH

Modular I/O system

RM 200

PROFIBUS-DP

Operating Manual

PROFIBUS - DP

9499 040 62611

valid from: 8368

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Contents

1 Introduction

The input/output modules RM 200 with different communication ports like e.g. for 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 202 (9407-738-20201) of the modular I/O system RM 200 is equipped with a PROFIBUS-DP interface for transmission of process data, parameters and configuration data. The connection is realized via a 9-pole sub-D connector socket. These serial communication interface permits connections to supervisory systems, visualization tools,etc.

The module configuration is simply effected by the PROFIBUS configuration tool of the master device.

Communication is according to the master/slave-principle. The coupler module RM 202 is always PROFIBUS-DP slave.

Cable medium as well as physical and electrical interface properties:

- Network topology
  Linear bus with bus termination at both ends. Stub lines are possible (dependent of cable type- the maximum possible overall tap line length is 6,6m with 1,5Mbit/s and 1,6 m with 3- 12 MBit/s), passive tap line should however be avoided.
- Transmission medium
  screened, twisted-pair cable (according to EN 50170 Vol.2).
- Baudrates and cable length (without repeater)
  The maximum cable length depends on the used transmission rate.
  The baudrate is determined by the master configuration and recognized automatically by RM 202.

Baudrate	Maximum cable length
9,6 / 19,2 / 93,75 kbit/s	1200 m
187,5 kbit/s	1000 m
500 kbit/s	400 m
1,5 Mbit/s	200 m
3 ... 12 Mbit/s	100m

- Interface
  connectable with Sub-D connector (9-pole).
- Address settings
  Address settings via coding switches, range 01 ... 126, default 4
- 32 devices in a segment, extensible to 127 with repeater.

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

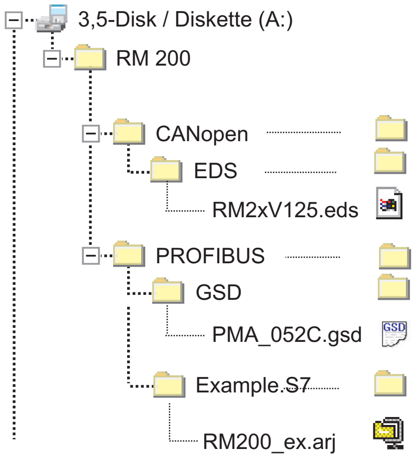
- Modules are pluggable in any order
  - up to 16 analog inputs per node
  - up to 16 analog outputs per node
  - up to 9 digital I/O modules per node
- Diagnosis und monitoring via three LED's
  - Data-Exchange - LED: signals data exchange
  - Diagnosis - LED: indicates error states
  - Power - LED: lights up when power supply is ok
- Configuration of modules simply via PROFIBUS -configurator
- Broad range of available sensor and signal modules

ⓘ This document describes the coupler module RM 202 in the **Software-Version 1.00** 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 *Mounting*

A 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 PROFIBUS **RM 202**. 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. For removing: Release the two ledges and pull out the module.

Temperature module like RM 224-x should be placed far away from modules with higher power consumption such as RM 252, RM 231-x, RM 201 etc.

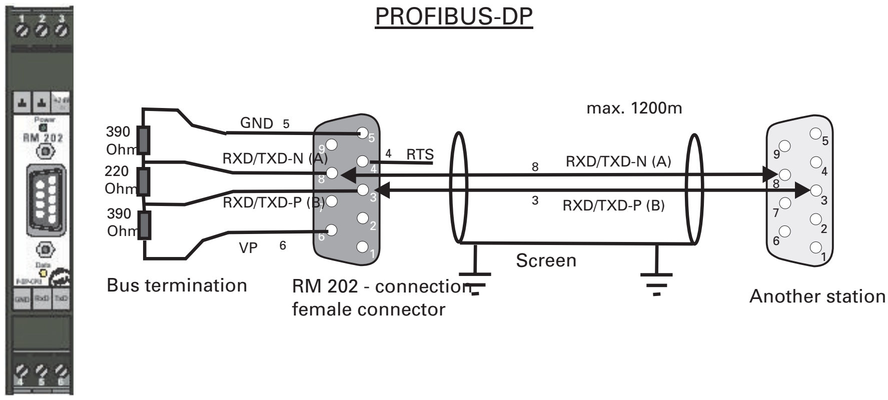
To keep the specified protection degree (IP20) empty slots must be protected by slot covers RM 214.

The screw-/plug-in-terminals can be plugged in from above or below into the module housing (audible locking). Removing the screw-/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 physical connnection to PROFIBUS-DP is effected via 9-pole sub-D female connector using the RS485 transmission technology.

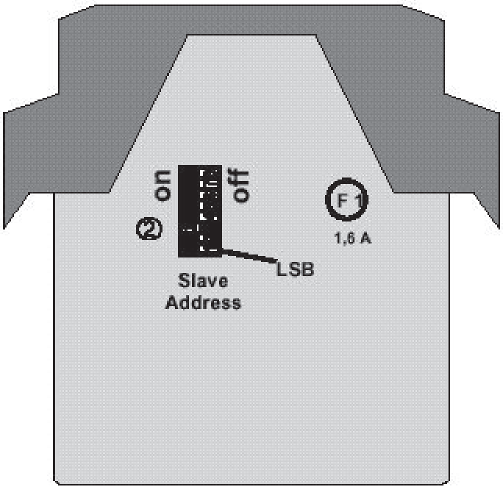
Fig.: 1 Connection PROFIBUS-DP



The construction of suitable cabling must be provided by the user, whereby the general cable specifications according to EN 50170 vol. 2 must be taken into account.

3.3 *Address settings*

The PROFIBUS-address has to be set on the bus coupler RM 202 via DIP-switches.



DIP Switch (8 pos.)

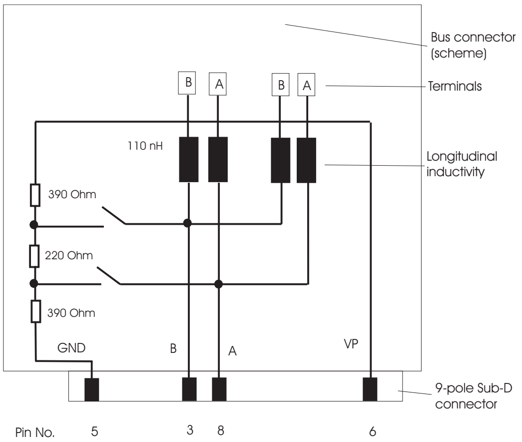
DIP ①	Address
0000 0000	invalid
0000 0001	1
0000 0010	2
0000 0011	3
0000 0100	4 ②
.....	....
0111 1110	126
0111 1111	invalid
8765 4321	Switch-Pos.

The positions of the switches are shown in binary-code. The number at the lowest position corresponds to the LSB (DIP-switch-position 1).The upper number 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 not contained in RM 202, if required it must be realized via the connector.
- Earthing



Construction of bus termination

Bus terminal resistors adapt the impedance of the bus to the apparent impedance of the bus users. The input circuit of the attached field devices is substantially high impedance as the bus termination. By the termination of the bus cable at both ends of a segment with the termination resistors, it is guaranteed that

- a defined static potential is adjusted on the line,
- line reflections are minimized and
- an almost constant load behavior at the bus is adjusted

Two versions of the bus wiring are specified in the EN 50 170. With the line type A all data transmission rates to 12 Mbaud can be used. Beside the standard line also cable for underground, garland cable and trailing cable are available.
The line parameters are as follows:

Parameter	Line type A
characteristic impedance in Ω	135 ... 165 bei 3 ... 20 MHz
work capacity (pF/m)	< 30
loop resistance (Ω/km)	< 110
core diameters (mm)	> 0,64
core cross-sectional area (mm^2)	> 0,34

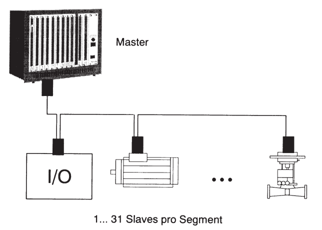
For special hints for installation of PROFIBUS cables, see PNO Technical guideline "***Installation guidelines for PROFIBUS-DP/FMS***" (Order no. 2.111 [dt]; 2.112 [engl.])

3.5 *Installation hints*

Minimum expansion of a PROFIBUS project

A PROFIBUS system consists at least of the following components:

- a slave as participant or several, which makes data available on request of the master,
- the transmitting medium, consisting of bus cable and bus plug for interconnecting the individual users,
- a bus segment or several, which are connected with repeater



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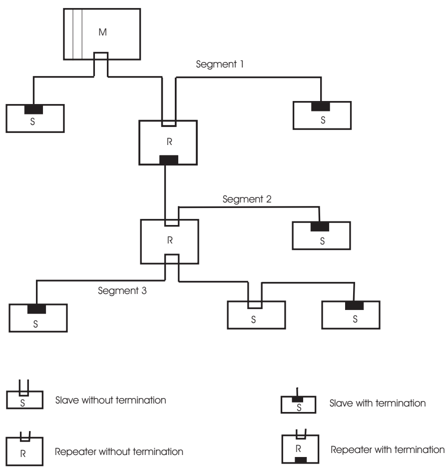
Maximum extension of a PROFIBUS system

A bus segment consists of max. 32 field devices (active and passive). The maximal quantity of slaves, which can be operated of a PROFIBUS master several segments away, is due to the different internal memory structure of the assigned masters. Therefore you should inform yourself when planning a project about the efficiency of the masters. The bus cable can be opened at each position to take up a new user by adding a bus plug. At the end of a segment the bus can be extended to the given segment lengths and connected to new users. The length of a bus segment depends on the adjusted transmission speed. The data transmission rate essentially becomes by the system constellation (length of a segment, distributed input/outputs) and the required inquiry cycles of individual users determines. All users in the bus communicate with transmission speed given by the master.
At the start and at the end of a segment termination resistors must be connected, in order to guarantee a physically clean signal level. These are already integrated in most available plugs and must be inserted only by switches



PROFIBUS systems are build as line structure. A PROFIBUS project can be extended by of connection of repeaters,

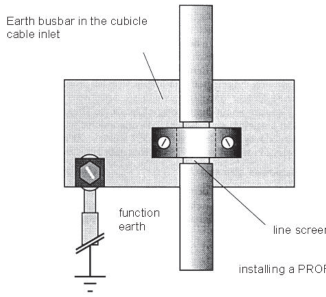
- if more than 32 users have to be attached
- or larger distances have to be reached than are defined in accordance with transmission speed.

In the maximum configuration of a PROFIBUS system max. 126 stations with the addresses 0... 125 can be involved. Each assigned repeater reduces the max. quantity of stations within a segment. It does not have as passive user a PROFIBUS ident number. Its input wiring loads the segment additionally to the current consumption of the bus drivers. A repeater has however no influence on the total number of the attached stations at the bus. The max. connectable quantity of repeaters, which may be switched into series, can differ with the manufacturer. When projecting a project you should inform therefore beforehand with the manufacturer about possible limitations.

3.5.1 Wiring within buildings

The following installation notes apply to a twisted pair wires with screen. The screen serves the improvement of the electromagnetic properties. A PROFIBUS cable according to line type A has a braided screen and a foil screen within the cable. The line screen in the following executions always contains both screen versions (braided screen and foil screen). Always use both screens because the foil screen alone is very thin and can easily be interrupted, which leads to an interruption of the potential leveling system.

The line screen has to be connected at both ends with large surfaces to conducting material to the reference earth. With the installation of a repeaters or a field device in a cubicle the line screen should connected with cable clamps to the ground busbar closely behind the cable entry.



installing a PROFIBUS cable with cable clamps

The screen has to be continued up to the field device and be connected there with the conducting case and/or the metallic plug. It is to check that the case of a device and the cubicle, in which the field device is installed have the same earth potential. The assembly of a ground busbar on a painted surface is without effect. If these advises are applied, high frequency interferences are conducted away through the braided screen. If interference voltages from the outside should break through to the data lines, the voltage potential on both data lines is raised in the same way, so that the differential voltage is not destructively influenced under normal conditions. With a shift of the earth potential of a few volts is still a safe data communication possible. If one expects a higher potential shift (potential DGND at the pin 5 against reference earth), then a potential equalization line should be laid parallel to the bus with a minimum cross-sectional area of 10 mm^2, which is to be connected with each field device at the reference earth of the field device. Most of the field devices have a central earth screw. In extreme disturbing environment the bus cable can be laid in a steel tube or a tight tin duct. The pipe or the duct is to be grounded then regularly.

The bus is to be installed always with a minimum distance of 20 cm to other lines, which carry a voltage higher than 60 V. The bus cable is also to lay separated from telephone lines and cables, which lead into explosion protected areas. In such cases it is recommended to use a separate tin duct for the bus cable.

In a tin duct generally only conductive materials should be used, which are connected with the reference earth regularly. The bus cables are not to be exposed to mechanical load or obvious damage. If such impact is expected, special preventive measures have to be taken e.g. installation in pipes etc.
Note: In accordance with EN 50 170 a branch line lengths per segment of smaller than 6,6m is admissible at data transmission rate of 1,5 Mbaud. In some systems it turned out depending upon the arrangement of the field devices that branch lines load the bus to much capacitive. Then occur line reflections and signal distortions, which falsify the information signal and do not ensure a Hamming distance of 4 („slip-free data communication“). In most cases both with the development of a device and with the installation, branch lines can be avoided. Therefore take care that if possible no branch lines are used.

Earth free installation:
If the installation has to be earth-free for certain reasons, then the device mass is to be connected with the reference earth only with a very high impedance (with a RC combination). The system searches itself then its own potential. With of connection of repeaters for interconnecting bus segments the earth-free installation should generally be preferred, to avoid the transfer of potential differences from one bus segment into another.

4 General

The PROFIBUS-DP coupler RM 202 connects the modular Fieldbus system RM 200 to the PROFIBUS. The coupler RM 202 operates as PROFIBUS-DP slave according to the PROFIBUS standard EN 50 170 vol.2.

4.1 *Supported I/O modules*

The following I/O modules are supported by the coupler RM 202 in the version V1.00:

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
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 PROFIBUS coupler has to be placed always in the utter left slot of the housing.

4.2 *IDs of the different I/O module types*

Each I/O module has an unique hardware identifier (module ID). The PROFIBUS-DP coupler RM 202 supports max. 9 I/O slot positions. Slot position number 1 is the first I/O module slot besides the Fieldbus coupler.
Following IDs are supported from the PROFIBUS-DP coupler RM 202 in the version V1.00.

ID	I/O-Modules
0x00	no I/O-module plugged
0x04	RM 221-0 / analog input, standard signal, 4 channel, 12 Bit, 4 x I, galv. isolation between modules
0x44	RM 221-1 / analog input, standard signal, 4 channel, 12 Bit, 4 x U, galv. isolation between modules
0x84	RM 221-2 / analog input, standard signal, 4 channel, 12 Bit, 2 x I; 2 x U, galv. isolation between modules
0x0B	RM 222-0 / analog input, standard signal, 4 channel, 12 Bit, with signal supply, 4 x I
0x4B	RM 222-1 / analog input, standard signal, 4 channel, 12 Bit, with signal supply, Poti, 4 x U
0x8B	RM 222-2 / analog input, standard signal, 4 channel, 12 Bit, with signal supply, Poti, 2 x I and 2 x U
0x0E	RM 224-0 / analog input, TC, 2 channel, galv. isolated, 16 Bit, full range
0x08	RM 224-1 / analog input, temperature, 4 channel, 16 Bit, full range
0x05	RM 231-0 / analog output, standard signal, 4 channel, 12 Bit, A, 4 x I; 4 x 0/10 V
0x85	RM 231-1 / analog output, standard signal, 4 channel, 12 Bit, B, 4 x I; 2 x 0/10 V; 2 x -10/10 V
0x45	RM 231-2 / analog output, standard signal, 4 channel, 12 Bit, C, 4 x I; 4 x -10/10 V
0x02	RM 241 / dig. input, sensor, 4 channel
0x06	RM 242 / dig. input, 24 VDC, 8 channel
0x09	RM 243 / dig. input, 230 VAC, 4 channel
0x01	RM 251 / dig. output, 24 VDC, 8 channel
0x07	RM 252 / dig. output, relay, 4 channel, change over contact

4.3 *Representation of numbers*

The process data are processed as follows by the PROFIBUS-DP coupler:

digital I/Os:

Each digital I/O module is represented by 1 byte. Digital I/O modules with only 4 in or outputs need only the bits 3... 0, the bits 7... 4 are always 0.
1 byte / bit sequence

7	6	5	4	3	2	1	0

analog I/Os:

Each analog in/output channel is represented by 1 Word (Signed Integer). The max values range 0xFFFF (-1) to 0x8000 (-32768) and 0x0000 (0) to 0x7FFF (+32767). A Word consists of two bytes. In the parameter telegram it can be determined whether the Motorola (High byte first) or the Intel format (Low byte first) is to be used. In the GSD file the Motorola format is entered as default.

4.4 *Standardization of analog values*

Depending upon the type of the analog in or output the physical unit mV, µA or 1/10 °C is used. With the parameter setting of the device it is to be considered that the selected unit and the selected measuring range fit the actually used module.

-10 V	... +10 V	=	-10000 (0xD8F0)...	+10000 (0x2710)	[mV]
0 V	... +10 V	=	0 (0x0000) ...	+10000 (0x2710)	[mV]
0 mA	... 20 mA	=	0 (0x0000) ...	+20000 (0x4E20)	[µA]
4 mA	... 20 mA	=	0 (0x0000) ...	+16000 (0x3E80)	[µA + 4000]
-270,0 °C	... 2299,3 °C	=	-2700 (0xF574)...	+22993 (0x59D1)	[0,1 °C]

4.5 *Data structure for data exchange*

In the status 'DATA-Exchange' the PROFIBUS master exchanges the process data with the PROFIBUS slaves. The utilizable data length has the following values for the PROFIBUS-DP-Slave RM 202:

Input:	16 x word (16 ana. channels)	and 5 x byte (5 dig. channels)	= 37 Byte
Output:	16 x word (16 ana. channels)	and 5 x Byte (5 dig. channels)	= 37 Byte

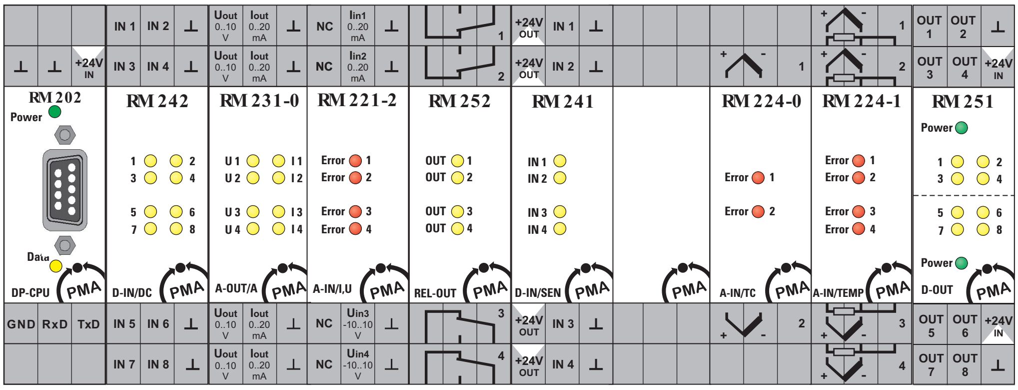
The actual length of the in or the outlet data depends on the used I/O modules.

The following example shows the addressing of the individual I/Os. An application requires e.g. a unit with the following I/Os:

coupler:	PROFIBUS-DP-coupler	RM 202
dig. In:	8 x common potential (24 V/DC inputs)	RM 242
	4 x inputs for 3-conductor sensors	RM 241
dig. Out:	8 x outputs (24 V/DC)	RM 251
	4 x outputs (relay contacts)	RM 252
ana. In:	4 x standard signals (2 x I / 2 x U)	RM 221-2
	4 x TC/Pt100	RM 224-1
	2 x TC	RM 224-0
ana. Out:	4 x standard signals (0...10 V / 0...20mA)	RM 231-0

The user can combine the I/O modules according to the restriction ' max. 16 analog inputs and 16 analog outputs ' freely. The Fieldbus coupler RM 202 always takes the place utterly left in the module. To be able to use all necessary I/Os, in this example a basic housing with 10 places is used.

Example:



Slot: 0 1 2 3 4 5 6 7 8 9

The individual I/Os are addressed as follows within the process data transmission:

Byte	**Input**	
1	RM 242 / Slot 1	8 x dig.In
2	RM 221-2 / Slot3	channel 1
3		
4	RM 221-2 / Slot3	channel 2
5		
6	RM 221-2 / Slot3	channel 3
7		
8	RM 221-2 / Slot3	channel 4
9		
10	RM 241 / Slot 5	4 x dig.In
11	RM 224-0 / Slot 7	channel 1
12		
13	RM 224-0 / Slot 7	channel 2
14		
15	RM 224-1 / Slot 8	channel 1
16		
17	RM 224-1 / Slot 8	channel 2
18		
19	RM 224-1 / Slot 8	channel 3
20		
21	RM 224-1 / Slot 8	channel 4
22		

Byte	**Output**	
1	RM 231-0 / Slot 2	channel 1
2		
3	RM 231-0 / Slot 2	channel 2
4		
5	RM 231-0 / Slot 2	channel 3
6		
7	RM 231-0 / Slot 2	channel 4
8		
9	RM 252 / Slot 4	4 x dig.Out
10	RM 251 / Slot 9	8 x dig.Out

The PROFIBUS-DP master transmits as process data 10 bytes to the slave RM 202 and receives in the response-telegram 22 bytes.

How the bytes (dig. I/Os) and words (analog I/Os) are assembled and how the standardization of the analog values is performed is written in the sections ‘4.3 Representation of numbers‘ and ‘ 4.4 Standardization of analog values ‘.

4.6 *PROFIBUS-DP characteristics of RM 202*

4.6.1 Utilizable data lengths of used telegrams

SAP61 transmit parameter data	=	max. 38 Bytes
SAP62 check configuring data	=	max. 9 Bytes
SAP60 read diagnostic information	=	6 Bytes / 25 Bytes (ext.Diag.)

4.6.2 Registered data at PNO

Ident-number:	0x052C
Model name:	RM 202
Name of producer:	PMA GmbH
Revision status:	1.00
Master/Slave:	Slave
GSD-file:	PMA_052C.GSD

4.6.3 Supported Service Access Points (SAPs)

Default-SAP	data exchange (Write_Read_Data)
SAP56	read inputs (Read_Inputs)
SAP57	read outputs (Read_Outputs)
SAP58	control commands to the DP slave (Global_Control)
SAP59	read configuring data (Get_Config)
SAP60	read diagnostic information (Slave_Diagnosis)
SAP61	transmit parameter data (Set_Param)
SAP62	check configuring data (Check_Config)

The PROFIBUS-DP coupler RM 202 supports the cyclic data communication according to the PROFIBUS-DP standard EN 50 170 vol. 2. Later announced optional services e.g. the acyclic data communication are not supported by the coupler.

5 Parameter data

With the parameter telegram the master identifies itself with the slave and determines, in which mode the slave has to operate.

The coupler RM 202 expects user specific parameter data containing informations about the desired functioning of each modules. The parameter telegram contains following input:

1. Byte	Standard-Parameter	
...		
8. Byte		
9. Byte	User_Prm_Data[1]	Number depending on the configured modules
10. Byte	User_Prm_Data[2]	
...	...	
38. Byte	User_Prm_Data[30]	

5.1 *Meaning of the user specific parameters “User_Prm_Data[1..30]”:*

The modular Fieldbus system RM 200 with PROFIBUS-DP coupler RM 202 supports the parameter setting for complete modules. For this purpose the appropriate GSD file contains module-specific parameters which e.g. which can processed with SIEMENS STEP7®, COM PROFIBUS® and HILSCHER SyCon®. It is possible to determine in a clear and simple way the I/O characteristics for each module.

❑ **User_Prm_Data[1]** (general device adjustments)

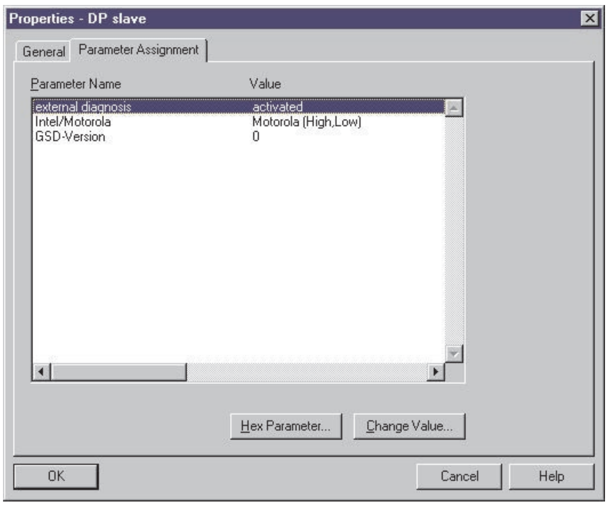
MSB							LSB
D7	D6	D5	D4	D3	D2	D1	D0

Bit-no.	Meaning	Status ‘0’	Status ‘1’	Default
D0	external diagnosis	switched on	switched off	switched off
D1	Word- representation	Intel-Format (Low-Byte first)	Motorola-Format (High-Byte first)	Motorola-Format
D2-D7	Not used (0)			

❑ **User_Prm_Data[2]** (GSD-Version)

- 0 = V 1.00

The GSD version is not changeable by the user.



Example STEP7: user specific parameter

❑ **User_Prm_Data[3] ...User_Prm_Data[30]** (I/O-Parameter)

To describe the I/O parameters of the I/O modules between 1 and 5 parameter bytes are needed. The following table shows the facts:

Module	Device-ID (1)	Parameter bytes	Identifier format
Empty place	0x00	1	0x00
RM 241	0x02	1	0x10
RM 242	0x06	1	0x10
RM 243	0x09	1	0x10
RM 251	0x01	2	0x20
RM 252	0x07	2	0x20
RM 221-x/222-x	0x04	4	0x53
RM 224-1	0x08	5	0x53
RM 224-0	0x0E	3	0x51
RM 231-x	0x05	2	0x63

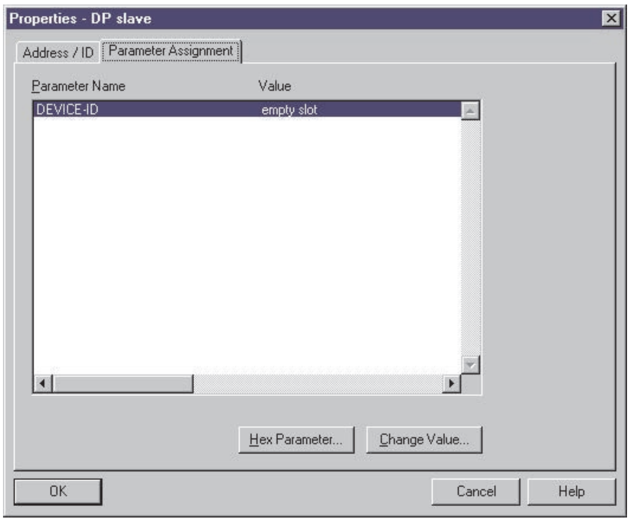
(1) with the DEVICE ID only the bits 0... 3 are relevant. The bits 4... 7 of the DEVICE ID normally specify the respective version. In the parameter telegram these bits are used however partly for I/O parameters.

If a PROFIBUS-DP-Masters uses a parameter telegram with a max. length of 32 bytes, it must be checked whether the desired module fulfills this criterion.

5.2 *Non-occupied position*

A non-occupied position has to be parameterized only if within the unit still further I/O modules follow.

Only the parameter 0x00 (DEVICE ID) will be transferred. This parameter is fixed and can not be changed by the user.

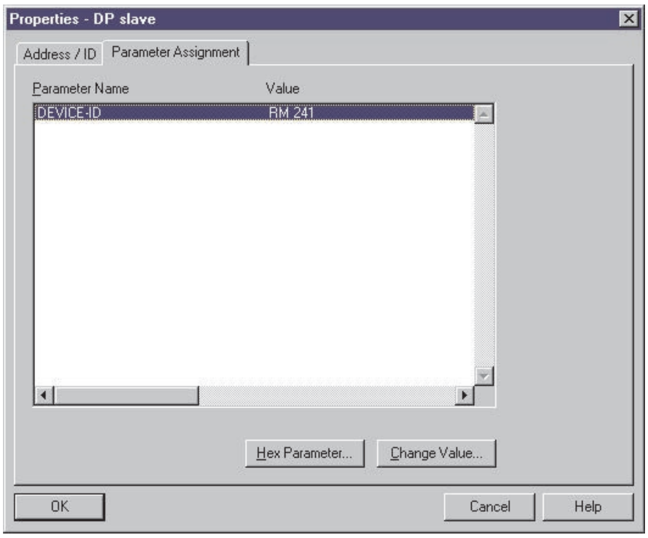


Example STEP7: Parameter for empty slot

Default - parameter sequence: 0x00

5.3 *Digital inputs RM 241, RM 242, RM 243*

For the digital inputs only the DEVICE ID (0x02 for RM 241, 0x06 for RM 242, 0x09 for RM 243) will be transferred.



Example STEP7: Digital input module RM 241

Default - parameter sequence: e.g. 0x02 (for RM 241)

5.4 *Digital outputs RM 251 (8 channel, 24VDC)*

To describe the module RM 251 two parameter bytes are necessary:

- **Byte 1**

bit 0...3	:	Device-ID = 0x01 (cannot be changed)
bit 4	:	behavior of the outputs 1 & 2 in the event of an error
bit 5	:	behavior of the outputs 3 & 4 in the event of an error
bit 6	:	behavior of the outputs 5 & 6 in the event of an error
bit 7	:	behavior of the outputs 7 & 8 in the event of an error

0 = safe status as specified in byte 2 (default)
1 = the last valid value is held, after power on zero

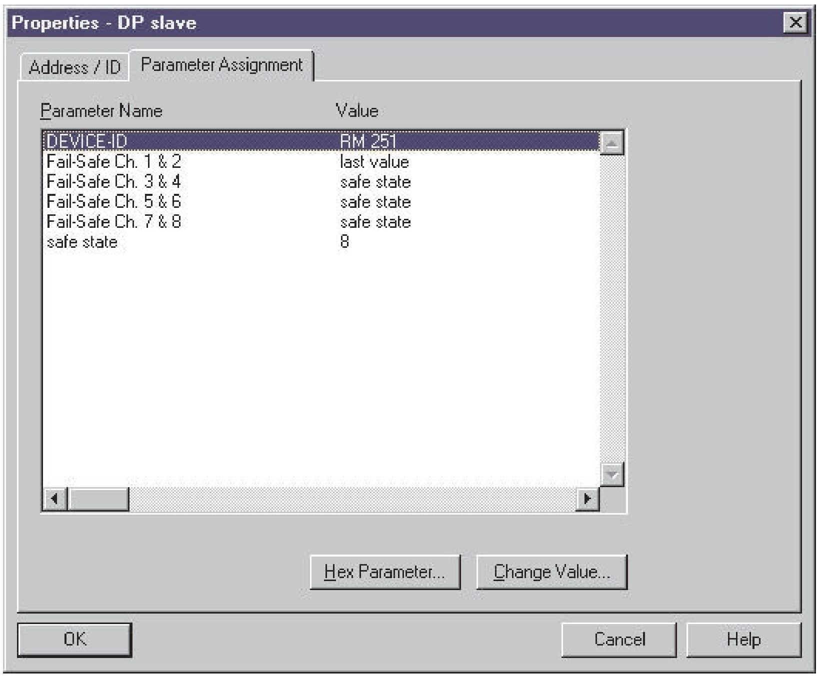
- **Byte 2**

This byte outputs the safe status for the 8 digital outputs. Bit 0 corresponds to the output 1 and bit 7 to the output 8.

MSB							LSB
D7	D6	D5	D4	D3	D2	D1	D0

Bit-no.	Meaning	Status '0'	Status '1'	Default
D0	channel 1	Fail Safe value 0	Fail Safe value 1	0
D1	channel 2	Fail Safe value 0	Fail Safe value 1	0
...				
D7	channel 8	Fail Safe value 0	Fail Safe value 1	0

The Safe Status is output whenever the process data exchange between master and slave is disturbed.



Example STEP7: parameter of digital output module RM 251

Default parameter sequence: 0x02 0x00

5.5 *Digital outputs RM 252 (4 channel, relay)*

To describe the module RM 252 two parameter bytes are necessary:

❑ **Byte 1**

bit 0...3	:	Device-ID = 0x07 (cannot be changed)
bit 4	:	behavior of the output 1 in the event of an error
bit 5	:	behavior of the output 2 in the event of an error
bit 6	:	behavior of the output 3 in the event of an error
bit 7	:	behavior of the output 4 in the event of an error

0 = safe status as in byte 2 specified (default)
1 = last valid value is held, after power on zero

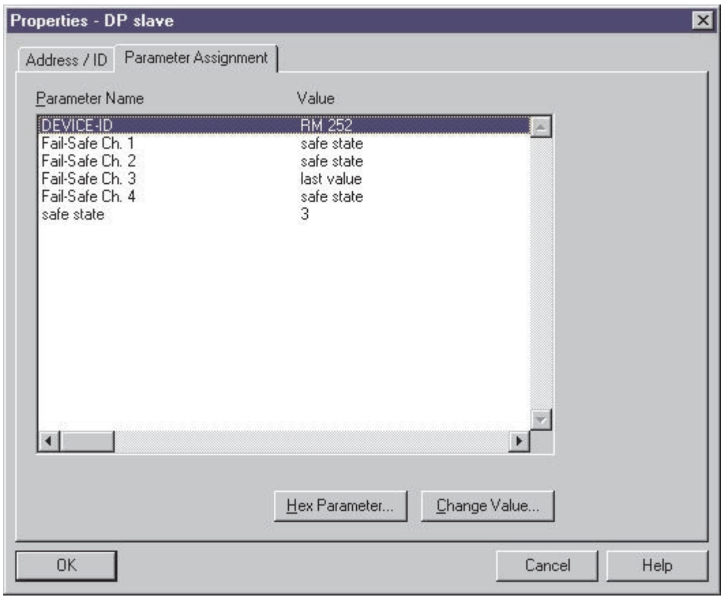
❑ **Byte 2**

This byte outputs the safe status for the 4 digital outputs. Bit 0 corresponds to the output 1 and bit 3 to the output 4. The bits 4... 7 are reserved and always 0.

MSB							LSB
D7	D6	D5	D4	D3	D2	D1	D0

Bit-no.	Meaning	Status ‘0’	Status ‘1’	Default
D0	channel 1	Fail Safe value 0	Fail Safe value 1	0
...				
D3	channel 4	Fail Safe value 0	Fail Safe value 1	0
D4...D7	Not defined (0)			0

The safe status is output whenever the process data exchange between master and slave is disturbed.



Example STEP7: Parameter for relaymodule RM 252

Default parameter sequence: 0x07 0x00

5.6 *Analog inputs RM 221-x/ 222-x (4 channel, standard signals)*

To describe the module RM 221-x/ 222-x four parameter bytes are necessary:

❑ **Byte 1**

bit 0...3 Device-ID = 0x04 (cannot be changed)

❑ **Byte 2**

bit 0-1 : type of the analog input 1 (see table)
bit 2-3 : type of the analog input 2 (see table)
bit 4-5 : type of the analog input 3 (see table)
bit 6-7 : type of the analog input 4 (see table)

Type	Value	
0 ... 10 V	0	Default
-10 ... 10 V	1	
4 ... 20 mA	2	
0 ... 20 mA	3	

It is to check if the desired input type is supported also by the analog input module. There are two types of input types: voltage and current. The standard setting is 0... 10 V.

❑ **Byte 3**

bit 0-1 : degree of the filtering of the analog input 1 (see table)
bit 2-3 : degree of the filtering of the analog input 2 (see table)
bit 4-5 : degree of the filtering of the analog input 3 (see table)
bit 6-7 : degree of the filtering of the analog input 4 (see table)

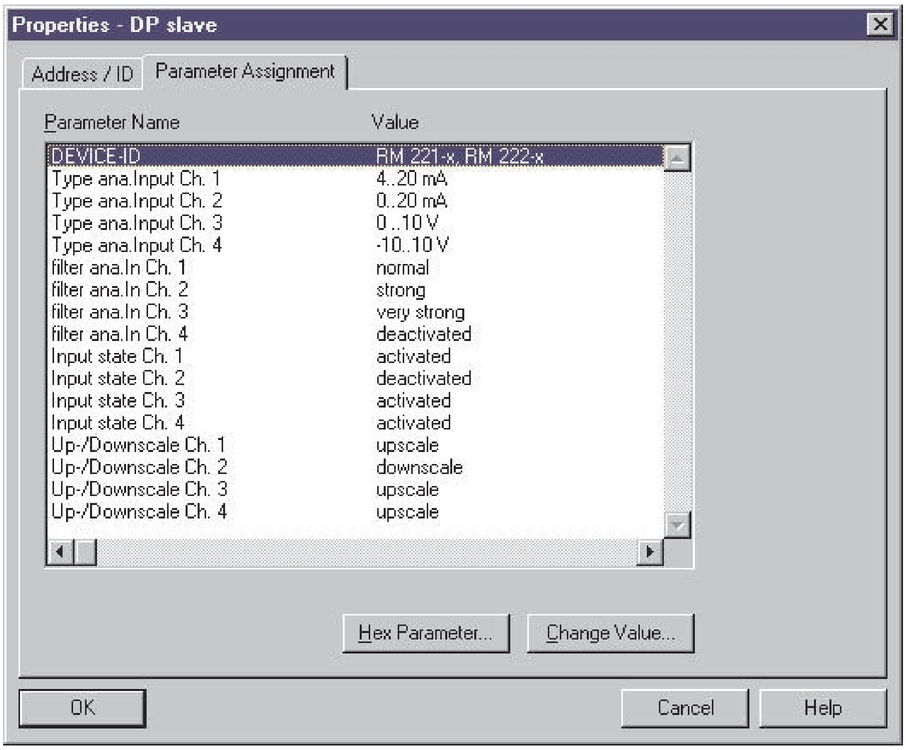
Filtering	Value	
Not active	0	
normal	1	Default
much	2	
Very much	3	

❑ **Byte 4**

bit 0 : Up-/Downscale in the event of an error for channel 1
bit 1 : Up-/Downscale in the event of an error for channel 2
bit 2 : Up-/Downscale in the event of an error for channel 3
bit 3 : Up-/Downscale in the event of an error for channel 4

0 = upscale (default)
1 = downscale

bit 4 : channel activated / deactivated for channel 1
bit 5 : channel activated / deactivated for channel 2
bit 6 : channel activated / deactivated for channel 3
bit 7 : channel activated / deactivated for channel 4
0 = activated (default)
1 = deactivated



Example STEP7: Parameter for analog input module RM 221-x/ RM 222-x

Default parameter sequence : 0x04 0x00 0x55 0x00

5.7 *Analog inputs RM 224-1 (4 channel, RTD (Pt100) and T/C)*

To describe the module RM 224-1 five parameter bytes are necessary:

- **Byte 1**

bit 0-3 Device-ID = 0x08 (cannot be changed)

- **Byte 2**

bit 0-3 : type of the analog input 1 (see table)
bit 4-7 : type of the analog input 2 (see table)

- **Byte 3**

bit 0-3 : type of the analog input 3 (see table)
bit 4-7 : type of the analog input 4 (see table)

Type	Value	
T/C - J	0	default
T/C - K	1	
T/C - L	2	
T/C - E	3	
T/C - T	4	
T/C - S	5	
T/C - R	6	
T/C - B	7	
T/C - N	8	
T/C - W	9	
Pt100	10	

- **Byte 4**

bit 0-1 : Degree of the filtering of the analog input 1 (see table)
bit 2-3 : Degree of the filtering of the analog input 2 (see table)
bit 4-5 : Degree of the filtering of the analog input 3 (see table)
bit 6-7 : Degree of the filtering of the analog input 4 (see table)

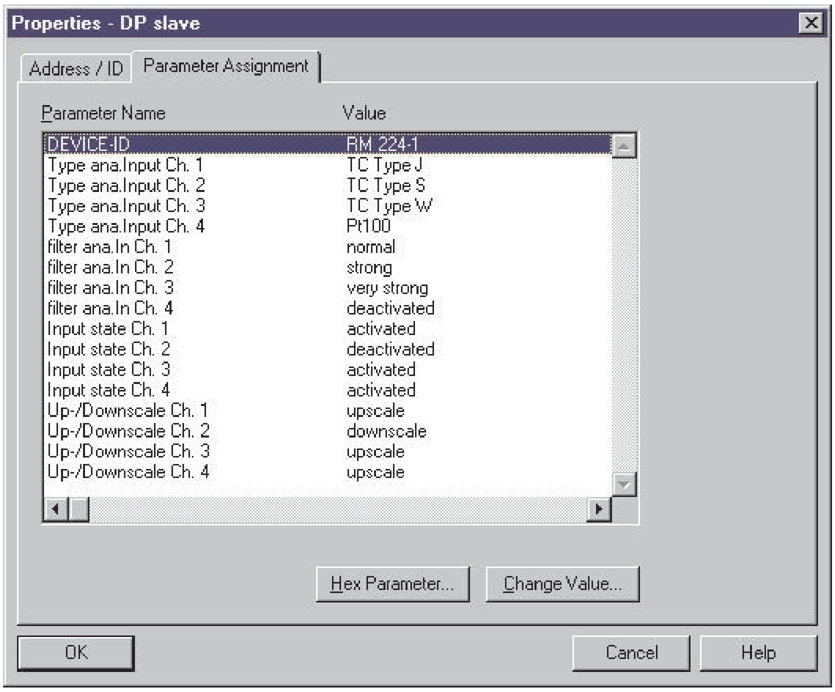
Filtering	Value	
deactived	0	
normal	1	default
much	2	
very much	3	

- **Byte 5**

bit 0 : Up-/Downscale in the event of an error for channel 1
bit 1 : Up-/Downscale in the event of an error for channel 2
bit 2 : Up-/Downscale in the event of an error for channel 3
bit 3 : Up-/Downscale in the event of an error for channel 4

0 = upscale (default)
1 = downscale

bit 4 : Channel activated / deactivated for channel 1
bit 5 : Channel activated / deactivated for channel 2
bit 6 : Channel activated / deactivated for channel 3
bit 7 : Channel activated / deactivated for channel 4
0 = activated (default)
1 = deactivated



Example STEP7: Parameter of temperature module RM 224-1

Default parameter sequence : 0x08 0x00 0x00 0x55 0x00

5.8 *Analog inputs RM 224-0 (2 channel, T/C)*

To describe the module RM 224-0 three parameter bytes are necessary:

- **Byte 1**

bit 0-3 Device-ID = 0x0E (cannot be changed)

- **Byte 2**

bit 0-3 : type of the analog input 1 (see table)
bit 4-7 : type of the analog input 2 (see table)

Type	**Value**	
T/C - J	0	default
T/C - K	1	
T/C - L	2	
T/C - E	3	
T/C - T	4	
T/C - S	5	
T/C - R	6	
T/C - B	7	
T/C - N	8	
T/C - W	9	

- **Byte 3 (Bits 0...3)**

bit 0-1 : Degree of the filtering of the analog input 1 (see table)
bit 2-3 : Degree of the filtering of the analog input 2 (see table)

Filtering	Value	
deactivated	0	
normal	1	default
much	2	
very much	3	

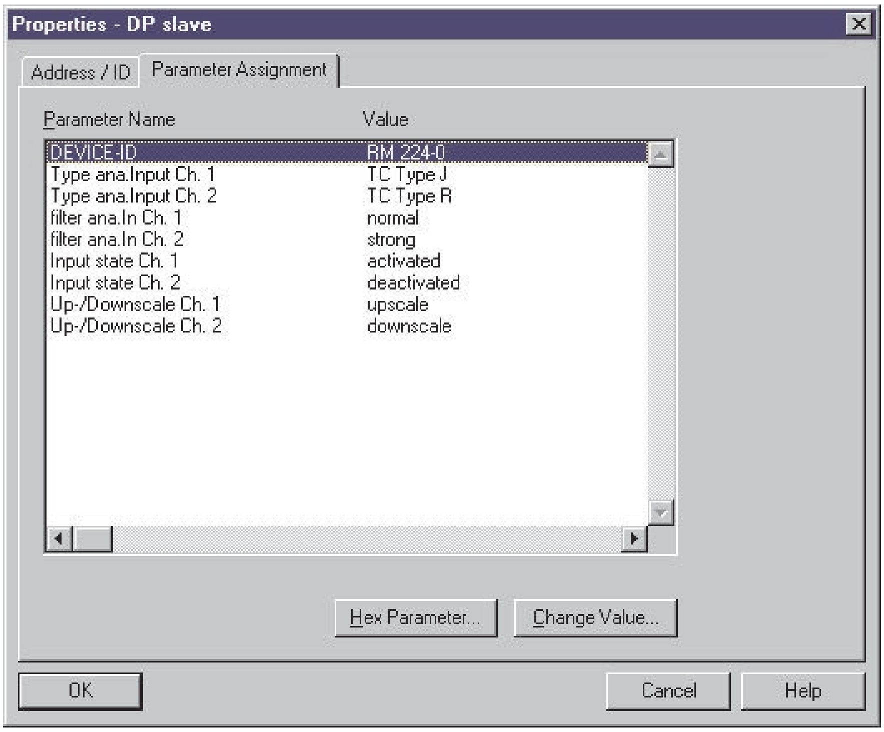
- **Byte 3 (Bits 4...7)**

bit 4 : Up-/Downscale in the event of an error for channel 1
bit 5 : Up-/Downscale in the event of an error for channel 2

0 = upscale(default)
1 = downscale

bit 6 : Channel activated / deactivated for channel 1
bit 7 : Channel activated / deactivated for channel 2

0 = activated (default)
1 = deactivated



Example STEP7: Parameter of thermocouple module RM 224-0

Default parameter sequence : 0x0E 0x00 0x05

5.9 *Analog outputs RM 231-x (4 channel, standard signals)*

To describe the module RM 231-x two parameter bytes are necessary

- **Byte 1**

bit 0...3 : Device-ID = 0x05 (cannot be changed)

bit 4 : behavior of the output 1 in the event of an error
bit 5 : behavior of the output 2 in the event of an error
bit 6 : behavior of the output 3 in the event of an error
bit 7 : behavior of the output 4 in the event of an error

0 = set output to 0 (default)
(voltage = 0 V, current = 0 or 4 mA)
1 =last valid value is held

- **Byte 2**

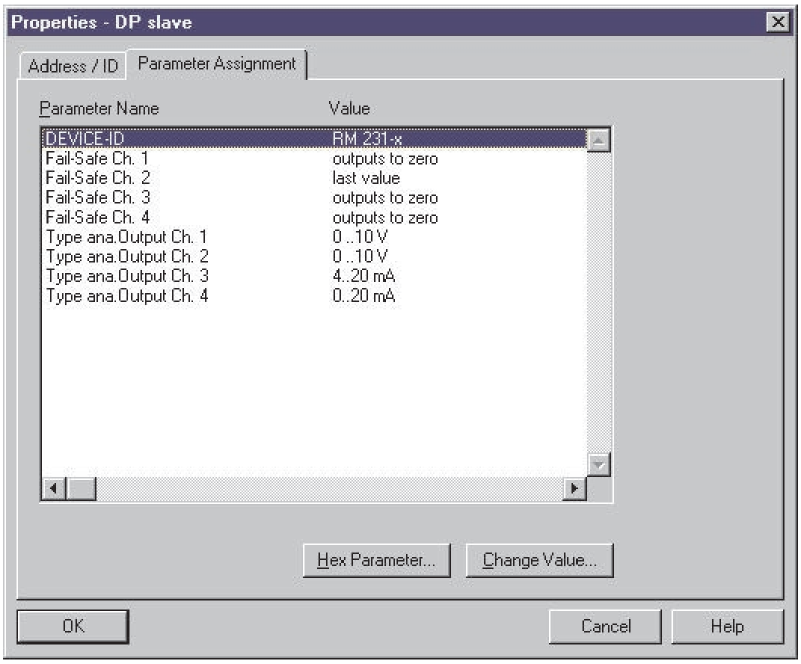
bit 0-1 : type of the analog output 1 (see table)
bit 2-3 : type of the analog output 2 (see table))
bit 4-5 : type of the analog output 3 (see table)
bit 6-7 : type of the analog output 4 (see table)

Type	Value	
0 ... 10 V	0	default
-10 ... 10 V	1	
4 ... 20 mA	2	
0 ... 20 mA	3	

It is to be made certain that the desired type is supported also by the analog output module. There are two types of output types:
0... 10 V or -10... 10 V. Each analog output is also capable to be a current output of 0(4)... 20 mA.

Installation hint:

With the installation is to be checked that only the output is wired, to which the module was parameterized. This is displayed by a lighted LED for current or voltage for each channel.



Example STEP7: Parameter of analog output module RM 231-x

Default parameter sequence : 0x05 0x00

5.10 *Up-/Downscale and averaging*

Note on UP-/Downscale of analog inputs:

If an analog input port cannot measure meaningful values, e.g. caused by a sensor breakage, then it can be determined via the UP-/Downscale-bit whether the max. or the minimum value of the respective measuring range will be transferred.

Note to the averaging:

The measured analog values can be submitted to a sliding averaging (low-pass 1. order). It applies the following equation:

$Y[n+1] = \alpha * X + \beta * Y[n]$ with $0 < \alpha \leq 1$ and $(\alpha + \beta) = 1$

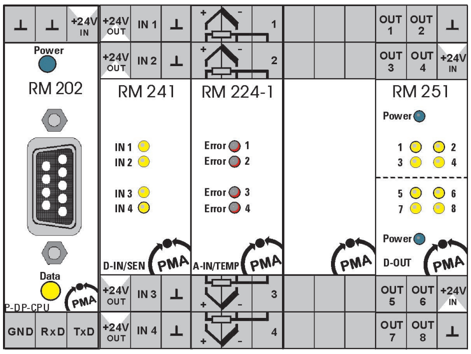
$Y[n]$ = average value at time n * T (T = scanning time)
X = actual scanning value

The four possible adjustments have the following effects:

deactivated: $\alpha = 1$
normal: $\alpha = 1/5$
much: $\alpha = 1/20$
very much: $\alpha = 1/100$

5.11 *Example of a parameter telegram*

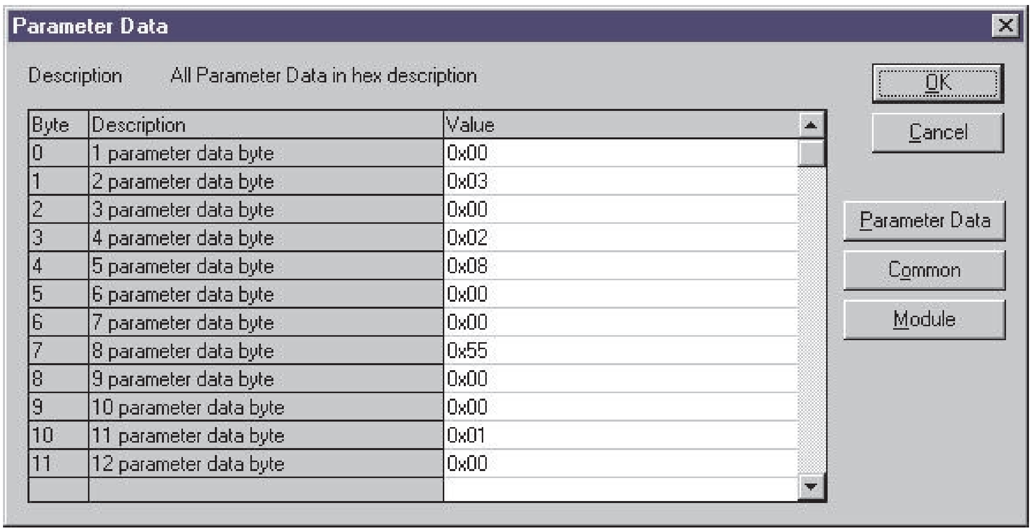
The following example shows the structure of a parameter telegram consisting of 5 modules of RM 202, RM 241, RM 224-1, a non-occupied position and RM 251.



The bytes 1 to 7 of the parameter telegram contain the standard parameters. The 8th byte contains SPC3-spezific data. Starting from the 9th byte are the user specific data. These data depend on the chosen combination of modules.

Byte 9	User_Prm 1:	general devices adjustments
Byte 10	User_Prm 2:	GSD version
Byte 11	User_Prm 3:	DEVICE ID for module in slot 1 = RM 241 = 0x02
Byte 12	User_Prm 4:	DEVICE ID for module in slot 2 = RM 224-1 = 0x08
Byte 13	User_Prm 5:	type of analog input for channel 1 and channel 2 / slot 2
Byte 14	User_Prm 6:	type of analog input for channel 3 and channel 4 / slot 2
Byte 15	User_Prm 7:	degree of the filtering for channels 1 to 4 / slot 2
Byte 16	User_Prm 8:	Up/Downscale and active/deactivated for channels 1 to 4/slot 2
Byte 17	User_Prm 9:	DEVICE ID for slot 3 = non-occupied position = 0x00
Byte 18	User_Prm 10:	(Bit 0...3) DEVICE ID for slot 4 = RM 251 = 0x01
Byte 19	User_Prm 11:	(Bit 4...7) behavior of the outputs 1 to 8 in the event of an error / slot 4
Byte 20	User_Prm 12:	safe status for the outputs 1 to 8 / slot 4

The parameter telegram necessary for this module has therefore a total length of 20 bytes. Apart from the usual 8 parameters still 12 user specific parameters are added. The slots 5 to 9 is not needed with this unit. It is not necessary to parameterize this slots as non-occupied positions, since no further I/O modules follow.



Byte	Description	Value
0	1 parameter data byte	0x00
1	2 parameter data byte	0x03
2	3 parameter data byte	0x00
3	4 parameter data byte	0x02
4	5 parameter data byte	0x08
5	6 parameter data byte	0x00
6	7 parameter data byte	0x00
7	8 parameter data byte	0x55
8	9 parameter data byte	0x00
9	10 parameter data byte	0x00
10	11 parameter data byte	0x01
11	12 parameter data byte	0x00

Example SYCON: Parameter list for example parameter set

Note: Byte 1 relates to User_Prm 1.

6 Configuration data

After the parameter setting the master has to send a configuration telegram to the particular slave. It provokes the slave to compare the transmitted configuration with deposited configuration data. If the slave discovers deviations between the configuration data and the entries in the GSD file, he announces ‘incorrect configuring’ at a later diagnostic interrogation to the master. The slave is then not ready for the utilizable data communication.

With the configuring telegram 9 bytes are to be transmitted to the PROFIBUS-DP coupler RM 202. Octet 1 determines, how the data of the I/O module in the slot 1 are to be processed, Octet 9 determines the data for slot 9. Empty slots obtain the value 0 as identifier byte.

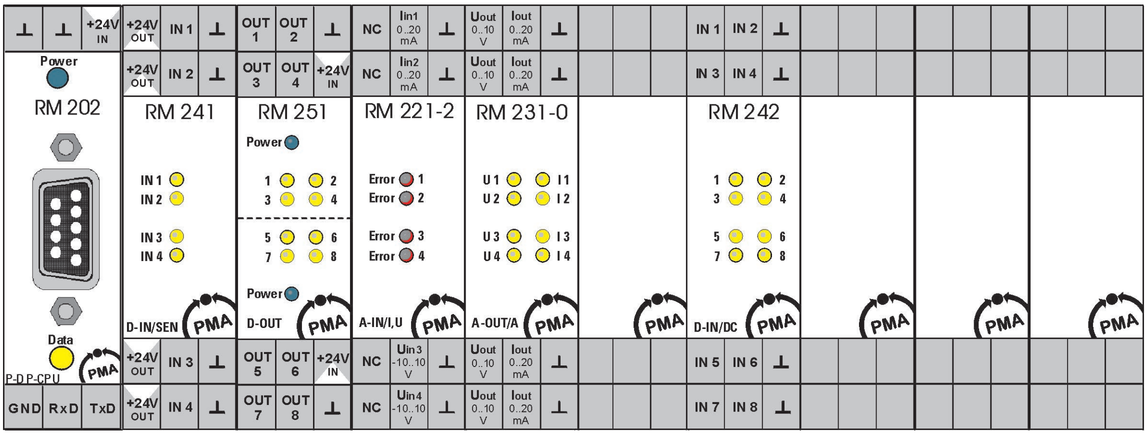
Structure of a octet in configuration telegram (general identifier format according to EN 50 170 Vol. 2):

bits 3 2 1 0:	definition of the length of the data	0x0... 0xf	1 Byte / Word 16 Bytes / Words
bits 5 4:	in- / output	00 01 10 11	special identifier format input output in- / output
bit 6:	format	0 1	Byte Word
bit 7:	consistency	0 1	consistency of byte / word consistency entire length

Normally the bus master configuration tool inserts the identifier automatically when selecting a module.

6.1 *Example for the determination of the general identifier format*

A basic module with 10 slots is equipped with RM 202, RM 241, RM 251, RM 221-x, RM 231-x, RM 242.



	Slot 0	=	RM 202 (no identifier format, because always existent)	
Octet 1	(Slot 1)	=	1 Byte In / 0 Bytes Out / consistency through Byte RM 241 (4 x dig. In)	= 0x10
Octet 2	(Slot 2)	=	0 Bytes In / 1 Byte Out / consistency through Byte RM 251 (8 x dig. Out)	= 0x20
Octet 3	(Slot 3)	=	4 Words In / 0 Bytes Out / consistency through Word RM 221-x (4 x ana. In)	= 0x53
Octet 4	(Slot 4)	=	0 Bytes In / 4 Words Out / consistency through Word RM 231-x (4 x ana. Out)	= 0x63
Octet 5	(Slot 5)	=	Non-occupied position Non-occupied position	= 0x00
Octet 6	(Slot 6)	=	1 Byte In / 0 Bytes Out / consistency through Byte RM 242 (8 x dig. In)	= 0x10
Octet 7	(Slot 7)	=	Non-occupied position Non-occupied position	= 0x00
Octet 8 (Slot 8)		=	Non-occupied position Non-occupied position	= 0x00
Octet 9 (Slot 9)		=	Non-occupied position Non-occupied position	= 0x00

The length of the configuring telegram amounts to max. 9 octets. Non-occupied positions have to be assigned only if still further I/O modules follow. In this example it must be assigned the non-occupied position in slot 5. The non-occupied positions of slots 7 to 9 do not have to be assigned. This configuration-telegram has a length of 6 octets.

7 PROFIBUS-DP diagnostic information

PROFIBUS-DP offers comfortable and versatile possibilities of processing diagnostic messages due to error states.
The diagnostic information of RM 202 consists of standard diagnostic information (6 bytes) and device specific diagnostic information.

7.1 *Standard - diagnostic message*

A standard-diagnostic message consists of 6 bytes.

	Bit	Name	Meaning
1. Byte	0	Diag.station	Station does not exist (set by the master)
	1	Diag.station_not_ready	Slave is not ready for data exchange
	2	Diag.cfg_Fault	Configuration data are not consistent
	3	Diag.ext_diag	Slave has external diagnostic data
	4	Diag.not_supported	Requested service is not supported by the slave
	5	Diag.invalid_slave_response	Slave sets fixed to 0
	6	Diag.prm_fault	Incorrect parameter setting (ID number etc..)
	7	Diag.master_lock (setzt Master)	Slave is parameterized by another master

	Bit	Name	Meaning
2. Byte	0	Diag.Prm_req	Slave has to be parameterized again The application has identified a status, which requires a restart with a new parameter setting and configuring. After the diagnosis the master executes a start-up with given parameter setting and configuring. This bit is set when switching on the PROFIBUS-DP coupler RM 202
	1	Diag.Stat_diag	Static diagnosis The slave is not able to present valid data caused by a condition in the application. The master requires thereupon only diagnostic information, until the slave takes this bit back again. The PROFIBUS-DP status is however DATA Exchange, so that after canceling of the static diagnosis data exchange can be continued immediately again. This bit is set by the PROFIBUS-DP coupler RM 202 if an I/O module drops out.
	2	fixed on 1	
	3	Diag.WD_on	Watchdog aktive
	4	Diag.freeze_mode	Freeze command received
	5	Sync_Mode	Sync command received
	6	reserved	
	7	Diag.deactivated (set by the master)	

	Bit	Name	Meaning
3. Byte	0..6	reserved	
	7	Diag.ext_overflow	This bit is set by the slave, if more diagnostic data are available, as fit into the diagnostic data area.

	Bit	Name	Meaning
4. Byte	0..7	Diag.master_add	Master address after parameter setting (0xFF without parameter setting)

	Bit	Name	Meaning
5. Byte	0..7		ID number (high byte); RM 202: 0x05

	Bit	Name	Meaning
6. Byte	0..7		ID number (low-byte); RM 202: 0x2C

Additional for external diagnosis:

	Bit	Name	Meaning
7. Byte	0..7		external diagnosis: Header length specification Bit 5 ... 0 = block length in bytes inclusive header Bit 7, 6 = 0, 0

	Bit	Name	Meaning
from 8. Byte	0..7		external diagnosis

7.2 *Device-related external diagnosis*

The PROFIBUS-DP coupler RM 202 supports the device-related diagnosis. The external diagnosis has the fixed length of 20 bytes.

0 = not applicable / 1 = applicable

	Bit		Meaning
1. Byte	0		invalid parameter data
	1		invalid I/O configuration
	2		EEPROM on the RM 202 is defect
	3		calibration data in analog I/Os incorrect
	4..7		reserved

Byte 2 to byte 9 contain the status of the I/O-module in slot 1 up to slot 9. For each disturbed channel the appropriate bit is set.
Digital I/O modules can have 4 or 8 input/outputs (‘ channels ‘) depending upon type. Analog I/O modules contained depending upon type 2 or 4 channels.

0 = channel undisturbed / 1 = channel is disturbed

	Bit	Name	Meaning
2. Byte	0..7		status of the I/O module in slot 1

❑ **example**:
1 module RM 224-1 (4 x Pt100 / T/C) is plugged.

	Bit		Meaning	Value 0	Value 1
2. Byte	0		channel 1 disturbed	no	yes
	1		channel 2 disturbed	no	yes
	2		channel 3 disturbed	no	yes
	3		channel 4 disturbed	no	yes
	4		channel 1 calibration error	no	yes
	5		channel 2 calibration error	no	yes
	6		channel 3 calibration error	no	yes
	7		channel 4 calibration error	no	yes

A disturbance is e.g. a measuring range violation or a terminal temperature error.

	Bit	Name	Meaning
3. Byte	0..7		like the 2. Byte (but for slot 2)
...			
10.Byte	0..7		like the 2. Byte (but for slot 9)

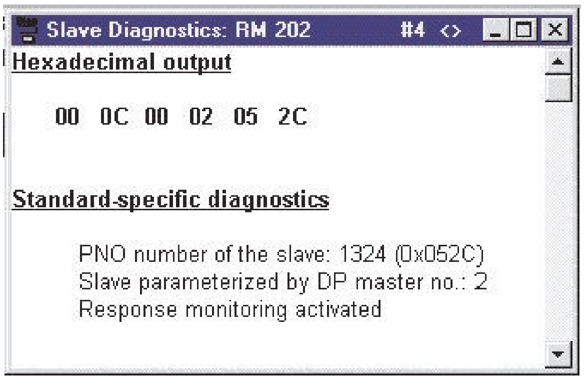
	Bit	Name	Meaning
11. Byte	0..7		Software-version of the PROFIBUS-DP-coupler RM 202 Examples: V1.00 = 0 / V1.23 = 23

	Bit	Name	Meaning
12. Byte	0..7		hardware identifier (ID) of the I/O module in slot 1
...			
20.Byte	0..7		hardware identifier (ID) of the I/O module in slot 9

7.2.1 Slave diagnosis - examplary on SIEMENS - COM PROFIBUS

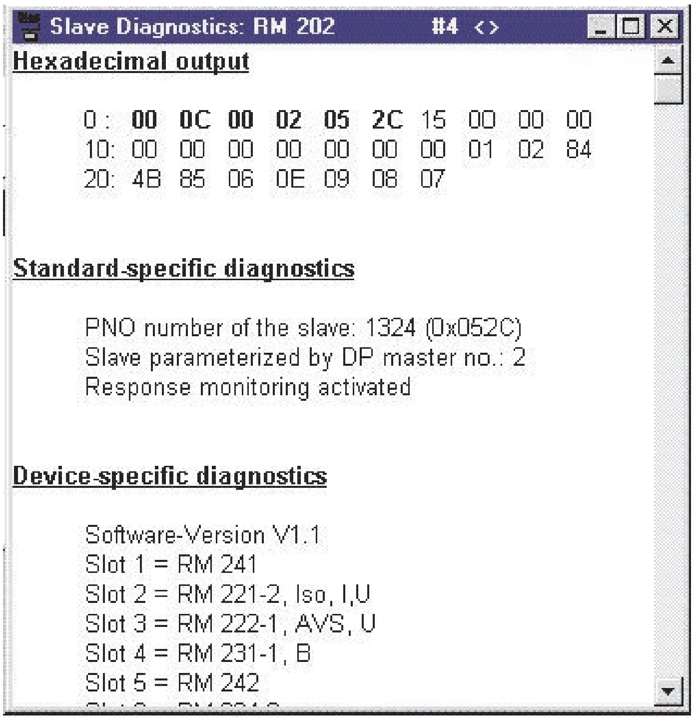
The outcoming of a slave diagnosis is shown exemplary on by means of COM PROFIBUS from SIEMENS. Similar functions can be available for other tools.

The following picture shows the standard-specific diagnosis.

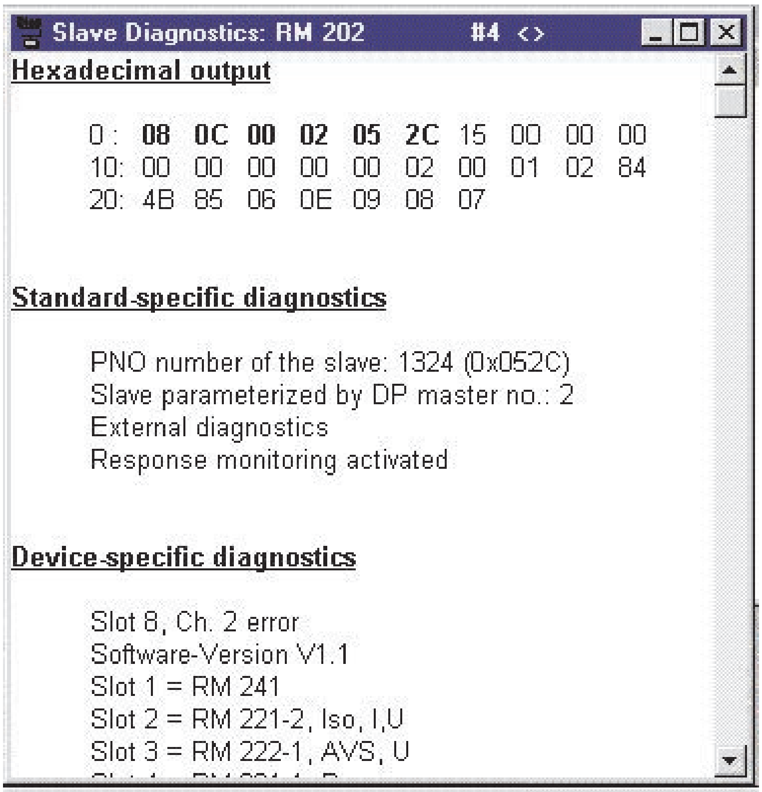


The represented slave operates with a deactivated ‘ extended diagnosis ‘.

The next picture shows the diagnosis of a PROFIBUS-DP slave with activated ‘ extended diagnosis ‘. Apart from the standard diagnosis the user receives still additional information about the configuration of the RM 202 unit and the software version of the PROFIBUS-DP coupler RM 202.



The foolowing figure below shows the diagnosis of a PROFIBUS-DP slaves with activated ‘ extended diagnosis ‘ and an error at the input 2 of the module in slot 8. As shown in the diagnostic message, a 4-channel temperature modul RM 224-1 is placed in slot 8. The error could be e.g. a sensor break at channel 2 of the RM 224-1 module.



Since it is an extended diagnosis with error information, the flag ‘external diagnosis’ (see page 35) is set. This flag causes an error status at the master (e.g. S7) and the LED ‘ SF ‘ to light up.

7.3 *Additional supported PROFIBUS services*

The PROFIBUS-DP coupler RM 202 supports the Fail Safe mode. A Clear-Data-telegram contains no utilizable data. The PROFIBUS-DP coupler RM 202 gives out the following values to the digital and analog outputs after a CLEAR DATA telegram depending on the configuration:

- Mode **last value:** the last transferred value
- Mode **safe value:** the value 0 for analog outputs,
the predefined value for digital outputs

The SYNC and FREEZE mode are optional services and not supported by the PROFIBUS-DP coupler RM 202

8 Switch-on reactions and error detection

8.1 *Diagnosis LED at the top side of the RM 202*

The PROFIBUS-DP coupler RM 202 has 3 LEDs. The two LEDs at the front indicate an intact supply voltage (green) and the status of the DATA Exchange (yellow). At the top of the RM 202, a further LED serves especially for the recognition of error states (yellow). This diagnosis LED displays the following states by different flashing codes:

LED signal	Meaning
LED off	RM 202 communicates with the PROFIBUS master (all OK)
long - short - pause	Parameter telegram does not match the current configuration
short - long - pause	Configuration telegram does not match the current configuration
short - pause	Parameter- and configuration telegram invalid
short - short - pause	No connection, baud rate unknown
long - pause	Problems with the EEPROM on the RM 202
short - short - short - pause	Problems with I/O modules, invalid I/O configuration

A complete flashing cycle takes 2 seconds, a short pulse 250 ms, long pulse and one pause duration of at least 750 ms. Between a short and a long pulse is a time of 250 ms.

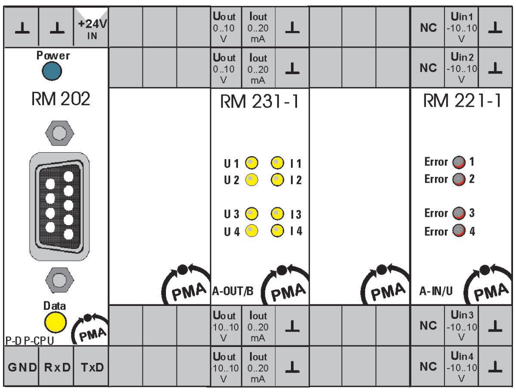
The diagnosis LED displays always the error status with the highest priority. ‘Problems with I/O modules, invalid I/O configuration ‘ is the message with the highest priority, ‘ parameter telegram does not match the current configuration ‘ has the lowest priority.

Example:

An intact unit is connected to the 24 V supply. The PROFIBUS plug is not yet connected to the RM 202. The diagnosis LED will signal ‘no connection‘ by the sequence ‘ short - short - pause ‘ .

8.2 *Wrong parameter setting of analog I/O modules*

The analog output modules RM 231-x and the analog input modules RM 221-x/222-x are available in three different variants. With the parameter setting it is to check that the desired I/O type of the I/O module is supported by the actual plugged module. If a not available I/O type is parameterized, the wrong parameter setting is displayed by the error LED and the U/I LEDs of the respective channel.
Example:



The sketched unit of 5 modules has 4 analog outputs and 4 analog inputs. The user parameterizes the analog I/Os as follows:

analog outputs:	channel 1	:	-10 ... 10 V	ERROR !
	channel 2	:	0 ... 10 V	OK
	channel 3	:	0 ... 20 mA	OK
	channel 4	:	4 ... 20 mA	OK

Channel 1 is incorrectly parameterized. This error is signaled by flashing of the two LEDs for U and I at channel 1. With correct parameter setting lights up only one of the two LEDs per channel. By the lighting up of the respective LED for each channel is displayed, which output (U or I) is used.

analog inputs:	channel 1	:	0 ... 10 V	OK
	channel 2	:	-10 ... 10 V	OK
	channel 3	:	0 ... 20 mA	ERROR !
	channel 4	:	0 ... 10 V	OK

Channel 3 is incorrectly parameterized. This error is displayed by flashing the error LED at channel 3. After a correct parameter setting the LEDs indicate errors like sensor breakage, measuring range violation or a defect of the I/O module.

8.3 *Switch-on reactions*

Directly after switching on the PROFIBUS-DP coupler RM 202 expects the parameter setting followed by the configuration data from the PROFIBUS master. Until to the entrance into the status ‘ DATA Exchange ‘ the following values at the digital and analog outputs are brought to output:

digital outputs: The ‘ safe status ‘ determined in the last parameter telegram will be taken on. The factory defaults of this values are 0x00.

analog outputs:	0 V ... +10 V	:	0 V
	-10 V ... +10 V	:	0 V
	0 mA ... 20 mA	:	0 mA
	4 mA ... 20 mA	:	4 mA

The type of the analog output is determined by the last received parameter telegram. The factory defaults are 0 V ... +10 V.

Since not all PROFIBUS-DP masters can work with the extended diagnosis, the extended diagnosis is only activated with a valid parameter telegram.

8.4 *Error detection*

The PROFIBUS-DP coupler RM 202 can identify different error states. For the coupler and for each slot one byte is available in the ‘ device-related diagnosis ‘(see chapter 7.2).described on page 36ff. The following events are interpreted as errors and the appropriate bits to the disturbed channel are set in the ‘ device-related diagnosis ‘.

digital outputs:

- Hardware identifier of the module is invalid.
  A recognition of short-circuit or no-load (broken wire) operation, as it would be possible in with the module RM 251, is not supported by the PROFIBUS-DP coupler RM 202 V1.00.

digital inputs:

- Hardware identifier of the module is invalid:
  In this case 0x00 as input value is always transferred.

analog outputs:

- Hardware identifier of the module is invalid:
  Output data received from the PROFIBUS-DP coupler RM 202 cannot be output in this case at the analog outputs.
- Calibration data incorrect:
  Output data received from the PROFIBUS-DP coupler RM 202 cannot be output in this case at the analog outputs.
- Bit error when writing the DAC:
  It is further cyclically tried to output the data at the analog outputs.

analog inputs:

- Hardware identifier of the module is invalid
- Calibration data is incorrect
- Value outside of the valid measuring range / e.g. sensor break
- With T/C inputs: Cold junction compensation is incorrect

As soon as an error at an analog input port is determined, either the maximum value (upscale) or the minimum value (downscale) is transferred as process value (see parameter telegram). If the error cause can be eliminated during operation (sensor break), valid measured values are determined and transferred. The error bit of the ‘ device-related diagnosis ‘ is then automatically reset.

9 Quick entry

The disk enclosed in the engineering set contains the GSD file, project examples for a SIMATIC® S7. Communication with a RM 202 can be built up easily by means of configuration and project.

9.1 *Quick entry with S7*

Test environment

The following components are required for the test set-up:

- programming unit (PG740 recommended)
- automation unit
  - CPU315-2 DP
- a basic module RM 211, RM 212 or RM 213
- a coupler RM 202
- at minimum one I/O- module
- engineering set (order no. 9407 999 103x1)
- cable
  - PROFIBUS cable automation unit ↔ RM 202
  - programming unit ↔ automation unit

9.1.1 Test environment example

A RM 202 with address 4 should be connected to a CPU315-2 DP via PROFIBUS-DP.

Before taking the test environment into operation, you should ensure that the automation units do not contain user software (”initial clear”).

Procedure:

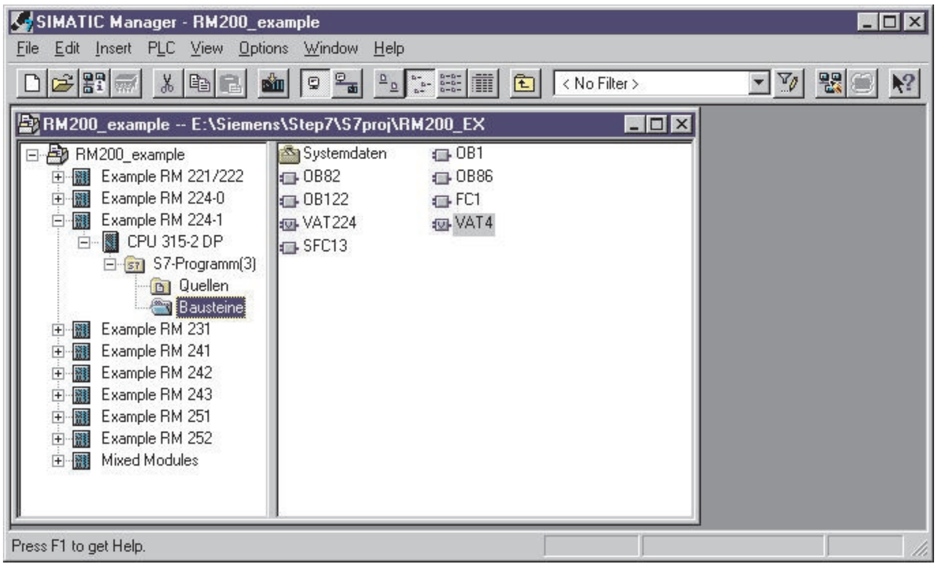
- make the connections (PROFIBUS)
- configure the instruments
  - adjust address 4 at RM 202 (via DIP switches) and connect to power supply.
  - activate the bus termination resistors at RM 202 connector and at PLC (S7) connector.
- PROFIBUS network configuration
  - insert floppy (engineering set) into the programming unit.
  - start STEP7
  - de-archive project example (A:\RM200\PROFIBUS\EXAMPLE.S7\RM200_ex.arj)
  - open project RM200_ex
  - select partial example project, e.g. “Example RM 224-1”
  - install GSD file in HW config editor
  - if necessary, match addresses of CPU hardware configurations and transmit them into the DP master (CPU315-2 DP).
  - switch the automation unit to Run.

After taking the test set-up into operation, testing the I/O area can be done by means of the picture block variable table (e.g. VAT 224) and reading of diagnosis information (e.g. VAT 4).

9.1.2 Example with STEP7 V5.0

The commissioning of a RM 200 module is explained step by step in the following chapter using STEP7 as example.

❑ **1. step: open project**



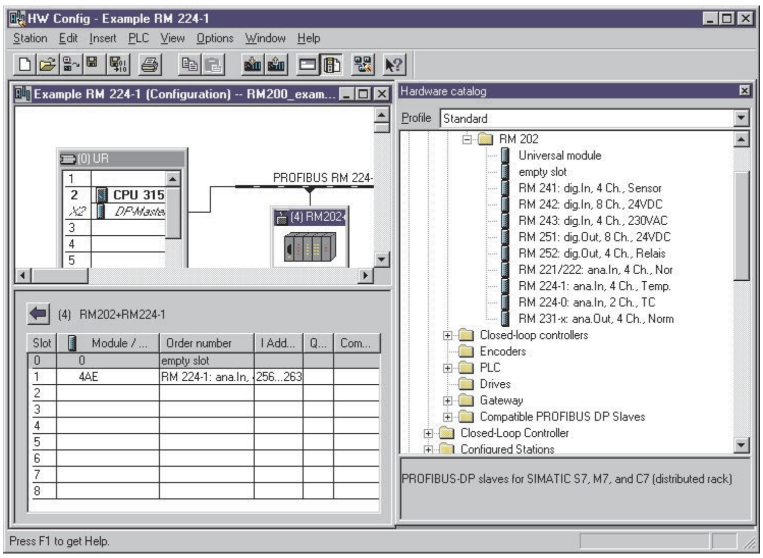
❑ **2. step: install GSD-file**

Within the editor HW-Config the appropriate GSD-file of the PROFIBUS-DP coupler RM 202 must be once imported with function ‘Install New GSE’ in menu ‘Options’.

❑ **3. step: create DP-master system**
e.g.: with CPU 315-2DP and PROFIBUS-DP - subnet.

❑ **4. step: select unit from hardware catalog**

Drag a RM 202 -unit from the hardware catalog and drop it on the PROFIBUS-DP master system. The RM 202-unit is in the tree under ‘PROFIBUS-DP / Additional field devices / I/O‘. Select the address of the RM 202 in the opening window, here: 4



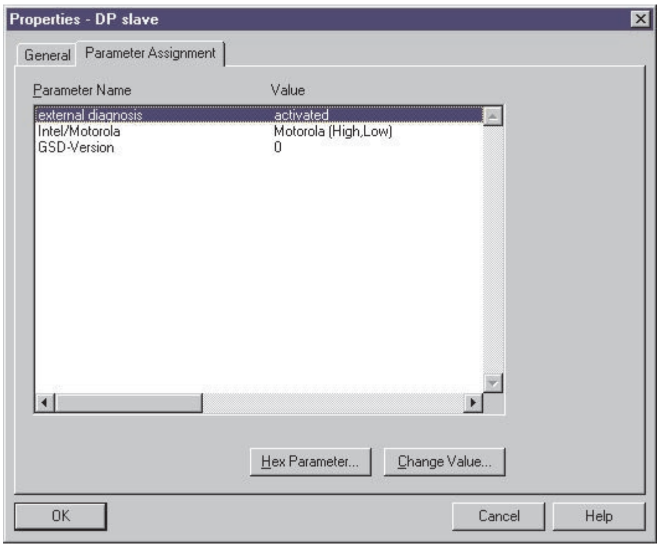
❑ **5. step: Configuration of the RM 202-unit**

By pulling the desired modules on the respective card locations of the RM 202 unit the device is configured.

With the configuration of the RM 202-unit it should be proceeded very carefully. It is to be made sure, that the configuration on the display corresponds exactly to the physical reality. If there is a difference between actual and projected configuration the PROFIBUS-DP master cannot take the RM 202-unit into operation.

❑ **6. step: Parameter setting of the RM 202-unit**

With double-click on the module RM 202 the general parameters of the RM 202- couplers can be adjusted. Via the card index ‘Parameter Assignment‘ the extended diagnosis can be activated/deactivated and the Motorola/Intel format for the module can be selected.



The parameters are allowed to change only through double-click on the respective entry or by operation of the button ‘ Change Value ...‘. To add the parameters manually via the button ‘ Hex parameter ‘is a illegal action.

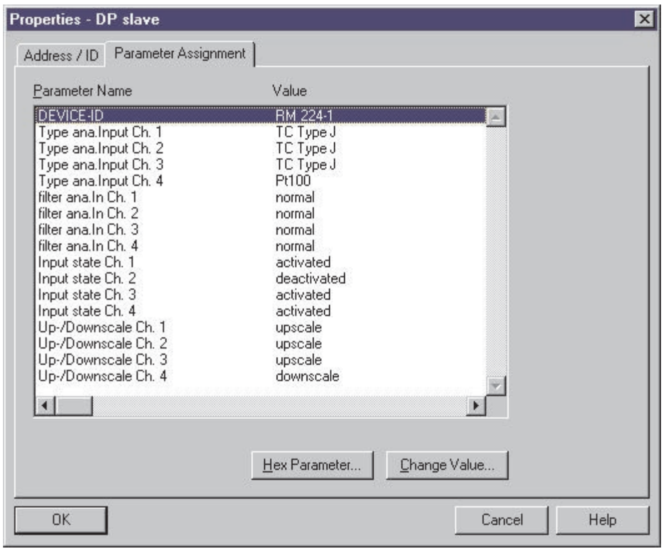
The GSD version cannot be changed in the display menu.

❑ **7. step: Parameter setting of the I/O modules**

By one double-click on the individual module locations of the RM 202-unit, the I/O module in that location can be parameterized.

The parameters are allowed to change only through double-click on the respective entry or by operation of the button ‘ Change Value ...‘. To add the parameters manually via the button ‘ Hex parameter ‘is a illegal action.
Each I/O module has an entry with the name ‘ DEVICE ID ‘. This parameter is firmly assigned to the respective module and can not be changed.

The meaning of the I/O parameters can be read in the section about the parameter telegram.

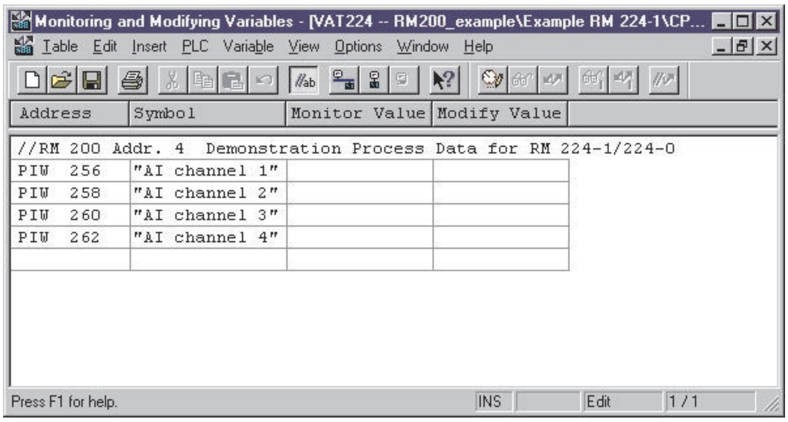


❑ **8. step: Downloading of the hardware configuration into target system**

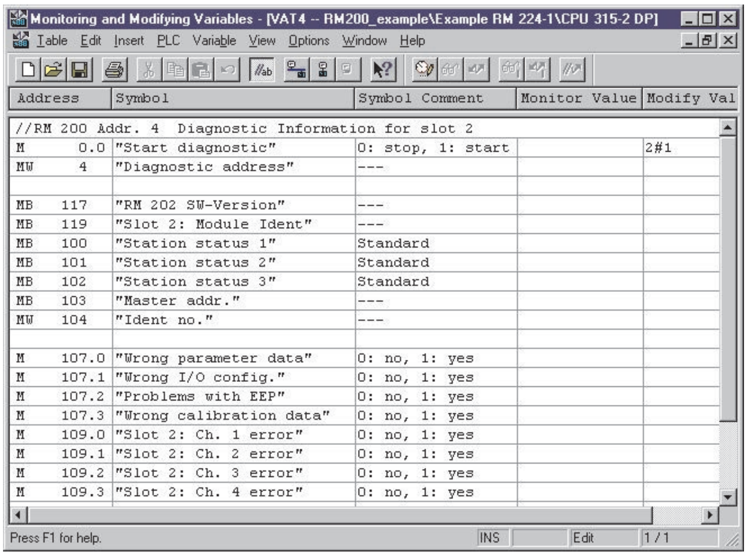
After downloading the configuration to the target bus master the PLC should be set into run mode. Via variable monitoring (see nect chapter) a simple access to input and output variables is possible.

9.1.3 Monitoring of variables

The example projects contain variable tables to monitor and modify the process values of a specific RM 200 module, e.g. VAT224 for RM 224-1. Furtheron it is possible to read the diagnosis data using VAT4.



Monitoring process values

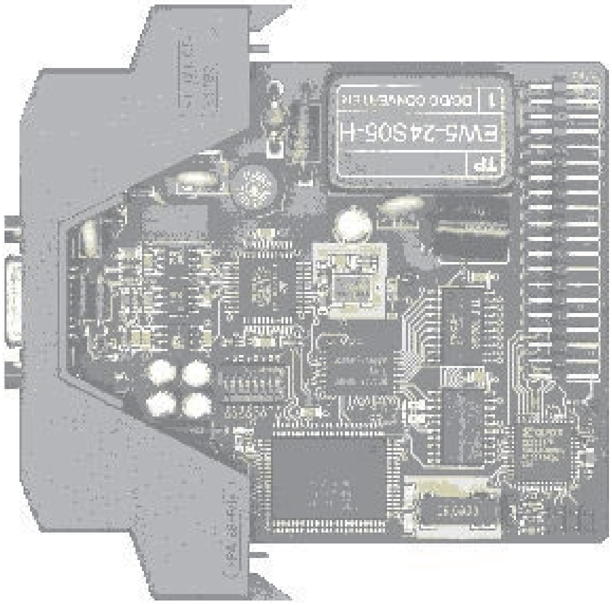


Example for diagnosis

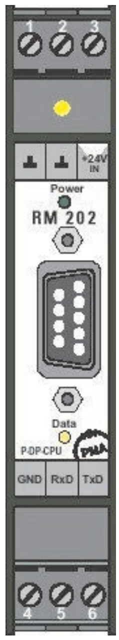
To read cyclically the diagnosis data the bit M0.0 has to be set to 1.

10 Hardware / Technical Data

10.1 *Picture of PROFIBUS-DP coupler RM 202*



10.2 *Connecting the interface*

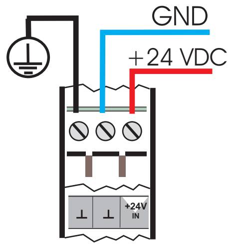


10.2.1 24 V/DC-supply

Terminal 1, 2	=	mass
Terminal 3	=	+24 V/DC

The terminals 1 and 2 are internally connected.

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



10.2.2 RS232

Terminal 4	=	GND_RS232
Terminal 5	=	RxD
Terminal 6	=	TxD

The RS232-interface is electrically isolated from the 24 V/DC supply and from the PROFIBUS connection.

With a PC a program update can be executed with this interface.

10.2.3 PROFIBUS connection (9pol. SUB-D-socket)

Pin 1	=	Screen
Pin 2	=	NC
Pin 3	=	**RxD/TxD-P** (reception/transmit data -Plus)
Pin 4	=	CNTR-P (control signal for repeater / 5 V TTL-level), Limited against overcurrent by 330 ohm resistor
Pin 5	=	**DGND** (data communication potential, mass to VP / +5 V)
Pin 6	=	**VP** (supply voltage of the terminal resistors), +5 V, limited against overcurrent with 50 mA Multifuse
Pin 7	=	NC
Pin 8	=	**RxD/TxD-N** (Receive-/Transmit data-Minus)
Pin 9	=	CNTRL-N (Control signal for repeater / GND)

10.3 *Note to the free jumper positions on the RM 202*

The free jumper positions on the RM 202 must not be short circuited. It is intended that the jumper positions are vacant and are not provided with jumpers (short-circuit bridges). The jumper serve the service staff to execute program updates etc.

10.4 *Replacement of the fuse on the RM 202*

If the green ‘Power’ LED does not light up with the connection of the supply voltage, the fuse should be checked. The fuse on the RM 202 protects the 24 V/DC supply voltage. With defective I/O modules, bus boards or the coupler module a short-circuit of supply voltage within the module is possible. The current is limited to max. 1.6 ampere by the fuse. After repairs of the error cause the defective fuse can be replaced by an identically type with 1,6 A / slow-acting.

10.5 *Data-LED*

The yellow ‘ Data’ LED indicates the mode DATA Exchange of the PROFIBUS-DP ‘statemachine’ of the RM 202. This state is achieved only if a PROFIBUS-DP master initializes the coupling module RM 202 correctly and switches into this mode.

10.6 *Diagnosis-LED*

The diagnosis LED at the top side of the RM 202 indicates different error states of the PROFIBUS-DP coupler RM 202. The exact function of this LED is described in the section
‘8.1 Diagnosis LED at the top side of the RM 202‘.

10.7 *Technical Data RM 202*

Application: Central module of the modular Fieldbus system

Supply voltage: +24 V DC (± 10 %), max. power consumption 2.5 W (only RM 202)
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 necessary voltages, those max. current consumption amounts to 1.5 A (depending upon the used I/O modules).

Microprocessor: MB90F55A with 16 MHz of external / 32 MHz internal quartz frequency

Memory:
- 128 kByte Flash EPROM / updateable via RS232
- 32 kByte static RAM
- 8 kByte EEPROM

PROFIBUS-DP:
- PROFIBUS-DP slave ASIC SPC3 after EN 50 170
- galvanic isolation through high speed opto couplers up to 12 MBaud
- Data transmission rates: 9,6 / 19,2 / 93,75 / 187,5 / 500 / 1500 / 3000 / 6000 / 12000 kBaud
- automatic baud rate detection
- Address range: 1...126

RS232: The additional serial interface serves the program update of the fieldbus coupler

Protective mechanisms: Protection against polarity errors and overvoltage

Cycle times: The attainable I/O cycle time is, depending upon stage of extension between 0,1 and 2,0 ms.

LED displays:
- 1x Exchange' (yellow): data exchange via PROFIBUS-DP
- 1x 'Power' (green): status of supply voltage
- 1x 'Diagnose' (yellow): diagnosis information

Potential separation: The areas supply voltage, PROFIBUS-DP and logic are separated from each other galvanically (insulation voltage 500 V DC).

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

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

Vibration and impact: 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
- SUB MIN D (9-pin) for PROFIBUS (socket)

Class of protection: IP 20,of the completely equipped device
Physical dimensions: 99 x 17,5 x 118,5 mm (H x W x D)
Weight: 85 g
Housing: Polyamide 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 change!

11 Appendix

11.1 *Definitions*

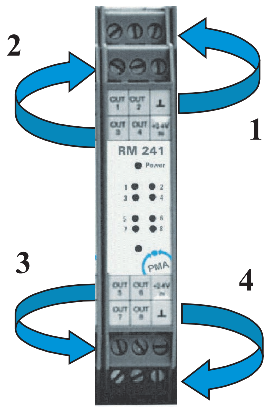
AG	Abbr. for automation device (e.g. PLC as busmaster)
Basic module	Unit for installation of the modules of the RM 200 - system (RM 211, RM 212, RM 213)
CANopen	Protocol based on CAN-Bus, specified by user organization CiA
COM PROFIBUS	PROFIBUS configuration tool of Siemens AG for S5
Data-Exchange	State of PROFIBUS communication: data exchange between master and slave
Fail Safe	Behaviour of an output value if communication to bus master fails
FAQ	Frequently asked questions
FREEZE	Input values are frozen until UNFREEZE signal arrives
GSD-file	Device Description file, containing communication parameters for PROFIBUS devices
EN 50 170 Vol. 2	European standard 50 170 “General purpose field communication system”, Vol. 2, PROFIBUS
External Diagnosis	External device specific diagnostic information
ID	Abbr. for Ident number
I/O	Abbr. for input /output
HW	Abk. f. Hardware
Identifier format	Defines the length, type (input/output) of cyclic messages
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
PG	Abbr. for Programming device (e.g. PC running STEP7)
PNO	**P**ROFIBUS User **O**rganization
PROFIBUS-DP	Standardized communication protocol according to EN50170 Vol.2 (DP: Decentralized periphery)
RC-combination	Combination from resistance and capacity
RM 200	Modular Remote I/O system from PMA GmbH
RS485	Standardized two wire connection, half duplex, (EIA RS 485)
SAP	Abbr. for “Service Access Point” transmission channel for PROFIBUS
S5 / S7	PLC families of Siemens AG
Standard-Diagnosis	6 Byte diagnosis information defined in EN 50 170 Vol.2
STEP7	Programming software for SIEMENS S7
SW	Abbr. f. software
SYNC	SYNCH-Mode: output values activated by SYNCHron-command
T/C	Abbr. for thermocouple

11.2 *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.

❑ **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 data sheet specifies two values for the lowest limit related to 0 °C and 50 °C.

❑ **Assignment of terminal descriptions to terminals**



❑ **Calculation of cycle time for PROFIBUS coupler module RM 202 (worst case)**
The calculation of the internal cycle time depends on the number of inserted (analog) modules and the external load on the PROFIBUS. Main internal times of the RM 202 are:

– digital signals only (1 to 9 modules): ≤ 2 ms
– 4-channel analog module (per module): ≤ 120 ms
– 2-channel analog module (per module): ≤ 20 ms

Examples:
A) 4 x RM 224-1 (4 channels TC/Pt100) + 4 x RM 231-0 (4 channels AO) + 1x RM 242 (8 DI) : ≤ **150 ms**
B) 9 x RM 242 (8 DI) : ≤ **0,4 ms**

❑ **Sensor break RM 224-1**
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.

PROFIBUS-DP Coupler Module RM202

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 !

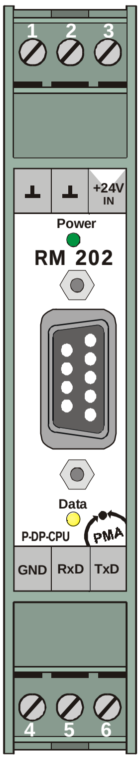
Maintenance / Repair

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



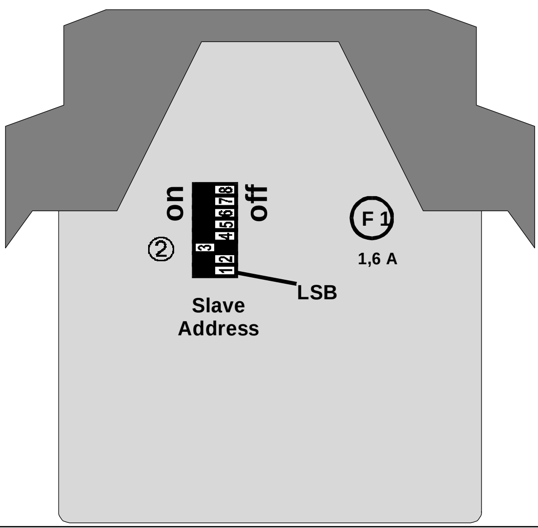
Pin	Assignment	
1	GND	Power supply
2	GND	
3	+24 V DC	
4	GND_RS232	RS 232-Interface
5	RxD	
6	TxD	
Art.-No.	9407-738-20201	

DIP Switch (8 pos.)

DIP ①	Address
0000 0000	invalid
0000 0001	1
0000 0010	2
0000 0011	3
0000 0100	4 ②
.....	....
0111 1110	126
0111 1111	invalid
8765 4321	Switch-Pos.

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

② Factory settings



Art.-Nr.: 9499-040-58941 • 30.06.00

Technical Data   RM 202

Application: central unit of a modular Fieldbus system device.

Power supply: +24 V DC ($\pm$10 %), max. power consumption 2.5 W (only RM 202)

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

Microprocessor: MB90F553A with 16 MHz external / 32 MHz internal crystal frequency

Memory:

- 128 kByte Flash EPROM capable to be updated via RS232
- 32 kByte static RAM
- 8 kByte EEPROM kByte

PROFIBUS DP:

- PROFIBUS DP Slave ASIC SPC3 according to EN 50170
- galvanic isolation with high speed opto couplers up to 12 MBaud
- Data transmission rates: 9.6 / 19.2 / 93.75 / 187.5 / 500 / 1500 / 3000 / 6000 / 12000 kBaud
- automatic Baud rate detection
- Address range: 1... 126

RS232: The additional serial interface serves the program updates of the Fieldbus coupler.

Protection: Protection against change of polarity and overvoltage.

Cycle times: The attainable I/O cycle time ranges between 0,1 and 2,0 ms depending upon the stage of extention.

LED displays:

- 1x ' DATA Exchange ' (yellow): data exchange via PROFIBUS DP
- 1x ' Power ' (green): status of the supply voltage

Potential separation: The parts of supply voltage, PROFIBUS DP and Logic are galvanically isolated from each other (insulation voltage 500 V DC).

Ambient temperature:

- Operation: 0... +50 °C
- Storage: -20... +70 °C

Climatic Application class: KUF DIN 40040 ($\leq$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 mm^2
- SUB-Min-D (9-pol.) for PROFI BUS (socket)

Class of Protection: IP 20 of the completely equipped device

Dimensions: 99 x 17.5 x 118.5 mm (h x w x d)

Weight: 85 g

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

Assembly: Modules plugged and locked from the front of the basic housing

Operation 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 !

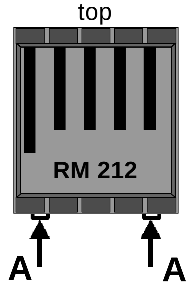
Maintenance / Repair

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.



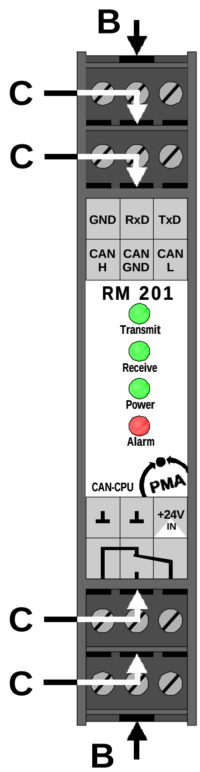
Installation / Removal the Modules

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.

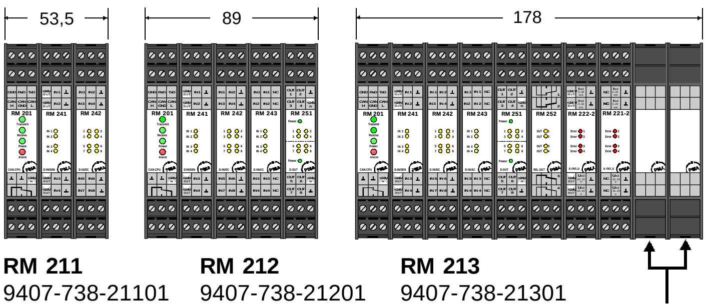
To keep the specified protection degree (IP20) emty slots must be protected by slot covers RM 214.



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.

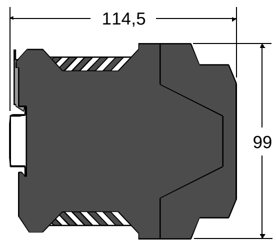


RM 211
9407-738-21101

RM 212
9407-738-21201

RM 213
9407-738-21301

slot cover
RM 214
9407-738-21401



side view

Subject to technical alterations!

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.

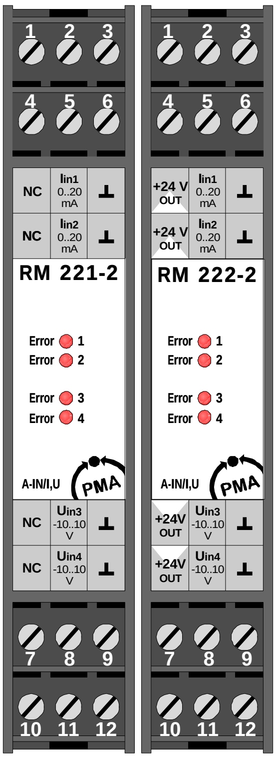
The instrument contains electrostatically sensitive components.

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		

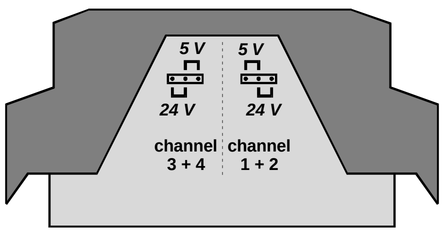
Remark:

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 mm²
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 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.

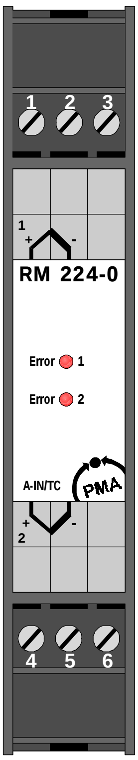
The instrument contains electrostatically sensitive components.

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

Art.-No.: 9499-040-59741 ◆ 05.06.00

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 224-0

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% CE
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!

DBL\RM2240FB.PM5

Analog Input Module RM 224-1

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 !

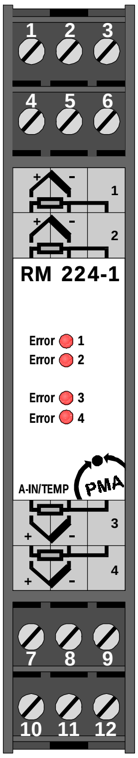
Maintenance / Repair

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

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, $f_{cut\text{-}off}$ < 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

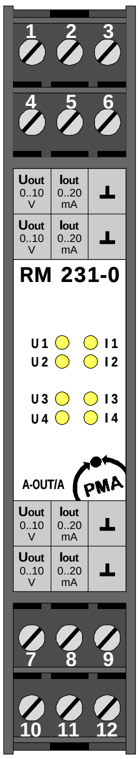
Subject to technical alterations!

Analog Output Module RM 231

Safety Instructions

ESD !	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 !

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.

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 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

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 !

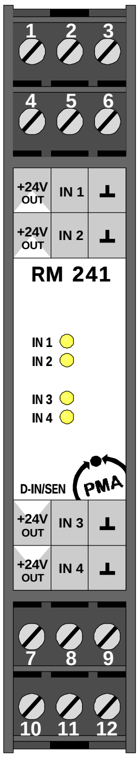
Maintenance / Repair

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:

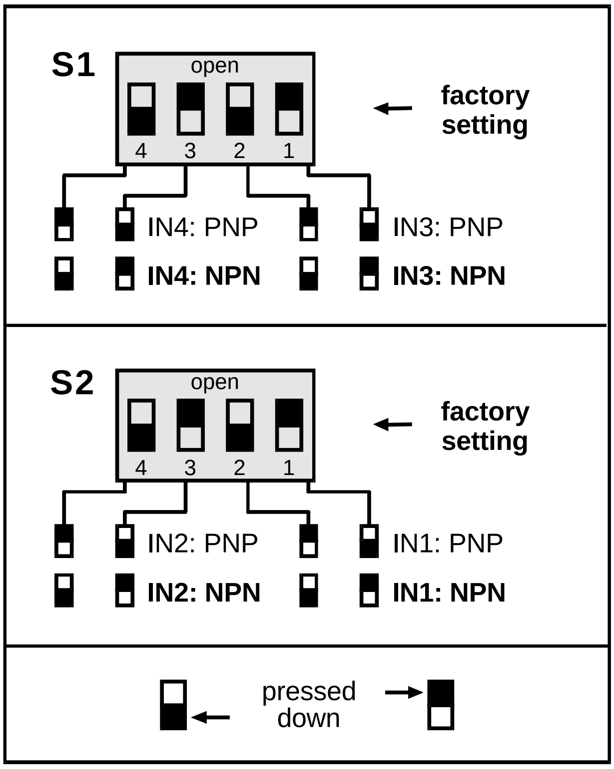
- Cause must be determined and removed !
- Only fuses of the same type and current rating as the original fuse must be used.
- Using repaired fuses or short-circuiting the fuse socket is inadmissible !

Pin Assignment



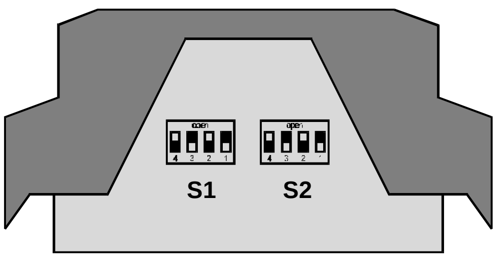
Pin	Assignment	
1	+24 V OUT	Input 1
2	IN 1	
3	GND	
4	+24 V OUT	Input 2
5	IN 2	
6	GND	
7	+24 V OUT	Input 3
8	IN3	
9	GND	
10	+24 V OUT	Input 4
11	IN4	
12	GND	
Art.-No.	9407-738-24101	

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.



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
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:	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 !

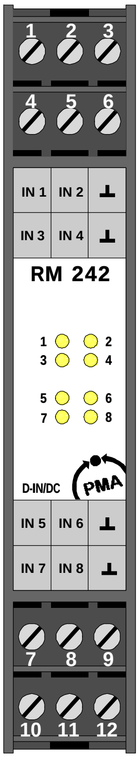
Maintenance / Repair

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	

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 mm^2

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

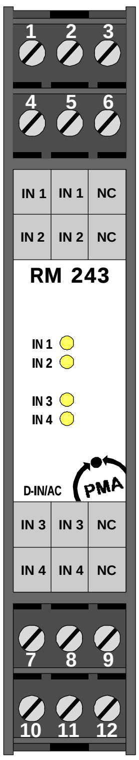
Subject to technical alterations!

Digital Input Module RM 243

Safety Instructions

ESD !	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	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	

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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
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:	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 !

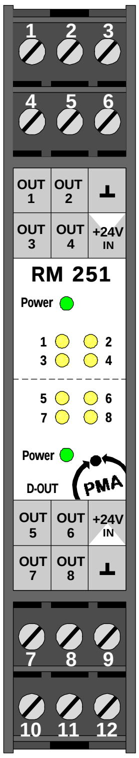
Maintenance / Repair

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).

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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
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 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 !

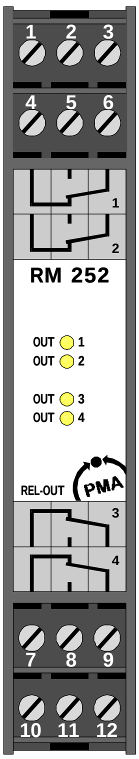
Maintenance / Repair

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	
2	Relay 1
3	
4	
5	Relay 2
6	
7	
8	Relay 3
9	
10	
11	Relay 4
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!

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