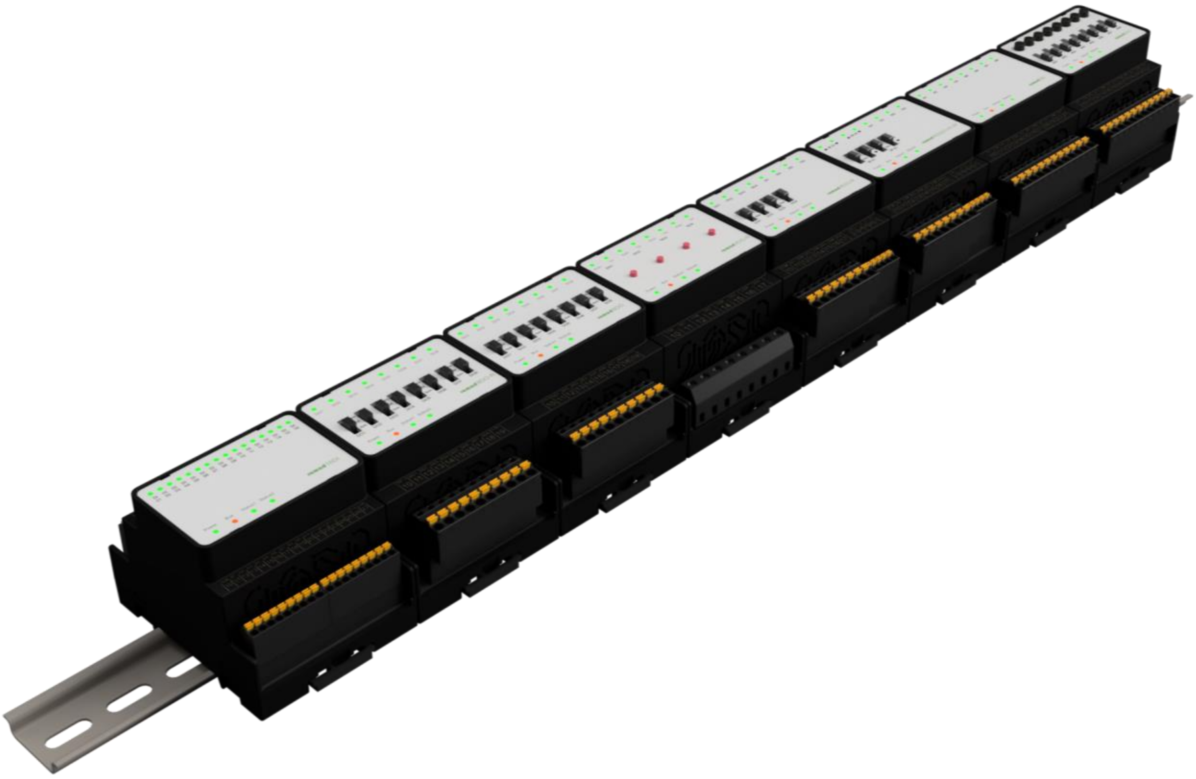
# Technical Documentation / Instruction Manual

## Local Override/Indication Devices (LO/ID)
## for use in building automation and control systems
## in accordance with DIN EN ISO 16484 / VDI 3814
## with
## Modbus RTU interface

## for DIN rail mounting



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**DIN rail mounted**

# Local Override/Indication Devices (LO/ID)

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**with**

# Modbus RTU interface

romod

## 1 Features and advantages of romod

**romod, the LO/ID for DIN-rail mounting from romutec®, provides the following features:**

- Clear arrangement and presentation of the plant's status
- Manual intervention and override of outputs possible at any time
- Connection between modules and DDC acc. to Modbus specifications
- Manual control functions and fault indicating system (acc. to DIN VDI 3814)
- Easy wiring of the DIN-rail mounted devices
- Optimization of the size of the cabinet because of small footprint on the mounting plate
- Easily expandable due to modular design
- No high investment costs for programming interfaces, no gateways necessary
- Automatic baud rate detection (autobaud)
- Applications: systems of building automation, e.g. heating, ventilation, air conditioning and refrigeration systems, as well as in equipment for operational control
- Direct connection to the Modbus RTU interface as slave devices
- Connection via RS485 (EIA485)
- The romutec® LO/ID operates as slave to all PLC or DDC systems that can provide Modbus RTU master functionality. Programming is done via the corresponding programming environment of the master system.

# 2 General information

## 2.1 Notes on the operating manual

To take full advantage of your new local override/indication devices (LO/ID), you should read all the chapters of this manual to get information about the features of the equipment and to learn how to safely use the system.

## 2.2 Safety information

Before you put your devices into operation, you should read the following carefully. This also applies if any questions should arise at a later time.

**Intended use:**
The devices are to be used exclusively for the terms and features specified in this documentation. With improper use, the manufacturer assumes no product liability and warranty claims.

- Follow all warnings and notes marked on the device or listed in the technical documentation.
- Operate the devices only when properly mounted on a DIN-rail or in a appropriate mounting frame
- The modules should not be installed in the immediate vicinity of frequency converters.
- Frequency converters must be provided with all safety measures in order to comply with the required regulations and guidelines (e.g. line filter, etc.)
- Do not use the product near water or other liquids which can damage the electronic components.
- The supply voltage must correspond to the information in the technical data.
- The terminals of the device should only be wired by authorized and trained personnel.
- Do not perform wiring work whenever the device is powered. There is a risk of electrical shock.
- Connecting and disconnecting the terminals or connectors under voltage should be avoided. The devices might be destroyed.
- Make sure that no objects, e.g. screws or other fastening material, gets into the device.
- Avoid installation in areas with extreme temperature fluctuations. The temperature ranges for storage and operation which are given in the datasheet must be maintained to ensure trouble-free operation.

However, should problems occur, do not try to repair the device yourself. Do not open or disassemble the device. Doing so, parts inside the device might be damaged on contact. Basically, if you have any problems please contact the manufacturer.

# 3 System description

The ***romod*** module family is a set of **romutec®** local override/indication devices (LO/ID) for mounting on DIN rails. It consists of various types of I/O modules. The connection to the Modbus master device is done via a RS485 connection. The communication takes place via Modbus RTU.

Functionally, the **romutec®** local override/indication devices replace conventional switches and indicator lamps, fault indicating systems and coupling relays etc. in conventional cabinets. A large part of costly point-to-point connections so may be substituted by a cheaper bus cabling.

Each module has its own RS485 bus interface, therefore no gateway module is required. The address is set by means of an 8-pole dip switch. The available range of addresses is 0 ... 254.

The local override/indication devices operate as slave modules with any Modbus master.

The system can be used at all RS485 ports. The baud rate of the protocol will be automatically detected when receiving several telegrams.

**As expansion modules the following types are available:**

- Digital signaling modules 16 DI, activation of the inputs conventionally wired via terminal and passing over the bus to the Modbus master device for further processing.
- Digital output modules 8 DO with ground referenced semiconductor outputs +24 V DC, activation of outputs by commands via Modbus or manual override with integrated sliding switches possible.
- Digital output modules 8 DO-R with potential-free relay outputs (two groups with four relays each), activation of outputs by commands via Modbus or manual override with integrated sliding switches possible.
- Digital input/output modules 4 DIO-R with four digital inputs and four potential-free relay outputs (normally open contacts), activation of outputs by commands via Modbus or manual override with integrated sliding switches possible.
- Digital output modules 4 DO-R containing four bistable relay outputs (normally open contacts), activation of outputs by commands via Modbus or manual override with integrated push buttons possible.
- Analog input modules 8 AI, input signals conventionally wired via terminals and passing over the bus to the Modbus master for further processing. Quantitative visualization of the input signal by means of LEDs in light / dark operating mode (with 0..10V signals), or indication of a wire break when using resistive sensors, configurable sensor inputs (0 .. 10 V and various RTD).
- Analog output modules 8 AO, setting the output values by commands via Modbus, manual override with integrated sliding switches and potentiometers possible.
- Digital input/output modules 4DI2DO-R-3P with four digital inputs and 2x 3-point potential-free relay outputs in two groups for controlling 2x Open-Stop-Close drives, activation of outputs by commands via Modbus or manual override with integrated sliding switches possible.

# 4 Configuration

## 4.1 Hardware

**Maximum number of expansion modules per Modbus interface**

Basically, as many romod devices can be connected to a bus interface as addresses can be set. The complete address range of 0 ... 254 is available. However, please adhere to the DDC's manufacturer's recommendations concerning the maximum number of slave devices which may be connected to the bus interface of the master device, as well as any constraints given for the address range.

**Installation and wiring**

Installation and wiring of the modules which are containing the hardware IOs will be done in the cabinet on the mounting plate.

**Addressing**

The address which is used for communication with the module has to be set by means of a dip switch in the range of 0 ... 254. Dip #1 (most left) represents the value 1, Dip #8 (most right) signifies the value 128.


The following should be considered when setting the addresses:

- There are not allowed any duplicate addresses. Each address can be assigned only once per Modbus line.
- The addresses can be selected arbitrarily in the range of 0 ... 254, setting sequential addresses is not necessary.
- **Note:** When setting the address 255, the device performs a reset followed by a lamp test. Doing so, all parameters stored in the EEPROM will be reset to factory settings. **Important:** This also happens during operation, without de-energizing the module in the meantime!

Using the EOL switch (two pin dip switch), the bus can be terminated (active termination, 560R / 120R / 560R). For this purpose, set **both** dip switches (1 + 2) to the 'ON' position.

**Meaning of the status LEDs (valid for all modules):**

| | | |
|---|---|---|
| **Power** | Green | Steady light = operational |
| | Orange | Autobauding, determining the baud rate |
| **Bus** | Green | Communicating with the master |
| | Red | Faulty telegram received, communication error, timeout |
| **Status 1** | Red/Green | Custom usable LED |
| **Status 2** | Red/Green | Custom usable LED |

## 4.2 Bus connection to Modbus master devices

### 4.2.1 Communication within Modbus master-slave systems

For communication between a controller (DDC or PLC) and the romutec® local override/indication devices (LO/ID), it is necessary to configure an RS485 interface of the controller as Modbus master with the ***serial port parameter settings 8,N,1***. This is done with the programming software of the manufacturer of the controller.
For questions, please consult the manual or contact the manufacturer of the controller.

### 4.2.2 Terminal assignment of the Modbus RTU (RS485) port

The terminal assignment for the bus connection of the romod series to Modbus RTU master devices is for all module types as follows:

| Type of Interface | Function | Terminal No. | Modbus Connection |
|---|---|---|---|
| **RS485** | Rx-Tx (Net_B)<br>/Rx-/Tx (Net_A)<br>I-GND | 5<br>4<br>3 | B (-)<br>A (+)<br>Bus-GND |

The bus interface is electrically isolated. The I-GND terminals must always be wired, whether with braided shield or individual strands, and connected to ground / earth potential. There is no internal connection between I-GND and the GND of the power supply.

**Terminating the RS 485 interface (acc. EIA-485) is required. Therefore, the termination has to be enabled by means of the two-pole dip switch on the last device which is connected to the bus. When terminating, set *both* dip switches (1 + 2) to the 'ON' position. The termination will be realized within the device in active mode.**
**Additionally, in every module a bias resistor of 47 k is present, which is enabled always.**

### 4.2.3 Recommended cable types for bus wiring

| ***For a total length*** | ***up to 100m:*** | ***more than 100m:*** |
|---|---|---|
| Cable type: | LIYCY 1x2x0,5mm² shielded | CYPIMF 1x2x0,5mm² shielded |
| Line resistance: | < 4,0Ω / 100m | < 4,0Ω / 100m |
| Capacitance: | < 13.0nF / 100m | < 6.0nF / 100m |

### 4.2.4 Modbus commands supported

The following commands will be supported:

| Function Code | Command | Specifics and limitations |
|---|---|---|
| **03** | Read Holding Registers | Reading a contiguous block of registers is possible only for certain registers; other registers must be read individually (number of registers = 1). |
| **06** | Write Single Register | |
| **16** | Write Multiple Registers | Writing a contiguous block of registers is possible only for certain registers; other registers must be written individually (number of registers = 1). |

## 4.3 Configuration registers

**Selection: Controlling the DI LEDs via bus command or via input terminals**
By default, the DI LEDs are driven depending on the activation of the hardware inputs. In this mode of operation, they are signaling the state of the digital inputs. If the LEDs, in contrast, shall be controlled via Modbus commands, this has to be defined previously in a configuration register ('Setting the Mask for DI indicating LEDs'). This is done separately for red and green.

**Selection of the LED color if LEDs are controlled via DI input terminals**
If the DI LEDs are driven via the digital inputs of the module, then this so-called masks ('LED Color red/green when controlled via terminal input') will define the color of the LEDs, separately for red and green.

**Selection: Inverting of the digital inputs**
The logical status of the digital inputs can be inverted by using the register 'Inverting Digital Inputs'. If the LEDs are controlled together with the corresponding inputs via the terminals, then the associated LEDs will follow the logical state.

**Selection: ‚Safe State' of the digital and analog outputs**
All digital and analog outputs can be configured so that they will assume a defined state ('safe state') if the module has not received valid bus telegrams via the Modbus for a certain time. These predefined states are set separately for each output, whereas the time until activating the safe state is common for all outputs of a module.
**Note: The time for triggering the 'safe state' should not be too short in order to avoid malfunctions as they can occur, e.g., when another device which is connected to the bus fails and will so cause time-outs.**

**Selection of the sensor types for analog inputs**
The analog inputs can work with different types of sensors (active and passive ones). The sensor type is defined for each analog input using a configuration register ('Types of sensors connected to the analog inputs'). This has an effect on the displayed analog values, as the sensor characteristics are implemented in the module.

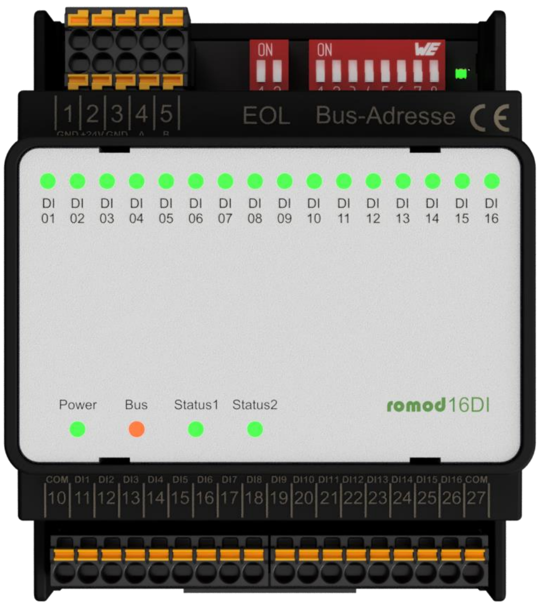
**Selection: Automatic baud rate detection or manually setting the baud rate**
It can be selected whether the automatic baud rate detection shall be active permanently or only in the first 5 minutes after a cold start. Furthermore, autobauding can also be completely deactivated. In this case, the device will work with a fixed baud rate which has to be set in another register.

**Setting the value for 'bus timeout'**
The LED 'Bus' starts flashing in red color and the safe state function of the outputs will be activated if no valid bus telegram is received for a certain time. This time is defined by the value which is set in the register 'bus timeout'.

**Register used for sending a command to the module**
By means of this register, functions like lamp test, resetting the counters, or the reset of all configuration registers can be triggered by sending a command to the device.

# 5 Description of available modules for Modbus connection

## 5.1 Digital input module 16 DI




The digital input module **romod 16 DI** is used for signaling of up to 16 digital messages. These include operating messages, error messages such as frost, filter dirty or fan belt damaged, and status messages such as damper positions.

The control of the inputs will be done with 24 V switched by external dry contacts that are connected to the module via terminals.

The reference potential is defined via the COM terminals and can be both, 0 volts and 24 volts. When using a reference potential of +24 volts, a control of the digital inputs with 0 V potential can be realized. The two COM terminals are connected internally, but not with the GND of the power supply, i.e. that reference potential for the inputs has to be connected anyway.

Using the settings in Modbus registers, you can select open circuit or closed-circuit principle for each input separately. Also, the color of each of the 16 LEDs is adjustable via a Modbus configuration register, either red, green or orange.

Furthermore, the LEDs can be controlled via Modbus commands, provided that this option previously has been defined in a configuration register. This setting can be made individually for each LED.

The digital inputs can be used as counters, but only for DC signals. For each input, a prescaler may be adjusted in order to count, e.g., just every second or third pulse. A subsequent change of the prescaler also results in a (retroactive) amendment of the corresponding counter values. The pulse duration must be at least 10 ms to be reliably detected.

For AC control of the inputs, the edge detection has to be delayed via configuration registers (see registers R1101 and R1111). In case of 50 Hz, this value should be set to at least 40 ms in order to avoid the counting of false detections. The maximum counter value when using a prescaler of 1 is 65,535 (which is equivalent to $2^{16}$-1).

There is a register that displays whether and which DI has changed since the last time this register has been read. When reading this register, all bits are reset to zero automatically. If a DI's status has altered several times, e.g. from 0 to 1 and back to 0, a change will be signalized, anyway.

Regarding the system configuration (addressing, maximum number of modules connected to a Modbus Master interface, installation, connection to the bus etc.), please follow the instructions in the chapter ***Configuration***.

**Important technical data:**

| | |
|---|---|
| Power supply: | 24 V AC or DC, connection via terminals |
| Current consumption: | max. 150 mA (DC), 220 mA (AC), all DIs loaded |

## Overview terminal assignment:

| romod 16 DI | GND | 24V AC/DC | COM for DIs | | | For activation of digital inputs use 24V AC/DC | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DI No. 1-8 | | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Terminal: | | | | | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| DI No. 9-16 | | | | | | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Terminal: | | | | | | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| COM für DIs | | | | | | | | | | | | | |
| Terminal: | | | 10 | 27 | | | | | | | | | |
| Power supply | | | | | | | | | | | | | |
| Terminal: | 1 | 2 | | | | | | | | | | | |

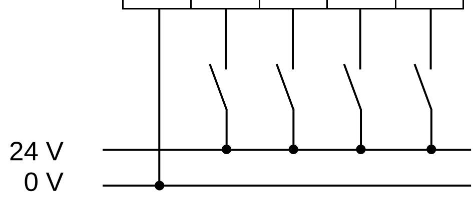
Sink and source operation mode is possible with the inputs. The two COM terminals of the DIs are bridged internally.

| **Modbus Connection** | **Terminal No.** | | |
|---|---|---|---|
| I-GND | 3 | | |
| A (+) | | 4 | |
| B (-) | | | 5 |

*Examples for activating the digital inputs with reference potential of 0V and 24V:*

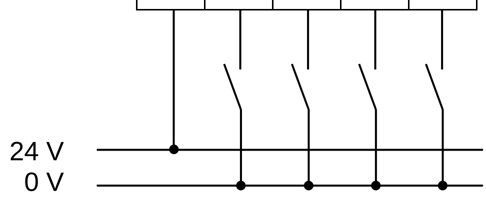
Activating DI with "positive potential" (24 Volts):

| COM | DI1 | DI2 | DI3 | DI4 |
|---|---|---|---|---|
| 10 | 11 | 12 | 13 | 14 |




Activating DI with "negative potential" (0 Volts):

| COM | DI1 | DI2 | DI3 | DI4 |
|---|---|---|---|---|
| 10 | 11 | 12 | 13 | 14 |



## 5.2 Digital output module with MOSFET outputs 8 DO


The digital output module **romod 8 DO** is a Local Override/Indication Device (LO/ID) which is used to control eight 1-stage motors, or other digital actuators. By means of the integrated switches, it provides the ability of manual override of the DOs which are usually controlled via Modbus commands.

The digital MOSFET outputs are provided by the module via terminals. They are ground referenced, + 24VDC.

The source voltage for the DOs is also connected via terminals and must be +24 volts (DC). The two supply terminals are connected with each other internally, but not with the 24 V power supply, i.e. there must be applied a source voltage for the outputs in any case.

For each DO there is a LED present which signalizes the status of the digital outputs. Using the settings in the relevant Modbus register, for each of this LEDs the color can be defined to either red, green or orange.

Furthermore, the LEDs can be controlled via Modbus commands, provided that this option previously has been defined in a configuration register. This setting can be made individually for each LED.

The current positions of the switches can be read out using two registers. Doing so, one register shows the switch position "Manually ON" and the other one the switch position "Automatic".

There is a register that displays whether and which switch has been operated since the last time this register has been read. When reading this register, all bits are reset to zero. If the position of a switch has been altered several times, e.g. from AUTO to OFF and back to AUTO, a change will be displayed, anyway.

All digital outputs can be configured so that they will assume a defined state (‘safe state’) if the module has not received valid bus telegrams via the Modbus for a certain time. These predefined states are set separately for each output, whereas the time until activating the safe state is common for all outputs of a module.

**Note: The time for triggering the 'safe state' should not be too short in order to avoid malfunctions as they can occur, e.g., when another device which is connected to the bus fails and will so cause time-outs.**

Regarding the system configuration (addressing, maximum number of modules connected to a Modbus Master interface, installation, connection to the bus etc.), please follow the instructions in the chapter ***Configuration***.

**Important technical data:**

| | |
|---|---|
| Power supply: | +24 V AC or DC, connection via terminals |
| Current consumption: | typically 21 mA (DC), 60 mA (AC), outputs WITHOUT any load |
| | |
| Specifications digital outputs: | MOSFET, ground referenced (source operation mode +24 VDC) |
| Output current | 5 ... 500 mA (leakage current max. 0.1 mA)<br>The load resistance shall not be less than 48 Ω. |
| Voltage drop | max. 0.4 V at 0.5 A |
| Inductive loads | should be avoided as far as possible, or be suppressed at the source, respectively. |

**Overview terminal assignment:**

| romod 8 DO | GND | 24V AC/DC | +24V DC for DOs | | DOs with ground referenced semiconductor outputs +24 V DC! | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DO No. 1-8 | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Terminal: | | | | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| +24VDC for DOs | | | | | | | | | | | | |
| Terminal: | | | 10 | 19 | | | | | | | | |
| Power supply | | | | | | | | | | | | |
| Terminal: | 1 | 2 | | | | | | | | | | |

The two supply terminals (10 + 19) for the DOs are connected with each other internally.

| Modbus Connection | Terminal No. | | |
|---|---|---|---|
| I-GND | 3 | | |
| A (+) | | 4 | |
| B (-) | | | 5 |

## 5.3 Digital output module with relay outputs 8 DO-R


The digital output module **romod 8 DO-R** is a Local Override/Indication Device (LO/ID) which is used to control eight 1-stage motors, or other digital actuators. By means of the integrated switches, it provides the ability of manual override of the DOs which are usually controlled via Modbus commands.

The relay outputs provide the normally open contact of each relay. They will be contacted via terminals.

The signal that will be switched by the relay contacts also has to be connected via terminals. The eight relay outputs are divided into two groups of four outputs. The two groups are not linked internally, so both COM-terminals must be wired.

***Important:*** **The signals to be switched must have the same phasing.**

For each DO there is a LED present which signalizes the status of the digital outputs. Using the settings in the relevant Modbus register, for each of this LEDs the color can be defined to either red, green or orange.

Furthermore, the LEDs can be controlled via Modbus commands, provided that this option previously has been defined in a configuration register. This setting can be made individually for each LED.

The current positions of the switches can be read out using two registers. Doing so, one register shows the switch position "Manually ON" and the other one the switch position "Automatic".

There is a register that displays whether and which switch has been operated since the last time this register has been read. When reading this register, all bits are reset to zero. If the position of a switch has been altered several times, e.g. from AUTO to OFF and back to AUTO, a change will be displayed, anyway.

All digital outputs can be configured so that they will assume a defined state (‘safe state’) if the module has not received valid bus telegrams via the Modbus for a certain time. These predefined states are set separately for each output, whereas the time until activating the safe state is common for all outputs of a module.

**Note: The time for triggering the 'safe state' should not be too short in order to avoid malfunctions as they can occur, e.g., when another device which is connected to the bus fails and will so cause time-outs.**

Regarding the system configuration (addressing, maximum number of modules connected to a Modbus Master interface, installation, connection to the bus etc.), please follow the instructions in the chapter ***Configuration***.

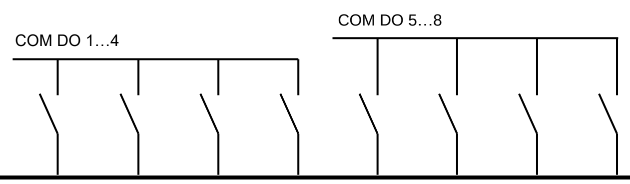
**Important technical data:**

| | |
|---|---|
| Power supply: | 24 V AC or DC, connection via terminals |
| Current consumption: | typically 85 mA (DC), 220 mA (AC) with all relay outputs activated |
| | |
| Specifications digital outputs: | Relay outputs (NO contact), max. 250 VAC) |

Characteristics (Resistive Load):

| | |
|---|---|
| Initial contact resistance | 100mΩ (at 1A / 24 VDC) |
| Rated load | 3 A at 250 VAC / 30 VDC |
| Max. switching voltage | 277 VAC, 30 VDC |
| Max. switching capacity | 830 VA (AC), 90 W (DC) |
| Endurance | $1x10^5$ ops (Rated Load) |
| Inductive loads | should be avoided as far as possible, or be suppressed at the source, respectively. |

**Overview terminal assignment:**

| **romod 8 DO-R** | Output voltages of DOs are potential-free (two groups) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GND | 24V AC/DC | COM DO 1…4 | COM DO 5…8 |   | | | | | | | |
| DO No. 1-8 | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Terminal: | | | | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| COM for DOs | | | | | | | | | | | | |
| Terminal: | | | 10 | 19 | | | | | | | | |
| Power supply | | | | | | | | | | | | |
| Terminal: | 1 | 2 | | | | | | | | | | |

The two COM supply terminals (10 + 19) for the DOs are NOT connected with each other internally.

***Important:*** **The signals to be switched must have the same phasing.**

| **Modbus Connection** | **Terminal No.** | | |
|---|---|---|---|
| I-GND | 3 | | |
| A (+) | | 4 | |
| B (-) | | | 5 |

## 5.4 Digital input/output module with relay outputs 4 DIO-R


The module **romod 4 DIO-R** provides four digital inputs and four digital outputs. It is used to control four 1-stage motors, or other digital actuators, and for signaling of up to four digital messages. These include operating messages, error messages such as frost, filter dirty or fan belt damaged, and status messages.

Furthermore, the **romod 4 DIO-R** is a Local Override/Indication Device (LO/ID), i.e. by means of the integrated switches, the module provides the ability of manual override of the DOs which are usually controlled via Modbus commands.

**Digital outputs:**

The relay outputs provide the normally open contact of each relay. They will be contacted via terminals.

***Important:*** **The signals to be switched must have the same phasing.**

By means of configuration registers there can be defined that the digital outputs will also follow the signals of the digital inputs (in addition to the control via Modbus). Both, static control and toggling are possible. Moreover, on and off delays can be set for each output, as well as minimum times for the states ON and OFF.

***Please note:*** **The configured switching delays and minimum on / off times will only work when the outputs are activated via bus commands. Whenever manual override is applied, the operator will be responsible for the adherence to these times.**

Mutual interlocking of outputs is also possible.

For each DO there is a LED present which signalizes the status of the digital outputs. Using the settings in the relevant Modbus register, for each of this LEDs the color can be defined to either red, green or orange.

Furthermore, the LEDs can be controlled via Modbus commands, provided that this option previously has been defined in a configuration register. This setting can be made individually for each LED.

The current positions of the switches can be read out using two registers. Doing so, one register shows the switch position "Manually ON" and the other one the switch position "Automatic".

There is a register that displays whether and which switch has been operated since the last time this register has been read. When reading this register, all bits are reset to zero. If the position of a switch has been altered several times, e.g. from AUTO to OFF and back to AUTO, a change will be displayed, anyway.

All digital outputs can be configured so that they will assume a defined state (‘safe state’) if the module has not received valid bus telegrams via the Modbus for a certain time. These predefined states are set separately for each output, whereas the time until activating the safe state is common for all outputs of a module.

**Note: The time for triggering the 'safe state' should not be too short in order to avoid malfunctions as they can occur, e.g., when another device which is connected to the bus fails and will so cause time-outs.**

**Digital inputs:**

The control of the digital inputs will be done with 24 V switched by external dry contacts that are connected to the module via terminals.

The reference potential is defined via the COM terminals and can be both, 0 volts and 24 volts, i.e. that reference potential for the inputs has to be connected anyway. When using a reference potential of +24 volts, a control of the digital inputs with 0 V potential can be realized.

Using the settings in Modbus registers, you can select open circuit or closed-circuit principle for each input separately. Also the color of each of the 16 LEDs is adjustable via a Modbus configuration register, either red, green or orange.

Furthermore, the LEDs can be controlled via Modbus commands, provided that this option previously has been defined in a configuration register. This setting can be made individually for each LED.

The digital inputs can be used as counters, but only for DC signals. For each input, a prescaler may be adjusted in order to count, e.g., just every second or third pulse. A subsequent change of the prescaler also results in a (retroactive) amendment of the corresponding counter values. The pulse duration must be at least 10 ms to be reliably detected.

For AC control of the inputs, the edge detection has to be delayed via configuration registers (see registers R1101 and R1111). In case of 50 Hz, this value should be set to at least 40 ms in order to avoid the counting of false detections. The maximum counter value when using a prescaler of 1 is 65,535 (which is equivalent to $2^{16}$-1).

There is a register that displays whether and which DI has changed since the last time this register has been read. When reading this register, all bits are reset to zero automatically. If a DI's status has altered several times, e.g. from 0 to 1 and back to 0, a change will be signalized, anyway.

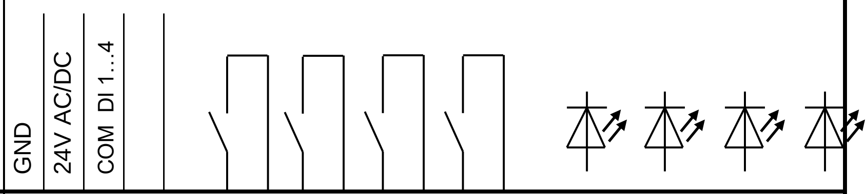
Regarding the system configuration (addressing, maximum number of modules connected to a Modbus Master interface, installation, connection to the bus etc.), please follow the instructions in the chapter ***Configuration***.

**Important technical data:**

| | |
|---|---|
| Power supply: | 24 V AC or DC, connection via terminals |
| Current consumption: | typically 68 mA (DC), 152 mA (AC) with all relay outputs activated |
| | |
| Specifications digital outputs: | Relay outputs (NO contact), max. 250 VAC) |
| Characteristics (Resistive Load): | |
| Initial contact resistance | 100mΩ (at 1A / 24 VDC) |
| Rated load | 3 A at 250 VAC / 30 VDC |
| Max. switching voltage | 277 VAC, 30 VDC |
| Max. switching capacity | 830 VA (AC), 90 W (DC) |
| Endurance | $1x10^5$ ops (Rated Load) |
| Inductive loads | should be avoided as far as possible, or be suppressed at the source, respectively. |

## Overview terminal assignment:

For activation of digital inputs use 24V AC/DC



| romod 4 DIO-R | GND | 24V AC/DC | COM DI 1...4 | DO 1 | DO 2 | DO 3 | DO 4 | DI 1 | DI 2 | DI 3 | DI 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DO No. 1-4 | | | | DO 1 | DO 2 | DO 3 | DO 4 | DI 1 | DI 2 | DI 3 | DI 4 |
| Terminal: | | | | 10, 11 | 12, 13 | 14, 15 | 16, 17 | | | | |
| DI No. 1-4 and COM | | | | | | | | | | | |
| Terminal: | | | 23 | | | | | 24 | 25 | 26 | 27 |
| Power supply | | | | | | | | | | | |
| Terminal: | 1 | 2 | | | | | | | | | |

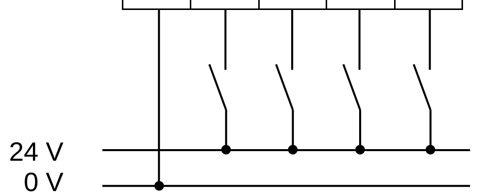
***Important:*** **The signals to be switched must have the same phasing.**

| **Modbus Connection** | **Terminal No.** | | |
|---|---|---|---|
| I-GND | 3 | | |
| A (+) | | 4 | |
| B (-) | | | 5 |

*Examples for activating the digital inputs with reference potential of 0V and 24V:*

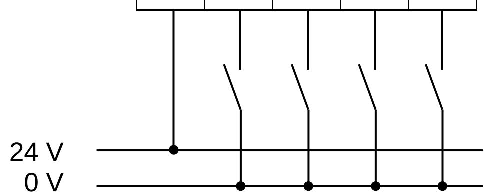
Activating DI with "positive potential" (24 Volts):

| COM | DI1 | DI2 | DI3 | DI4 |
|---|---|---|---|---|
| 23 | 24 | 25 | 26 | 27 |




Activating DI with "negative potential" (0 Volts):

| COM | DI1 | DI2 | DI3 | DI4 |
|---|---|---|---|---|
| 23 | 24 | 25 | 26 | 27 |



## 5.5 Digital output module with relay outputs 4 DO-R


The digital output module **romod 4 DO-R** is a Local Override/Indication Device (LO/ID) which is used to control four lighting circuits, or other digital actuators. By means of the integrated push buttons, it provides the ability of manual override of the DOs which are usually controlled via Modbus commands.

The relay outputs provide the normally open contact of each relay and will be contacted via terminals. They are implemented using **bistable relays**.

For each DO there are two LEDs present for indicating the status. The left LED signalizes whether the output is controlled via Modbus commands or whether it is manually overridden by the push button, whereas the right LED indicates the output's state (ON or OFF).

Changing between the modes ‘Automatic’ and ‘Manual’ is done by holding down the push button. The time required for this can be set together for all four channels. If a button is pressed for a too short time, the left LED ('Automatic') flashes orange for one single time shortly after releasing the button. If, however, the channel is blocked for manual override due to the settings in the mask, this LED flashes permanently during the button is pressed.

There is a register available that shows whether and which push button has been pressed since the last time this register has been read. When reading this register, all bits will be reset to zero. The current state of the push buttons and the outputs as well can also be read out via registers.

Furthermore, via a register there can be configured whether the outputs shall start in automatic mode or manually overridden (OFF). In addition, a delay time can be defined, which must elapse between the switching of two outputs at least. Thus, the system perturbations resulting from the switching operations can be reduced.

All digital outputs can be configured so that they will assume a defined state (‘safe state’) if the module has not received valid bus telegrams via the Modbus for a certain time. These predefined states are set separately for each output, whereas the time until activating the safe state is common for all outputs of a module.

**Note: The time for triggering the 'safe state' should not be too short in order to avoid malfunctions as they can occur, e.g., when another device which is connected to the bus fails and will so cause time-outs.**

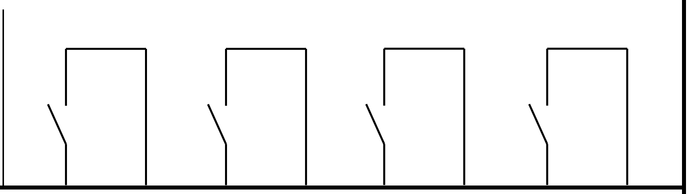
Regarding the system configuration (addressing, maximum number of modules connected to a Modbus Master interface, installation, connection to the bus etc.), please follow the instructions in the chapter ***Configuration***.

**Important technical data:**

| | |
|---|---|
| Power supply: | 24 V AC or DC, connection via terminals |
| Current consumption: | typically 14 mA (DC), 40 mA (AC) |
| | |
| Specifications digital outputs: | Relay outputs (NO contact), max. 250 VAC) |
| Characteristics (Resistive Load): | |
| Initial contact resistance | 100mΩ (at 1A / 6 VDC) |
| Minimum switching current | 100mA (at min. 5 VDC) |
| Rated load | 16 A at 250 VAC |
| Max. switching voltage | 277 VAC |
| Max. switching capacity | 4432 VA (AC) |
| Endurance | $2.5 \times 10^4$ ops (Rated Load) |
| Inductive loads | should be avoided as far as possible, or be suppressed at the source, respectively. |

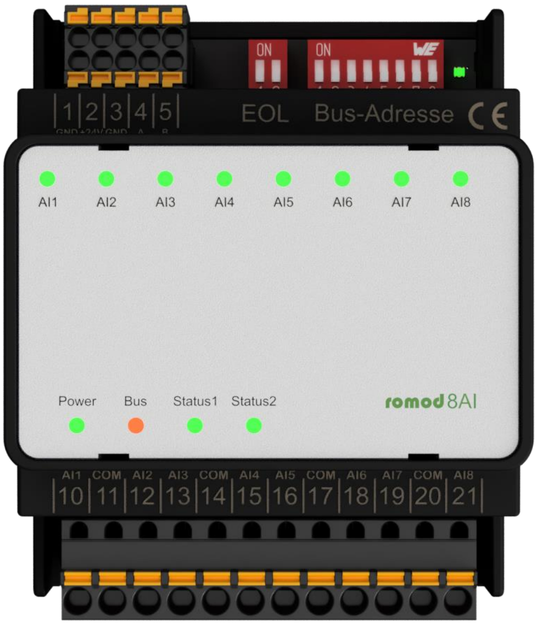
**Overview terminal assignment:**

| **romod 4 DO-R** | Output voltages of DOs are potential-free | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GND | 24V AC/DC | not used | not used | | | | | | | | |
| DO No. 1-4 | | | | | DO 1 | | DO 2 | | DO 3 | | DO 4 | |
| Terminal: | | | | | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| Power supply | | | | | | | | | | | | |
| Terminal: | 1 | 2 | | | | | | | | | | |



| **Modbus Connection** | **Terminal No.** | | |
|---|---|---|---|
| I-GND | 3 | | |
| A (+) | | 4 | |
| B (-) | | | 5 |

## 5.6 Analog input module 8 AI




The analog input module **romod 8 AI** is used for connecting, measuring and signaling of up to eight analog sensor values.

The sensors will be connected to the module via terminals.

The reference potential for the analog inputs is available at the GND terminals. For two AIs there is available one GND terminal in each case. All ground pins are connected to each other internally and to the GND of the power supply, as well.

Active signals (0-10V) as well as various passive sensor types (e.g. Pt1000, Ni1000) may be connected to the module. If an input is configured for 0..10V signals, its value will be signalized by the concerned status LED of the channel in light / dark operating mode in green color.
When using resistive sensors, a wire break of the sensor (open analog input) will be signalized by the LED of the channel in red color, otherwise it will be lit green dimmed. Unused inputs should be configured for 0-10V signals and connected to GND potential.

Regarding the system configuration (addressing, maximum number of modules connected to a Modbus Master interface, installation, connection to the bus etc.), please follow the instructions in the chapter ***Configuration***.

**Supported types of sensors:**

| Type of sensor | Measured range | | Unit of the measured value |
|---|---|---|---|
| | from | to | |
| 0..10 V | 0 V | 10 V | mV (1000 = 1,000 V) |
| 0…5 kΩ | 0 Ω | 5000 Ω | Ω/10 (1000 = 100,0 Ω) |
| 0…15 kΩ | 0 Ω | 15000 Ω | Ω (1000 = 1000 Ω) |
| Pt 100 | -50,0 °C | 199,9 °C | °C/10 (1000 = 100,0 °C) |
| Pt 1000 | -50,0 °C | 199,9 °C | °C/10 (1000 = 100,0 °C) |
| Ni 1000 | -50,0 °C | 199,9 °C | °C/10 (1000 = 100,0 °C) |
| Ni 1000 L&G | -50,0 °C | 199,9 °C | °C/10 (1000 = 100,0 °C) |
| KTY81-110 | -55,0 °C | 149,9 °C | °C/10 (1000 = 100,0 °C) |
| KTY81-210 | -55,0 °C | 149,9 °C | °C/10 (1000 = 100,0 °C) |
| NTC 20k | -50,0 °C | 149,9 °C | °C/10 (1000 = 100,0 °C) |
| NTC 10k | -50,0 °C | 149,9 °C | °C/10 (1000 = 100,0 °C) |
| KP10 / LM235 | -50,0 °C | 149,9 °C | °C/10 (1000 = 100,0 °C) |

**<u>Important technical data:</u>**

| | |
|---|---|
| Power supply: | 24 V AC or DC, connection via terminals |
| Current consumption: | max. 40 mA (DC), 80 mA (AC) |
| Resolution AI | 10 Bit |
| Impedance | 20 MΩ |

**<u>Overview terminal assignment:</u>**

| romod 8 AI | GND | 24V AC/DC | GND for AIs | | | | AIs for active sensors 0..10 V and various types of RTD sensors | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AI No. 1-8 | | | | | | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | |
| Terminal: | | | | | | | 10 | | 12 | | 13 | | 15 | | 16 | | 18 | | 19 | | 21 | |
| GND for AIs | | | | | | | | | | | | | | | | | | | | | | |
| Terminal: | | | 11 | 14 | 17 | 20 | | | | | | | | | | | | | | | | |
| Power supply | | | | | | | | | | | | | | | | | | | | | | |
| Terminal: | 1 | 2 | | | | | | | | | | | | | | | | | | | | |

| Modbus Connection | Terminal No. | | |
|---|---|---|---|
| I-GND | 3 | | |
| A (+) | | 4 | |
| B (-) | | | 5 |

## 5.7 Analog output module 8 AO


The analog output module **romod 8 AO** is a Local Override/Indication Device (LO/ID) which is used to provide eight 0-10V control signals. These may be utilized, e.g., for controlling heating valves, dampers or frequency converters etc. By means of the integrated switches and potentiometers, it provides the ability of manual override of the AOs which are usually controlled via Modbus commands.

The analog 0-10V outputs are provided by the module via terminals. The reference potential for the analog outputs is available at the GND terminals. For two AOs there is available one GND terminal in each case. All ground pins are connected to each other internally and to the GND of the power supply, as well.

The current positions of the switches ('Auto' or 'potentiometer') can be read from a register. Likewise, the potentiometers' positions can be polled from registers.

There is a register that displays whether and which switch has been operated since the last time this register has been read. When reading this register, all bits are reset to zero. If the position of a switch has been altered several times, e.g. from AUTO to POT and back to AUTO, a change will be displayed, anyway.

Also changes in the values of the potentiometers can be seen from a register. That register shows which potentiometer has been moved since the last time this register has been read. The corresponding analog value then can be polled specifically. Doing so, the bus cycle time may be reduced significantly.

All analog outputs can be configured so that they will assume a defined state (‘safe state’) if the module has not received valid bus telegrams via the Modbus for a certain time. These predefined states are set separately for each output, whereas the time until activating the safe state is common for all outputs of a module.

**Note: The time for triggering the 'safe state' should not be too short in order to avoid malfunctions as they can occur, e.g., when another device which is connected to the bus fails and will so cause time-outs.**

Regarding the system configuration (addressing, maximum number of modules connected to a Modbus Master interface, installation, connection to the bus etc.), please follow the instructions in the chapter ***Configuration***.

**Important technical data:**

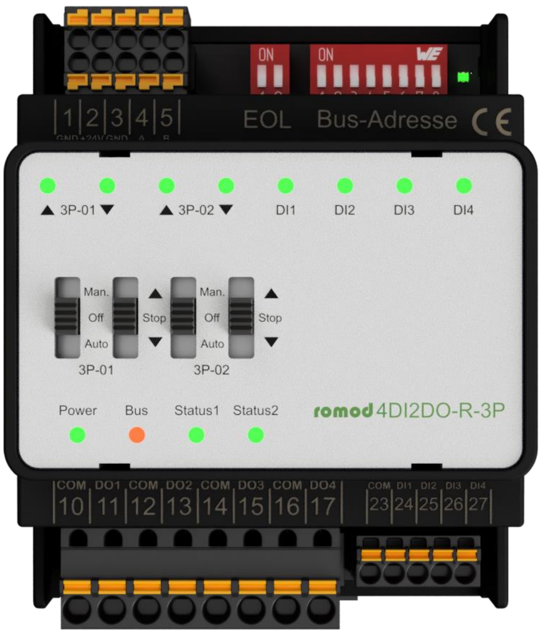
| | |
|---|---|
| Power supply: | 24 V AC or DC, connection via terminals |
| Current consumption: | max. 120 mA (DC), 160 mA (AC) with all analog outputs loaded |
| Capacity of the outputs | 10 mA each (short circuit proof) |
| Resolution AO | 10 Bit |
| Linearity error | < +/- 2% |

**Overview terminal assignment:**

| **romod 8 AO** | GND | 24V AC/DC | GND for AOs | | | | Output voltage AOs 0..10 V DC | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AO No. 1-8 | | | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Terminal: | | | | | | | 10 | 12 | 13 | 15 | 16 | 18 | 19 | 21 |
| GND for AOs | | | | | | | | | | | | | | |
| Terminal: | | | 11 | 14 | 17 | 20 | | | | | | | | |
| Power supply | | | | | | | | | | | | | | |
| Terminal: | 1 | 2 | | | | | | | | | | | | |

| **Modbus Connection** | **Terminal No.** | | |
|---|---|---|---|
| I-GND | 3 | | |
| A (+) | | 4 | |
| B (-) | | | 5 |

## 5.8 Digital input/output module with relay outputs 4DI2DO-R-3P




The module **romod 4DI2DO-R-3P** provides 2x 3-point relay outputs 230 V / 3 A in two groups for controlling 2 OPEN-STOP-CLOSE drives or similar. The four digital inputs can be used to connect and signal four messages, such as operating messages, error messages or status messages.

Furthermore, the **romod 4DI2DO-R-3P** is a Local Override/Indication Device (LO/ID), i.e. by means of the integrated switches, the module provides the ability of manual override of the DOs which are usually controlled via Modbus commands.

Two switches belong to each of the two 3-point outputs. One is used to select between automatic mode (activation of the DO via bus command), OFF and manual override ON. The position of the other switch (OPEN-STOP-CLOSE) only affects the outputs if the first switch is in the "Manual" position.

Two LEDs are assigned to each of the two drives, which indicate the direction the blind is moving, as well as the current position of the blind. The meaning can be found in the following table:

| LED ▲ | LED ▼ | Bedeutung |
|---|---|---|
| orange blinking | | moving UP |
| | orange blinking | moving DOWN |
| OFF | OFF | Position 0 ... ≤ 25% |
| OFF | green | Position 25 ... ≤ 50% |
| green | OFF | Position 50 ... ≤ 75% |
| green | green | Position 75 ... ≤ 100% |

While the blind is moving, the green LEDs that are showing the position will flash, too.

**Digital outputs:**

The relay outputs provide the normally open contact of each relay. They will be contacted via terminals.

***Important:*** **The signals to be switched must have the same phasing.**

For each channel, running times for opening and closing the blinds can be parameterized, as well as times for over- and understeering (longer activation than required for the complete opening or closing of the blinds). Delay times for switching the drive on again and switching to the other direction can also be set. All values are stored in non-volatile form in Modbus registers.

***Please note:*** **The configured running times will only work when the outputs are activated via bus commands. However, the switching delays for reversing direction and switching on again are also effective in the manually overridden mode.**

The current positions of the switches can be read out using two registers. Doing so, one register shows the switch position "Manually ON" or “Open” and the other one the switch position "Automatic" or “Close”.

There is a register that displays whether and which switch has been operated since the last time this register has been read. When reading this register, all bits are reset to zero. If the position of a switch has been altered several times, e.g. from AUTO to OFF and back to AUTO, a change will be displayed, anyway.

**Digital inputs:**

The control of the digital inputs will be done with 24 V switched by external dry contacts that are connected to the module via terminals.

The reference potential is defined via the COM terminals and can be both, 0 volts and 24 volts, i.e. that reference potential for the inputs has to be connected anyway. When using a reference potential of +24 volts, a control of the digital inputs with 0 V potential can be realized.

By means of a configuration register, the four digital inputs can be defined for the use of limit switches. When an end position is reached, the drive then will switch off. At the same time, the position of the blind, which is constantly calculated in the module, is corrected to 0% (closed) or 100% (open) depending on the end position. If no end position is reached in automatic mode within the configured run times (open/close run time plus time for oversteering or understeering), the drive, however, will switch off for safety reasons, but not in manually oversteered mode.

Furthermore, the digital inputs can also be configured for controlling the outputs using externally connected switches. Doing so, the outputs can then be controlled in exactly the same way as with the switches on the module. Any configured runtimes are not taken into account – as is also the case in manually overridden operation.

Using the settings in Modbus registers, you can select open circuit or closed-circuit principle for each input separately. Also the color of each of the 16 LEDs is adjustable via a Modbus configuration register, either red, green or orange.

For AC control of the inputs, the edge detection has to be delayed via configuration registers (see registers R1101 and R1111). In case of 50 Hz, this value should be set to at least 40 ms in order to avoid the counting of false detections. The maximum counter value when using a prescaler of 1 is 65,535 (which is equivalent to $2^{16}$-1).

There is a register that displays whether and which DI has changed since the last time this register has been read. When reading this register, all bits are reset to zero automatically. If a DI's status has altered several times, e.g. from 0 to 1 and back to 0, a change will be signalized, anyway.

Regarding the system configuration (addressing, maximum number of modules connected to a Modbus Master interface, installation, connection to the bus etc.), please follow the instructions in the chapter ***Configuration***.

**Important technical data:**

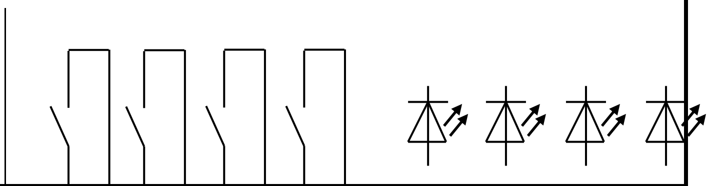
| | |
|---|---|
| Power supply: | 24 V AC or DC, connection via terminals |
| Current consumption: | typically 68 mA (DC), 152 mA (AC) with all relay outputs activated |
| Specifications digital outputs: | Relay outputs (NO contact), max. 250 VAC) |

Characteristics (Resistive Load):

| | |
|---|---|
| Initial contact resistance | 100mΩ (at 1A / 24 VDC) |
| Rated load | 3 A at 250 VAC / 30 VDC |
| Max. switching voltage | 277 VAC, 30 VDC |
| Max. switching capacity | 830 VA (AC), 90 W (DC) |
| Endurance | $1x10^5$ ops (Rated Load) |
| Inductive loads | should be avoided as far as possible, or be suppressed at the source, respectively. |

**Overview terminal assignment:**

For activation of digital inputs use 24V AC/DC



| romod 4DI2DO-R-3P | GND | 24V AC/DC | COM DI 1...4 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DO No. 1-4 | | | | DO 1 | | DO 2 | | DO 3 | | DO 4 | | DI 1 | DI 2 | DI 3 | DI 4 |
| Terminal: | | | | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | | | |
| DI No. 1-4 and COM | | | | | | | | | | | | | | | |
| Terminal: | | | 23 | | | | | | | | | 24 | 25 | 26 | 27 |
| Power supply | | | | | | | | | | | | | | | |
| Terminal: | 1 | 2 | | | | | | | | | | | | | |

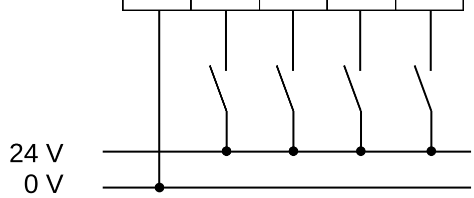
***Important:*** **The signals to be switched must have the same phasing.**

| **Modbus Connection** | **Terminal No.** | | |
|---|---|---|---|
| I-GND | 3 | | |
| A (+) | | 4 | |
| B (-) | | | 5 |

*Examples for activating the digital inputs with reference potential of 0V and 24V:*

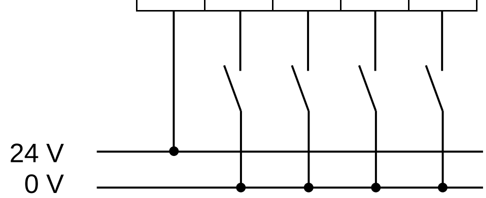
Activating DI with "positive potential" (24 Volts):

| COM | DI1 | DI2 | DI3 | DI4 |
|---|---|---|---|---|
| 23 | 24 | 25 | 26 | 27 |




Activating DI with "negative potential" (0 Volts):

| COM | DI1 | DI2 | DI3 | DI4 |
|---|---|---|---|---|
| 23 | 24 | 25 | 26 | 27 |



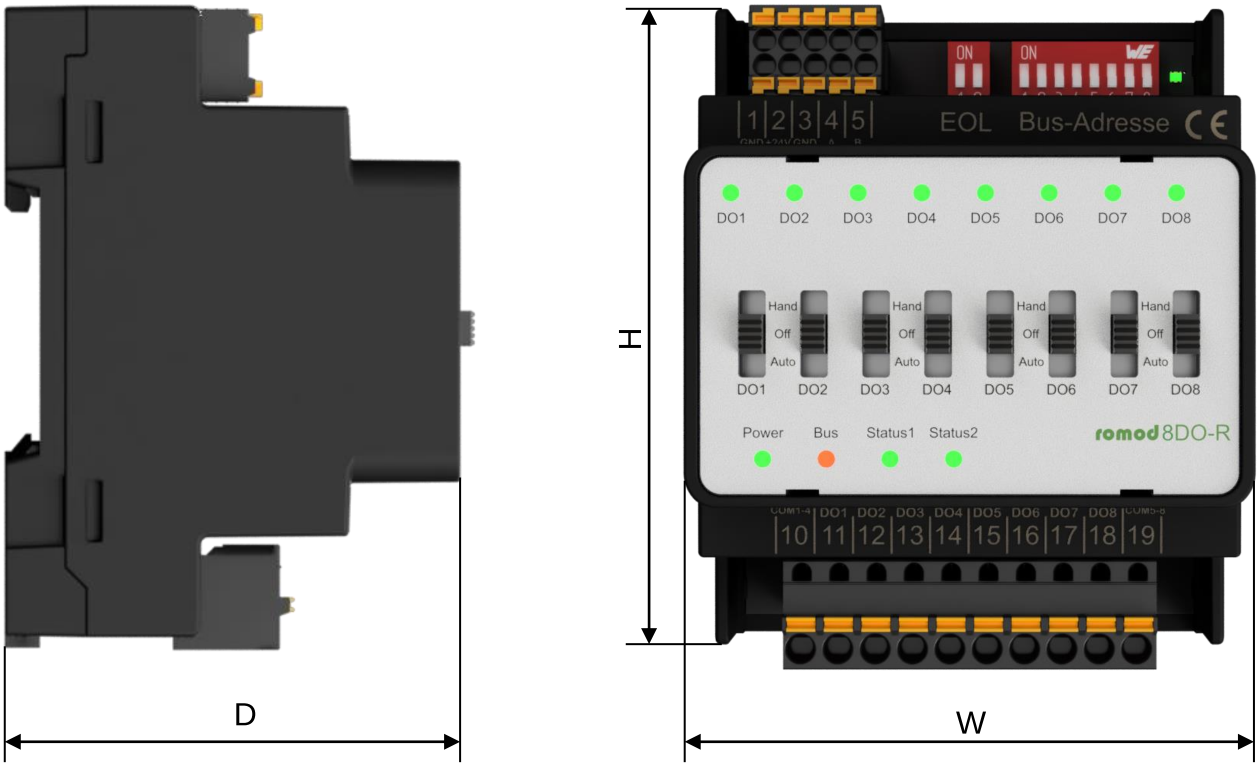
# Appendix

## A) Technical specifications

| | |
|---|---|
| **Supply voltage** | 24 V AC or DC, ± 10% |
| **Current consumption** | |
| 16 DI | max. 150 mA (DC), 220 mA (AC), all DIs loaded |
| 8 DO | typically 21 mA (DC), 60 mA (AC), outputs WITHOUT any load |
| 8 DO-R | typically 85 mA (DC), 220 mA (AC) with all relays activated |
| 4 DIO-R, 4DI2DO-R-3P | typically 68 mA (DC), 152 mA (AC) with all relays activated |
| 4 DO-R | typically 14 mA (DC), 40 mA (AC) |
| 8 AI | max. 40 mA (DC), 80 mA (AC) |
| 8 AO | max. 120 mA (DC), 160 mA (AC) with all analog outputs loaded |
| **Power dissipation** | |
| 16 DI | max. 3.6 W (DC), 5.3 W (AC), all DIs loaded |
| 8 DO | max. 2.1 W (DC), 3.1 W (AC) with max. load of outputs (8x 0,5 A) |
| 8 DO-R | max. 2.1 W (DC), 5.3 W (AC) with all outputs activated |
| 4 DIO-R, 4DI2DO-R-3P | max. 1.7 W (DC), 3.7 W (AC) with all outputs activated |
| 4 DO-R | max. 0.4 W (DC), 1.0 W (AC) |
| 8 AI | max. 1.0 W (DC), 1.9 W (AC) |
| 8 AO | max. 1.8 W (DC), 3.9 W (AC) with all analog outputs loaded |
| **Counting puls** (only digital inputs) | duration min. 10 ms, only for DC signals |
| **Max. counter value** (digital inputs) | 65,535 (= $2^{16}$-1) |
| **Bus interface** | RS485 |
| **Supported baud rates** (Autobauding) | 9,600 Baud, 19,200 Baud, 38,400 Baud, 57,600 Baud |
| **Bus cycle time** | individually depending on the baud rate and the number of data points that will be addressed |
| **Memory** | µPC internally |
| **Max. number of write cycles** | Configuration settings such as setting the LED colors, inverting the inputs, or upshift and downshift times are stored in the internal EEPROM and can be overwritten up to 100,000 times. |
| **Protocol** | Modbus RTU (RS485) |
| **Serial port parameter setting** | ***8,N,1*** |
| **Inputs and outputs** | see corresponding documentation of the respective modules |
| **Environmental conditions** | |
| **Operating temperature** | 0...50°C |
| **Transport and storage temperature** | 0...70°C |
| **Relative humidity** | 10...90%, non-condensing |
| **Protection class** | IP 20 |
| **Dimensions** | (for exact dimensions see appendix B) |

# B) Dimensions and weights

The dimensions of the modules can be seen from the following figures and the table below:




| Type | H | W | D | | Weight |
|---|---|---|---|---|---|
| | | | | | |
| **16 DI** | **92** | **72** | **70** | | 137 |
| **8 DO** | **92** | **72** | **70** | | 151 |
| **8 DO-R** | **92** | **72** | **70** | | 171 |
| **4 DIO-R** | **92** | **72** | **70** | | 156 |
| **4 DO-R** | **92** | **72** | **70** | | 171 |
| **8 AI** | **92** | **72** | **70** | | 146 |
| **8 AO** | **92** | **72** | **70** | | 158 |
| **4DI2DO-R-3P** | **92** | **72** | **70** | | 156 |

*All dimensions in mm, weight in grams*

## C) Wiring diagrams

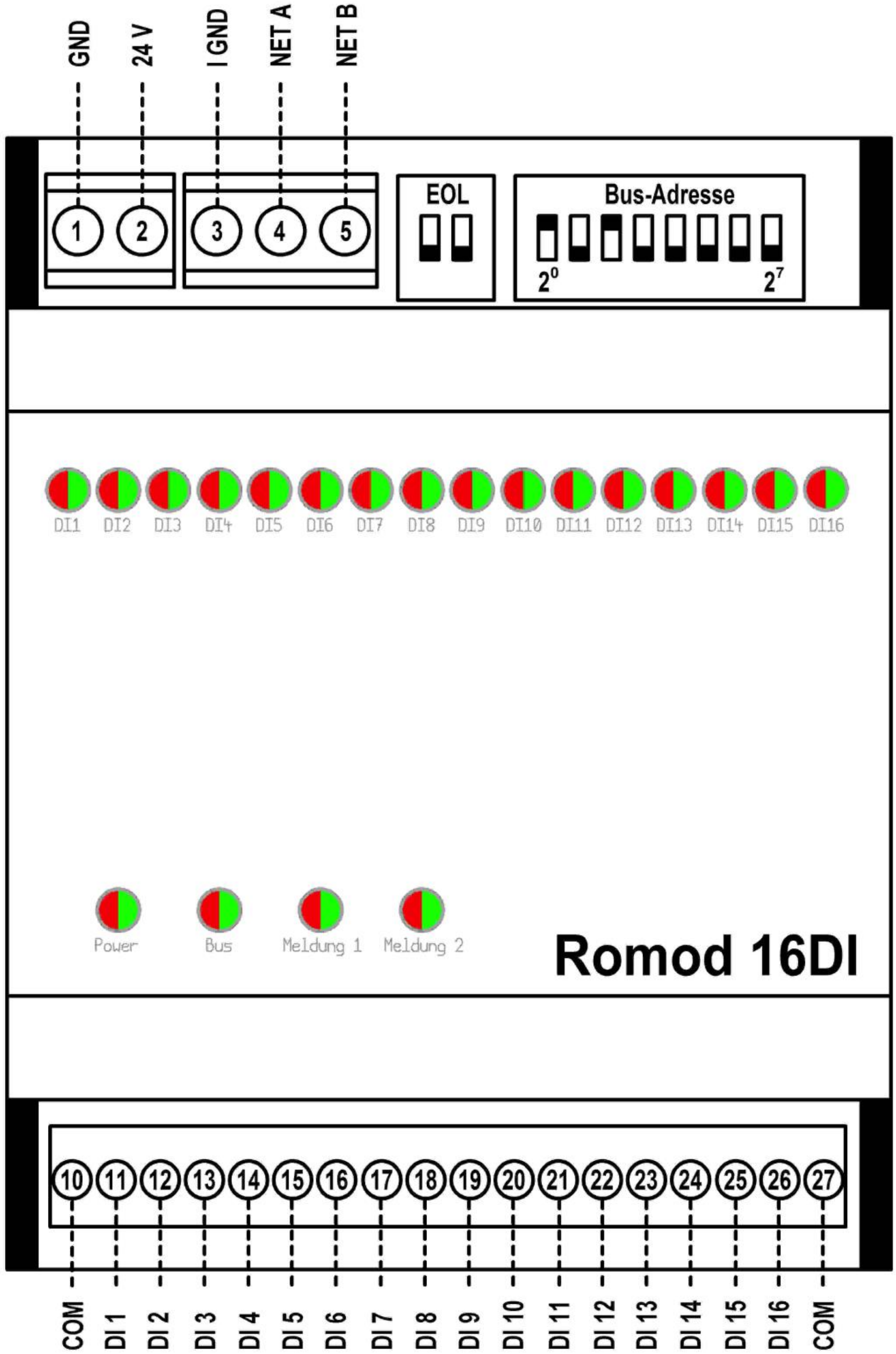



Fig. C-1 : romod 16 DI

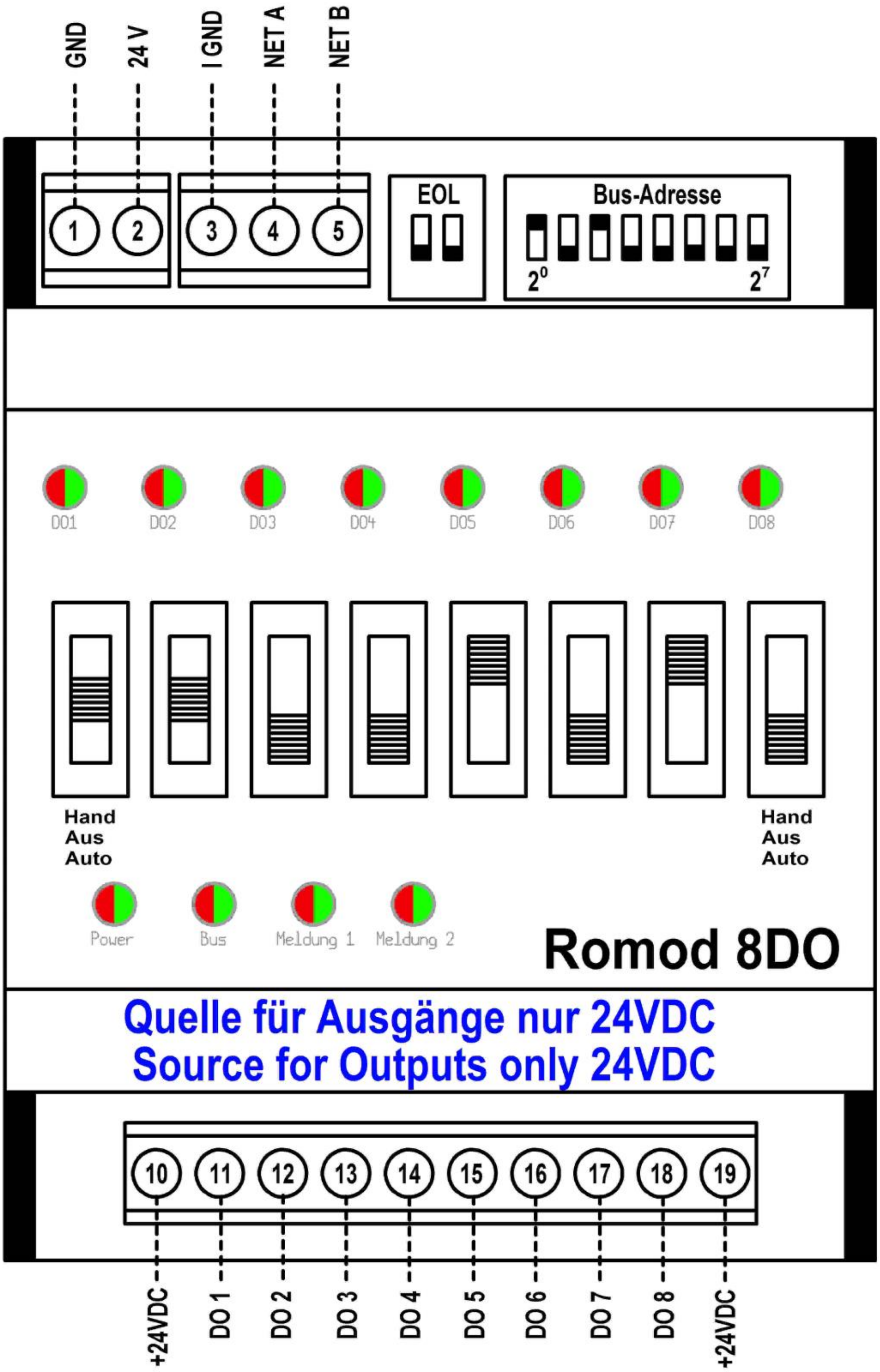
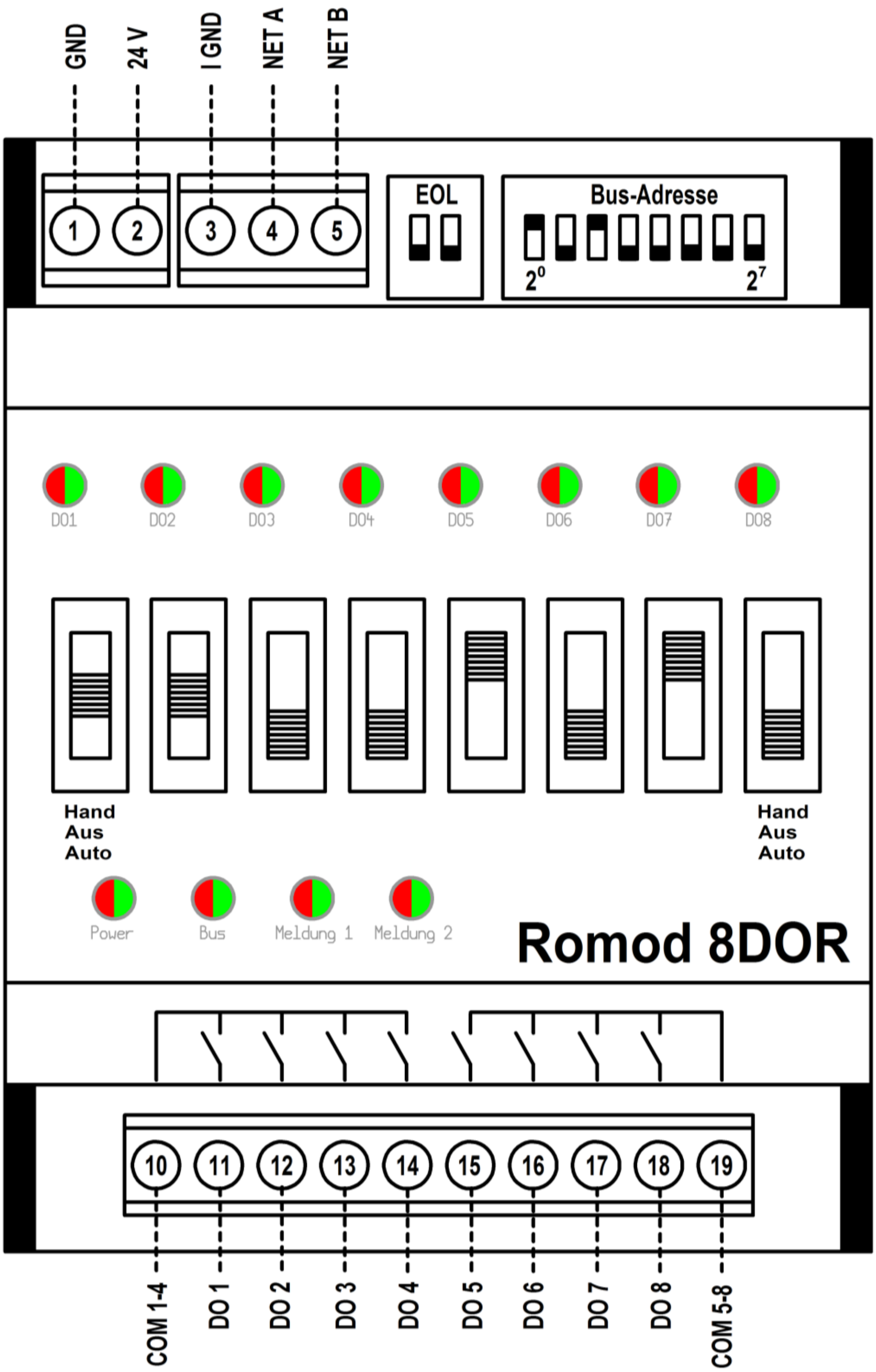
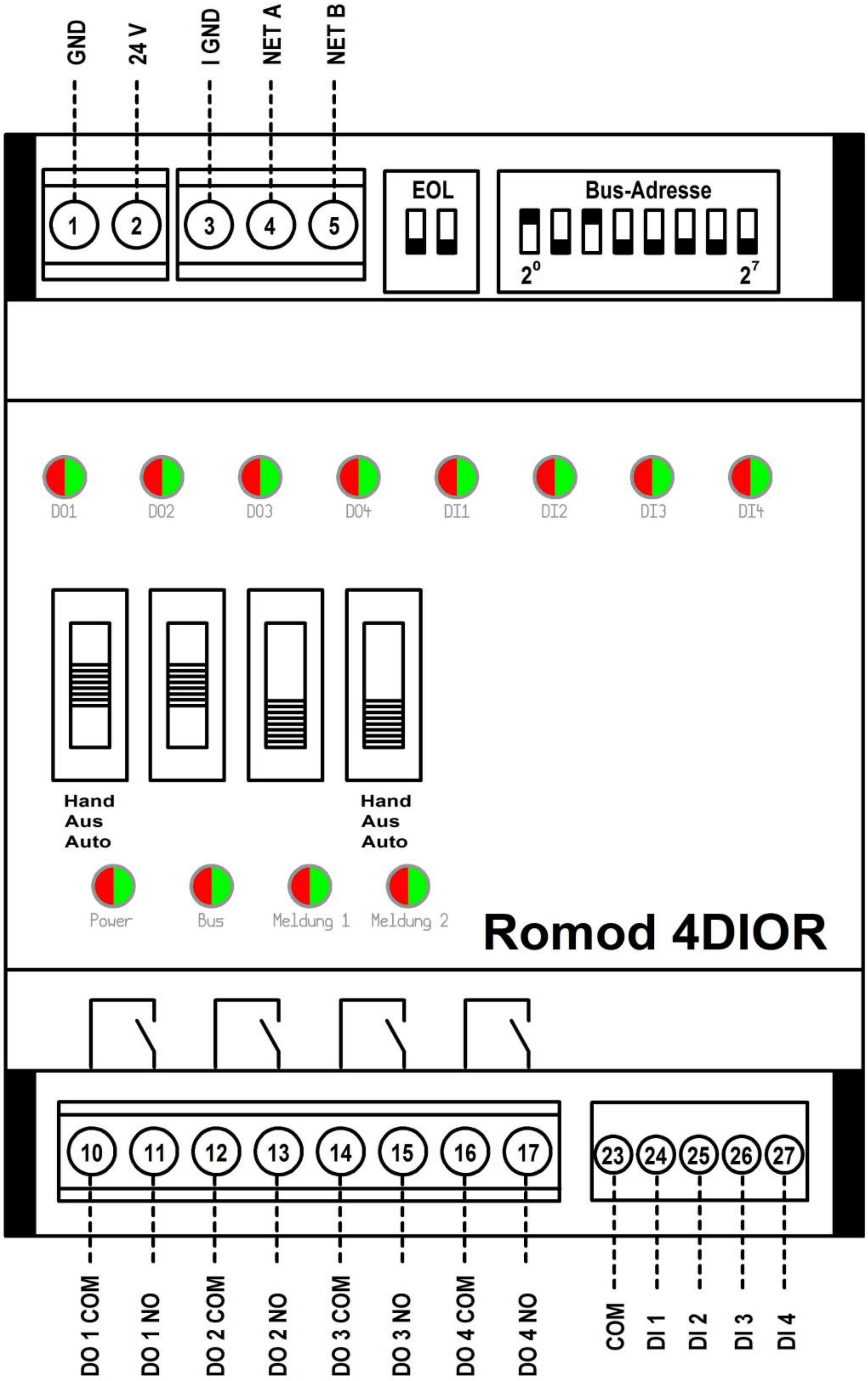



Fig. C-2 : romod 8 DO




***Important:***
**The signals to be switched must have the same phasing.**

Fig. C-3 : romod 8 DO-R




***Important:***
**The signals to be switched must have the same phasing.**

Fig. C-4 : romod 4 DIO-R

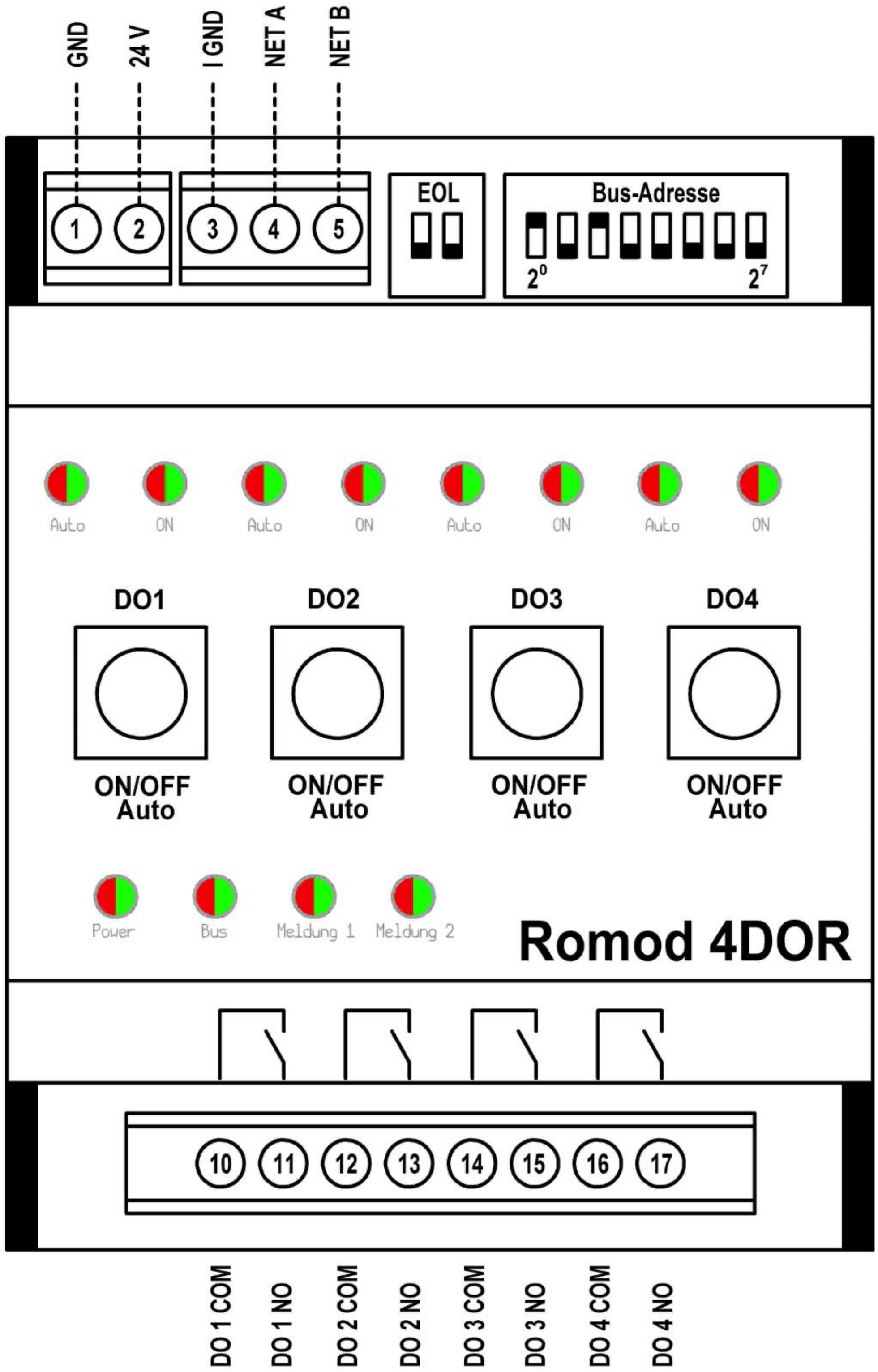



Fig. C-5 : romod 4 DO-R

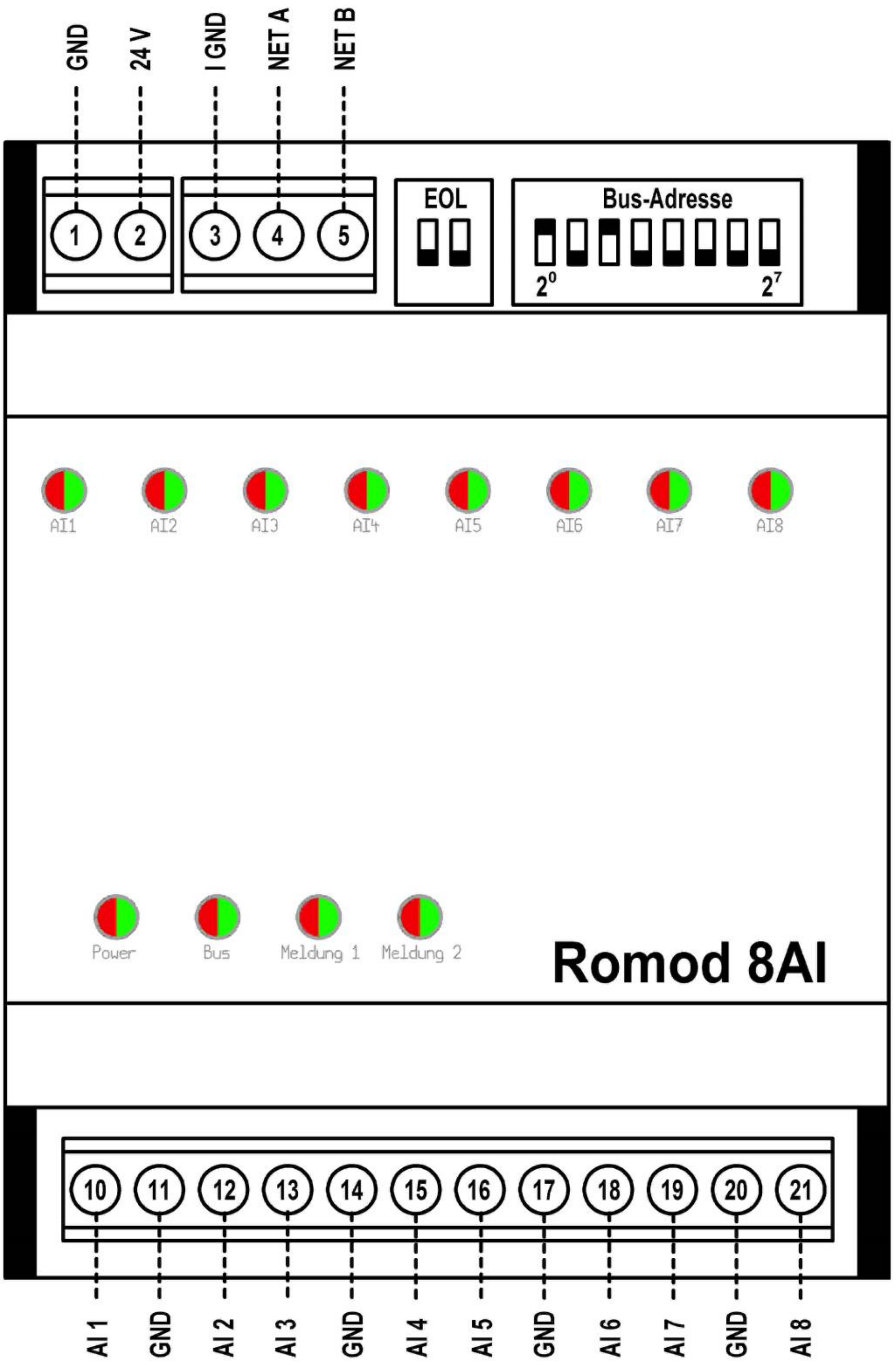



Fig. C-6 : romod 8 AI

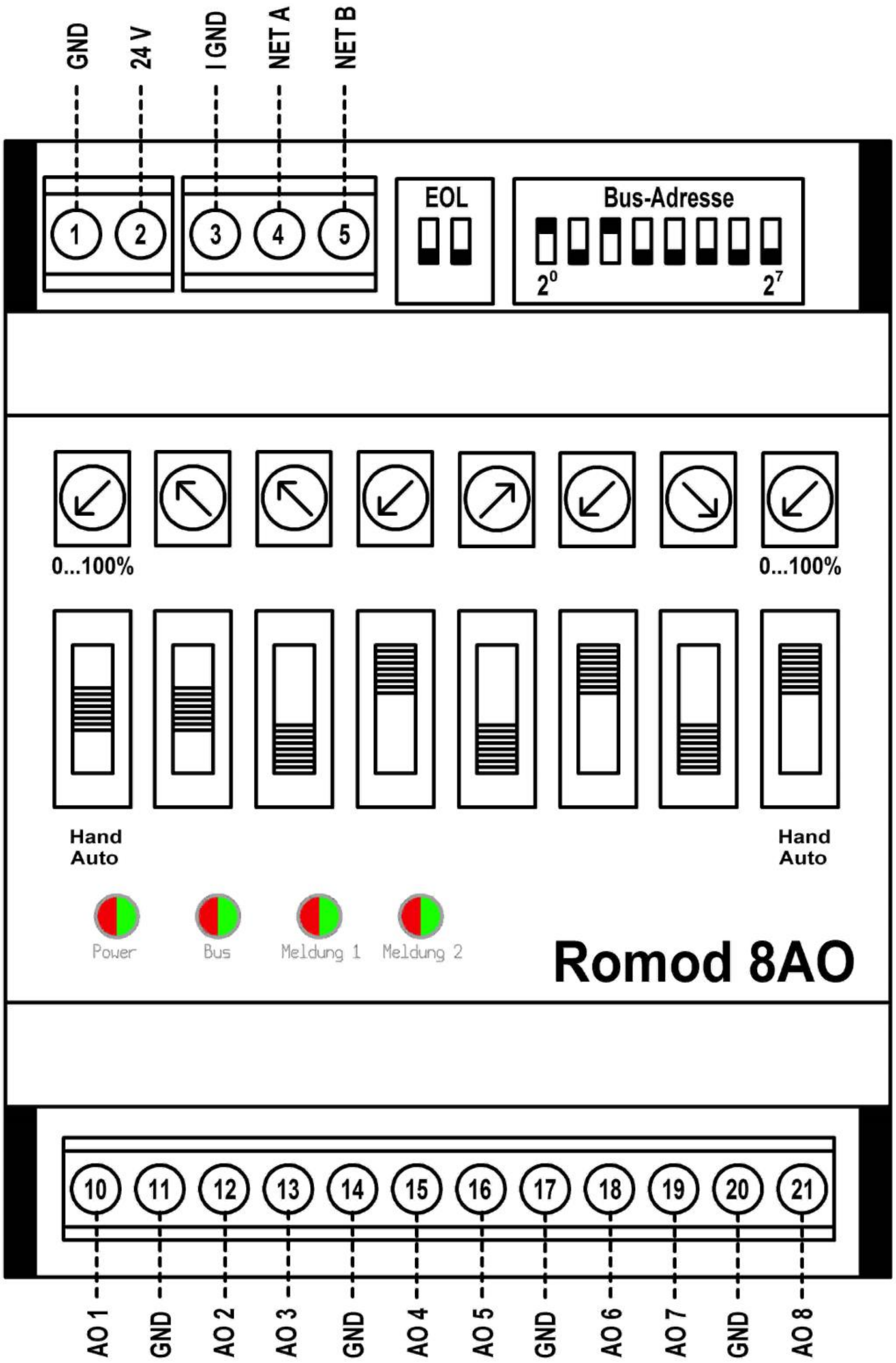
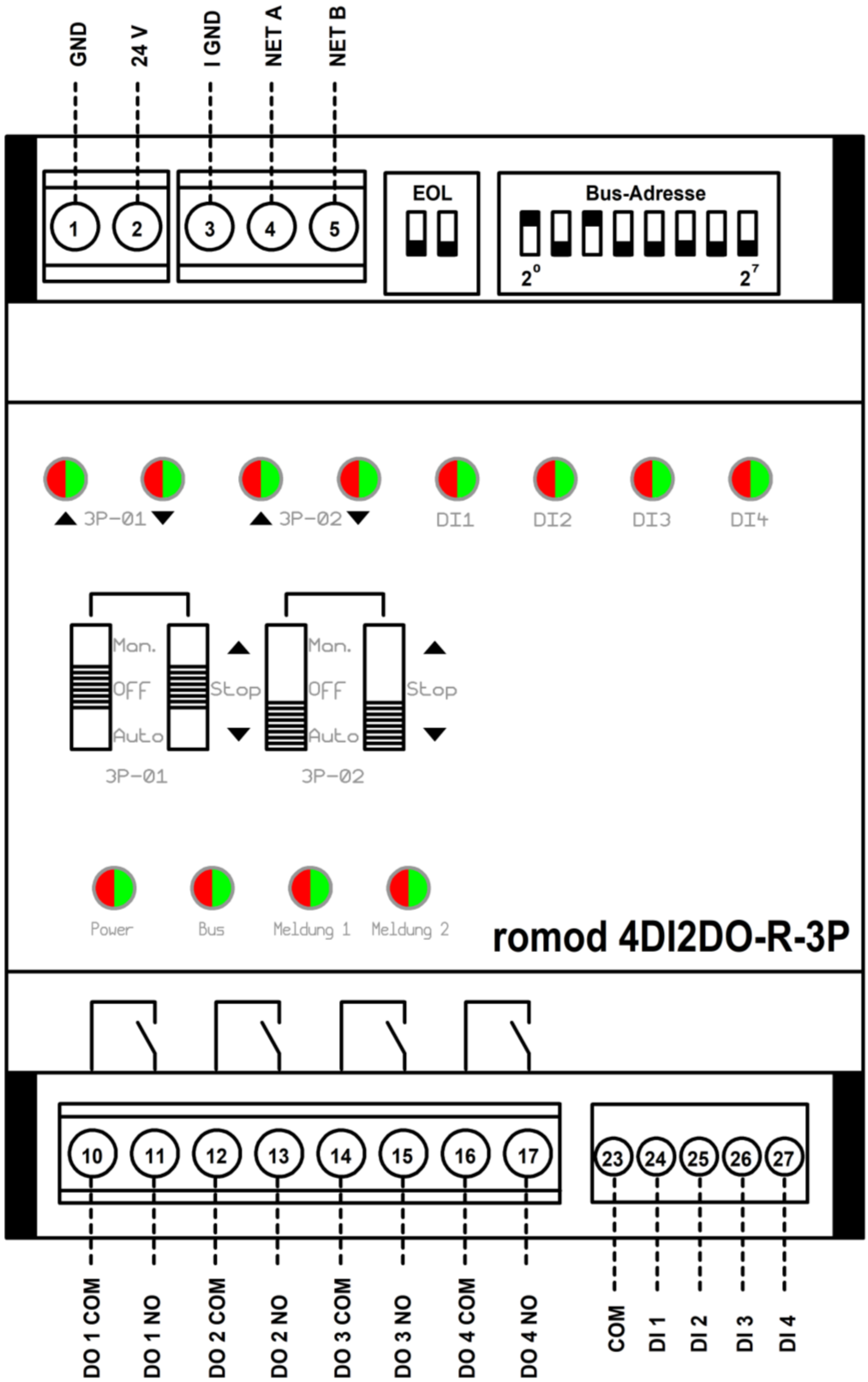



Fig. C-7 : romod 8 AO




***Important:***
**The signals to be switched must have the same phasing.**

Abb. C-8 : romod 4DI2DO-R-3P

## D) Types and Registers overview

| Type: romod… | Description: |
|---|---|
| | |
| 16 DI | 16 DI rail mounted module, 16x LEDs indicating DI states |
| | |
| | |
| 8 DO | 8 DO rail mounted module, 8x LEDs indicating DO states,<br>8x three-position switches ‘Auto-OFF-ON’, outputs +24 Volts |
| | |
| | |
| 8 DO-R | 8 DO rail mounted module, 8x LEDs indicating DO states,<br>8x three-position switches ‘Auto-OFF-ON’, relay outputs (NO) |
| | |
| | |
| 4 DIO-R | 4 DI / DO rail mounted module, 4x LEDs indicating DI states,<br>4x LEDs indicating DO states, 4x three-position switches<br>‘Auto-OFF-ON’, relay outputs (NO) |
| | |
| | |
| 4 DO-R | 4 DO rail mounted module, 8x LEDs indicating DO states and<br>manual/automatic operation mode, 4x push button switches,<br>4x relay outputs (NO), bistable relays |
| | |
| | |
| 8 AI | 8 AI rail mounted module, 8x LEDs indicating AI states,<br>inputs active (0..10 V) and passive (RTD) configurable |
| | |
| | |
| 8 AO | 8 AO rail mounted module 0..10 V,<br>8x 2-positon switches ‘Auto-Pot’, 8x potentiometers |
| | |
| | |
| 4DI2DO-R-3P | 4 DI / 2x 2 DO (2x 3-point outputs) rail mounted module,<br>4x LEDs indicating DI states, 4x LEDs indicating DO states,<br>2x three-position switches ‘auto-off-manual’, 2x three-position<br>switches ‘open-stop-close’, relay outputs (NO) |
| | |

# D1 - Overview of Registers 16DI Module

In the following descriptions of the register settings, ***default values***, if any, are ***highlighted***. These settings are suitable for most applications and at the initial commissioning.
The values in the underlined registers are stored in non-volatile memory. These registers should not be written continuously.

**(*) The registers marked with this asterisk can be read or written only individually, not as a contiguous block.**

| **R101 (*)** | | **Value Hex** | **Status of Digital Inputs** |
|---|---|---|---|
| | DI No. | (DI16 … DI1) | The bits of this register indicate the current status of the digital inputs. The least significant bit is associated with DI1, followed by the other ones up to DI16. |
| | 1 | 00 01 | DI 1 |
| | 2 | 00 02 | DI 2 |
| | 3 | 00 04 | DI 3 |
| | 4 | 00 08 | DI 4 |
| | 5 | 00 10 | DI 5 |
| | 6 | 00 20 | DI 6 |
| | 7 | 00 40 | DI 7 |
| | 8 | 00 80 | DI 8 |
| | 9 | 01 00 | DI 9 |
| | 10 | 02 00 | DI 10 |
| | 11 | 04 00 | DI 11 |
| | 12 | 08 00 | DI 12 |
| | 13 | 10 00 | DI 13 |
| | 14 | 20 00 | DI 14 |
| | 15 | 40 00 | DI 15 |
| | 16 | 80 00 | DI 16 |

| **R1100(*)** | | **Value Hex** | **Inverting Digital Inputs** |
|---|---|---|---|
| | DI No. | (DI16 … DI1) | Using this register, the 16 digital inputs can be inverted individually. Each DI is assigned to a bit of the register. The assignment corresponds to that of the register R101 (current status of the digital inputs). The settings of this register are stored in non-volatile memory. |
| | | ***00 00*** | ***No DI is inverted*** |
| | 1 | 00 01 | Inverting DI 1 |
| | 2 | 00 02 | Inverting DI 2 |
| | 3 | 00 04 | Inverting DI 3 |
| | 4 | 00 08 | Inverting DI 4 |
| | 5 | 00 10 | Inverting DI 5 |
| | 6 | 00 20 | Inverting DI 6 |
| | 7 | 00 40 | Inverting DI 7 |
| | 8 | 00 80 | Inverting DI 8 |
| | 9 | 01 00 | Inverting DI 9 |
| | 10 | 02 00 | Inverting DI 10 |
| | 11 | 04 00 | Inverting DI 11 |
| | 12 | 08 00 | Inverting DI 12 |
| | 13 | 10 00 | Inverting DI 13 |
| | 14 | 20 00 | Inverting DI 14 |
| | 15 | 40 00 | Inverting DI 15 |
| | 16 | 80 00 | Inverting DI 16 |

| R100 (*) | | Value Hex | Change flag Digital Inputs |
|---|---|---|---|
| | DI No. | (DI16 … DI1) | The bits of this register are set when the state of a DI has changed. When the register has been read, all bits are automatically reset to zero. Each DI is assigned to a bit of the register. The assignment corresponds to that of the register R101 (current status of the digital inputs). |
| | 1 | 00 01 | Change of DI 1 |
| | … | … | … |
| | 16 | 80 00 | Change of DI 16 |

| R1235(*) | | Value Hex | Setting the Mask for DI indicating LEDs (red) |
|---|---|---|---|
| | DI No. | (DI16 … DI1) | If the LEDs that are usually indicating the state of the DIs shall be driven by means of bus commands instead, the bits of this register have to be set to 0. Controlling the LEDs via bus then can be done with the register R1221. Each DI is assigned to a bit of the register. The assignment corresponds to that of the register R101 (current status of the digital inputs). |
| | | ***FF FF*** | ***all LEDs are controlled via the input signals of the DIs*** |
| | 1 | FF FE | Driving LED DI 1 (red) via bus command |
| | … | … | … |
| | 16 | 7F FF | Driving LED DI 16 (red) via bus command |

| R1236(*) | | Value Hex | Setting the Mask for DI indicating LEDs (green) |
|---|---|---|---|
| | DI No. | (DI16 … DI1) | If the LEDs that are usually indicating the state of the DIs shall be driven by means of bus commands instead, the bits of this register have to be set to 0. Controlling the LEDs via bus then can be done with the register R1222. Each DI is assigned to a bit of the register. The assignment corresponds to that of the register R101 (current status of the digital inputs). |
| | | ***FF FF*** | ***all LEDs are controlled via the input signals of the DIs*** |
| | 1 | FF FE | Driving LED DI 1 (green) via bus command |
| | … | … | … |
| | 16 | 7F FF | Driving LED DI 16 (green) via bus command |

| R1221(*) | | Value Hex | Controlling the LEDs (red) via bus command |
|---|---|---|---|
| | DI No. | (DI16 … DI1) | Prior condition for this mode of operation is that the corresponding bits in the register R1235 are set to 0. Each DI is assigned to a bit of the register. The assignment corresponds to that of the register R101 (current status of the digital inputs). |
| | 1 | 00 01 | Switching ON LED DI 1 (red) |
| | … | … | … |
| | 16 | 80 00 | Switching ON LED DI 16 (red) |

| R1222(*) | | Value Hex | Controlling the LEDs (green) via bus command |
|---|---|---|---|
| | DI No. | (DI16 … DI1) | Prior condition for this mode of operation is that the corresponding bits in the register R1236 are set to 0. Each DI is assigned to a bit of the register. The assignment corresponds to that of the register R101 (current status of the digital inputs). |
| | 1 | 00 01 | Switching ON LED DI 1 (green) |
| | … | … | … |
| | 16 | 80 00 | Switching ON LED DI 16 (green) |

| R1241(*) | | Value Hex | LED Color Red when controlled via terminal input |
|---|---|---|---|
| | DI No. | (DI16 … DI1) | This register determines whether the LED is lit in red color when the corresponding DI is activated via the input terminals. Prior condition is that the corresponding bits in R1235 are set to 1. Each DI is assigned to a bit of the register. The assignment corresponds to that of R101 (current status of the digital inputs). |
| | | ***00 00*** | ***None of the LEDs lights up in red color when DI is activated*** |
| | 1 | 00 01 | LED DI 1 lights up red when DI 1 is activated via terminal |
| | … | … | … |
| | 16 | 80 00 | LED DI 16 lights up red when DI 16 is activated via terminal |

| R1242(*) | | Value Hex | LED Color Green when controlled via terminal |
|---|---|---|---|
| | DI No. | (DI16 … DI1) | This register determines whether the LED is lit in green color when the corresponding DI is activated via the input terminals. Prior condition is that the corresponding bits in R1236 are set to 1. Each DI is assigned to a bit of the register. The assignment corresponds to that of R101 (current status of the digital inputs). |
| | | ***FF FF*** | ***Every LED lights up in green color when DI is activated*** |
| | 1 | 00 01 | LED DI 1 lights up green when DI 1 is activated via terminal |
| | … | … | … |
| | 16 | 80 00 | LED DI 16 lights up green when DI 16 is activated via terminal |

| **R10101** | | Register | Counter values of the digital inputs |
|---|---|---|---|
| **…** | | | Each register contains the counter value of a DI. **Important: Counters are only suitable for DC signals!** |
| **R10116** | | R 10101 | Counter value DI 1 |
| | | … | … |
| | | R 10116 | Counter value DI 16 |

| **R10201** | | Register | Prescaler for the counters of the digital inputs |
|---|---|---|---|
| **…** | | | Each register contains the prescaler of a DI's counter. |
| **R10216** | | R 10201 | Prescaler of counter DI 1 (R10101) |
| | | … | … |
| | | R 10216 | Prescaler of counter DI 16 (R10116) |

| **R10051** | | Register | Counter values (32 Bits) of the digital inputs |
|---|---|---|---|
| **…** | | | Each two registers contain the 32-bit counter value of a DI (raw value, prescaler has no influence). **Important: Counters are only suitable for DC signals!** A maximum of 8 values (i.e. 16 registers) may be read with one command! |
| **R10082** | R10051 + R10052 | | Counter value DI 1 |
| | … | | … |
| | R10081 + R10082 | | Counter value DI 16 |

| R1101(*) | | Value Hex | Delay of the edge detection |
|---|---|---|---|
| | DI No. | (DI16 … DI1) | This register determines for which inputs the detection of a change of the input signal has to be delayed. This is necessary if the DIs have to be driven with AC. The delay time is set in the register R1111. Each DI is assigned to a bit of the register. The assignment corresponds to that of R101. |
| | | ***00 00*** | ***None of the DI signals will be delayed*** |
| | 1 | 00 01 | Signal of DI 1 delayed / smoothed |
| | … | … | … |
| | 16 | 80 00 | Signal of DI 16 delayed / smoothed |

| R1111(*) | | Value Dez | Time for the delay of the input signal |
|---|---|---|---|
| | | | A change of signal which is connected to a DI will be realized only after expiry of this time. The value in the register R1111 multiplied by 10 gives the delay time in milliseconds. |
| | | ***10*** | ***Delay = 100 ms (if activated using R1101)*** |
| | | 4 | Delay = 40 ms (minimum recommended for 50 Hz AC signals) |

# D2 - Overview of Registers 8DO and 8DO-R Module

In the following descriptions of the register settings, ***default values***, if any, are ***highlighted***. These settings are suitable for most applications and at the initial commissioning.
The values in the underlined registers are stored in non-volatile memory. These registers should not be written continuously.

**(*) The registers marked with this asterisk can be read or written only individually, not as a contiguous block.**

| R151 (*) | | Value Hex | Status request of switch position Manually ON |
|---|---|---|---|
| | Switch No. | (S8 … S1) | The bits of this register indicate the state 'Manually ON' of the switches. The least significant bit is associated with switch No. 1, followed by the other ones up to switch No. 8. |
| | 1 | 00 01 | Switch 1 ON |
| | 2 | 00 02 | Switch 2 ON |
| | 3 | 00 04 | Switch 3 ON |
| | 4 | 00 08 | Switch 4 ON |
| | 5 | 00 10 | Switch 5 ON |
| | 6 | 00 20 | Switch 6 ON |
| | 7 | 00 40 | Switch 7 ON |
| | 8 | 00 80 | Switch 8 ON |

| R152 (*) | | Value Hex | Status request of switch position AUTO |
|---|---|---|---|
| | Switch No. | (S8 … S1) | The bits of this register indicate the state 'Auto' of the switches. The least significant bit is associated with switch No. 1, followed by the other ones up to switch No. 8. |
| | 1 | 00 01 | Switch 1 AUTO |
| | 2 | 00 02 | Switch 2 AUTO |
| | 3 | 00 04 | Switch 3 AUTO |
| | 4 | 00 08 | Switch 4 AUTO |
| | 5 | 00 10 | Switch 5 AUTO |
| | 6 | 00 20 | Switch 6 AUTO |
| | 7 | 00 40 | Switch 7 AUTO |
| | 8 | 00 80 | Switch 8 AUTO |

| R153 (*) | | Value Hex | Status request of switch position AUTO and Manually ON in one single register |
|---|---|---|---|
| | Switch No. | (S8 … S1) | The bits of this register indicate the state 'Auto' and 'Manually ON' of the switches in one single register. The least significant bit of each byte is associated with switch No. 1, followed by the other ones up to switch No. 8. The low byte shows the state 'Auto', and the high byte the state 'Manually ON'. |
| | 1 | 00 01 | Switch 1 AUTO |
| | … | | … |
| | 8 | 00 80 | Switch 8 AUTO“ |
| | 1 | 01 00 | Switch 1 ON |
| | … | | … |
| | 8 | 80 00 | Switch 8 ON |

| R150 (*) | | **Value Hex** | **Flag indicating a change of switch positions** |
|---|---|---|---|
| | Switch No. | (S8 … S1) | The bits of this register are set when the state of a switch has changed. When the register has been read, all bits are automatically reset to zero. Each switch is assigned to a bit of the register. The assignment corresponds to that of the registers R151 and R152 (current positions of the switches). |
| | 1 | 00 01 | Position of switch 1 has changed |
| | … | … | … |
| | 8 | 00 80 | Position of switch 8 has changed |

| R121 | | **Value Hex** | **Controlling the DOs via bus command** |
|---|---|---|---|
| | DO No. | (DO8 .. DO1) | Each DO is assigned to a bit of the register. The assignment corresponds to that of the register R135 (setting the mask for manual override of the DOs) |
| | 1 | 00 01 | Activating DO 1 |
| | … | … | … |
| | 8 | 00 80 | Activating DO 8 |

| R111 | | **Value Hex** | **Current state of the DO** |
|---|---|---|---|
| | DO No. | (DO8 .. DO1) | This register shows the current status of each DO, no matter whether a DO is activated via bus command, or manually by using the switch. Each DO is assigned to a bit of the register. The assignment corresponds to that of the register R135 (setting the mask for manual override of the DOs) |
| | 1 | 00 01 | State of DO 1 |
| | … | … | … |
| | 8 | 00 80 | State of DO 8 |

| **R2135** | | **Value Hex** | **Setting the mask for 'Safe State' of the DOs** |
|---|---|---|---|
| | DO No. | (DO8 .. DO1) | If it is required that the DOs will have a defined state when the bus fails, the corresponding bits of this register must be set to 1. Each DO is assigned to a bit of the register. The assignment corresponds to that of the register R121 (Controlling the DOs via bus command). The settings of this register are stored in non-volatile memory. |
| | | ***00 00*** | ***All DOs will retain their last state before bus failure*** |
| | 1 | 00 01 | Setting in R 2121 determines DO 1 when Safe State is triggered |
| | … | … | … |
| | 8 | 00 80 | Setting in R 2121 determines DO 8 when Safe State is triggered |

| **R2121** | | **Value Hex** | **Defining the DO's states for the 'Safe State' mode** |
|---|---|---|---|
| | DO No. | (DO8 .. DO1) | In this register, the states are defined which shall apply for the outputs in case of a failure of the Modbus. The prior condition is that the corresponding bits in register R 2135 are set to 1. Each digital output is assigned to a bit of the register. The assignment corresponds to that of the register R121 (controlling the DOs via bus command). The settings of this register are stored in non-volatile memory. |
| | | ***00 00*** | ***All DOs will be switched OFF if safe state is triggered*** |
| | 1 | 00 01 | DO 1 will be switched ON when safe state is triggered |
| | … | … | … |
| | 8 | 00 80 | DO 8 will be switched ON when safe state is triggered |

| **R1335(*)** | | **Value Hex** | **Setting the Mask for DO indicating LEDs (red)** |
|---|---|---|---|
| | DO No. | (DO8 .. DO1) | If the LEDs that are usually indicating the state of the DOs shall be driven by means of bus commands instead, the bits of this register have to be set to 0. Controlling the LEDs via bus then can be done with the register R1321. Each DO is assigned to a bit of the register. The assignment corresponds to that of the register R111 (current status of the digital outputs). |
| | | ***00 FF*** | ***all LEDs (red) automatically show the states of the DOs*** |
| | 1 | 00 FE | Driving LED DO 1 (red) via bus command |
| | … | … | … |
| | 8 | 00 7F | Driving LED DO 8 (red) via bus command |

| **R1336(*)** | | **Value Hex** | **Setting the Mask for DO indicating LEDs (green)** |
|---|---|---|---|
| | DO No. | (DO8 .. DO1) | If the LEDs that are usually indicating the state of the DOs shall be driven by means of bus commands instead, the bits of this register have to be set to 0. Controlling the LEDs via bus then can be done with the register R1322. Each DO is assigned to a bit of the register. The assignment corresponds to that of the register R111 (current status of the digital outputs). |
| | | ***00 FF*** | ***all LEDs (green) automatically show the states of the DOs*** |
| | 1 | 00 FE | Driving LED DO 1 (green) via bus command |
| | … | … | … |
| | 8 | 00 7F | Driving LED DO 8 (green) via bus command |

| R1321(*) | | Value Hex | Controlling the LEDs (red) via bus command |
|---|---|---|---|
| | DO No. | (DO8 .. DO1) | Prior condition for this mode of operation is that the corresponding bits in the register R1335 are set to 0. Each LED is assigned to a bit of the register. The assignment corresponds to that of the register R111 (current status of the digital outputs). |
| | 1 | 00 01 | Switching ON LED DO 1 (red) |
| | … | … | … |
| | 8 | 00 80 | Switching ON LED DO 8 (red) |

| R1322(*) | | Value Hex | Controlling the LEDs (green) via bus command |
|---|---|---|---|
| | DO No. | (DO8 .. DO1) | Prior condition for this mode of operation is that the corresponding bits in the register R1336 are set to 0. Each LED is assigned to a bit of the register. The assignment corresponds to that of the register R111 (current status of the digital outputs). |
| | 1 | 00 01 | Switching ON LED DO 1 (green) |
| | … | … | … |
| | 8 | 00 80 | Switching ON LED DO 8 (green) |

| R1341(*) | | Value Hex | LED Color Red when activated automatically with DO |
|---|---|---|---|
| | DO No. | (DO8 .. DO1) | This register determines whether the LED is lit in red color when the corresponding DO is activated. Prior condition is that the corresponding bits in the register R1335 are set to 1. Each LED is assigned to a bit of the register. The assignment corresponds to that of the register R111 (current status of the digital outputs). |
| | | ***00 00*** | ***None of the LEDs lights up in red color when DO is activated*** |
| | 1 | 00 01 | LED DO 1 lights up red when DO 1 is activated |
| | … | … | … |
| | 8 | 00 80 | LED DO 8 lights up red when DO 1 is activated |

| R1342(*) | | Value Hex | LED Color Green when activated automatically with DO |
|---|---|---|---|
| | DO No. | (DO8 .. DO1) | This register determines whether the LED is lit in green color when the corresponding DO is activated. Prior condition is that the corresponding bits in the register R1336 are set to 1. Each LED is assigned to a bit of the register. The assignment corresponds to that of the register R111 (current status of the digital outputs). |
| | | ***00 FF*** | ***Every LED lights up in green color when corresponding DO is activated*** |
| | 1 | 00 01 | LED DO 1 lights up green when DO 1 is activated |
| | … | … | … |
| | 8 | 00 80 | LED DO 8 lights up green when DO 1 is activated |

# D3 - Overview of Registers 4DIO-R Module

In the following descriptions of the register settings, ***default values***, if any, are ***highlighted***. These settings are suitable for most applications and at the initial commissioning.
The values in the underlined registers are stored in non-volatile memory. These registers should not be written continuously.

**(*) The registers marked with this asterisk can be read or written only individually, not as a contiguous block.**

*Digital Outputs:*

| R151 (*) | | Value Hex | Status request of switch position Manually ON |
|---|---|---|---|
| | Switch No. | (S4 … S1) | The bits of this register indicate the state 'Manually ON' of the switches. The least significant bit is associated with switch No. 1, followed by the other ones up to switch No. 4. |
| | 1 | 00 01 | Switch 1 ON |
| | 2 | 00 02 | Switch 2 ON |
| | 3 | 00 04 | Switch 3 ON |
| | 4 | 00 08 | Switch 4 ON |

| R152 (*) | | Value Hex | Status request of switch position AUTO |
|---|---|---|---|
| | Switch No. | (S4 … S1) | The bits of this register indicate the state 'Auto' of the switches. The least significant bit is associated with switch No. 1, followed by the other ones up to switch No. 4. |
| | 1 | 00 01 | Switch 1 AUTO |
| | … | | … |
| | 4 | 00 08 | Switch 4 AUTO |

| R153 (*) | | Value Hex | Status request of switch position AUTO and Manually ON in one single register |
|---|---|---|---|
| | Switch No. | (S4 … S1) | The bits of this register indicate the state 'Auto' and 'Manually ON' of the switches in one single register. The least significant bit of each byte is associated with switch No. 1, followed by the other ones up to switch No. 4. The low byte shows the state 'Auto', and the high byte the state 'Manually ON'. |
| | 1 | 00 01 | Switch 1 AUTO |
| | … | | … |
| | 4 | 00 08 | Switch 4 AUTO“ |
| | 1 | 01 00 | Switch 1 ON |
| | … | | … |
| | 4 | 08 00 | Switch 4 ON |

| R150 (*) | | Value Hex | Flag indicating a change of switch positions |
|---|---|---|---|
| | Switch No. | (S4 … S1) | The bits of this register are set when the state of a switch has changed. When the register has been read, all bits are automatically reset to zero. Each switch is assigned to a bit of the register. The assignment corresponds to that of the registers R151 and R152 (current positions of the switches). |
| | 1 | 00 01 | Position of switch 1 has changed |
| | … | … | … |
| | 4 | 00 08 | Position of switch 4 has changed |

| **R121** | | **Value Hex** | **Switching the DOs via bus command** |
|---|---|---|---|
| | DO No. | (DO4 .. DO1) | Each DO is assigned to a bit of the register. The assignment corresponds to that of the register R135. ***The respective DO must not be configured as permanently tracking the status of a DI in the registers R2001 ... R2004 (bits 9-12), otherwise control via bus is not possible.*** |
| | 1 | 00 01 | Switching on DO 1 |
| | … | … | … |
| | 4 | 00 08 | Switching on DO 4 |

| **R122** | | **Value Hex** | **Toggling the DOs via bus command** |
|---|---|---|---|
| | DO No. | (DO4 .. DO1) | Each DO is assigned to a bit of the register. The assignment corresponds to that of the register R135. ***The respective DO must not be configured as permanently tracking the status of a DI in the registers R2001 ... R2004 (bits 9-12), otherwise control via bus is not possible.*** |
| | 1 | 00 01 | Toggling of DO1 |
| | … | … | … |
| | 4 | 00 08 | Toggling of DO4 |

| **R111** | | **Value Hex** | **Current state of the DO** |
|---|---|---|---|
| | DO No. | (DO4 .. DO1) | This register shows the current status of each DO, no matter whether a DO is activated via bus command, or manually by using the switch. Each DO is assigned to a bit of the register. |
| | 1 | 00 01 | State of DO 1 |
| | … | … | … |
| | 4 | 00 08 | State of DO 4 |

| **R2001** **(DO1)** **…** **R2004** **(DO4)** | | **Value Hex** | **Mask for coupling a DO to the status of a DI** |
|---|---|---|---|
| | Bit No. | | If the DOs are to follow the status of certain DIs, the corresponding bits must be set in this register. If all the bits are set to 0, the states of the DIs take no effect on the DO. For each DI, one bit is assigned for toggling and one for static control. ***If the DOs are configured so that they permanently will follow the status of a DI (bits 9-12), the DOs can no longer be controlled via Modbus.*** |
| | | ***00 00*** | ***DI's status takes no effect on the DOs*** |
| | 1 | 00 01 | DO x will be toggled by activating DI1 |
| | 2 | 00 02 | DO x will be toggled by activating DI2 |
| | 3 | 00 04 | DO x will be toggled by activating DI3 |
| | 4 | 00 08 | DO x will be toggled by activating DI4 |
| | 9 | 01 00 | DO x will assume the same state as DI1 |
| | 10 | 02 00 | DO x will assume the same state as DI2 |
| | 11 | 04 00 | DO x will assume the same state as DI3 |
| | 12 | 08 00 | DO x will assume the same state as DI4 |

| R3501 | | Value Hex | Mask for interlocking DO 1 against other DOs |
|---|---|---|---|
| | Bit No. | | If DO1 has to be interlocked against other DOs, the corresponding bits must be set in this register. DOs configured here will take priority over DO1. A cross-over interlock has to be avoided. If, in contrast, all bits are set to 0, the states of the other DOs do not affect this DO. |
| | | ***00 00*** | ***Other DOs will not affect DO 1*** |
| | 1 | 00 01 | Value not valid for DO 1 |
| | 2 | 00 02 | DO 1 will be interlocked by activating DO 2 |
| | 3 | 00 04 | DO 1 will be interlocked by activating DO 3 |
| | 4 | 00 08 | DO 1 will be interlocked by activating DO 4 |

| R3502 | | Value Hex | Mask for interlocking DO 2 against other DOs |
|---|---|---|---|
| | Bit No. | | Same as register R3501, but settings for DO 2. |
| | | ***00 00*** | ***Other DOs will not affect DO 2*** |
| | 1 | 00 01 | DO 2 will be interlocked by activating DO 1 |
| | 2 | 00 02 | Value not valid for DO 2 |
| | 3 | 00 04 | DO 2 will be interlocked by activating DO 3 |
| | 4 | 00 08 | DO 2 will be interlocked by activating DO 4 |

| R3503 | | Value Hex | Mask for interlocking DO 3 against other DOs |
|---|---|---|---|
| | Bit No. | | Same as register R3501, but settings for DO 3. |
| | | ***00 00*** | ***Other DOs will not affect DO 3*** |
| | 1 | 00 01 | DO 3 will be interlocked by activating DO 1 |
| | 2 | 00 02 | DO 3 will be interlocked by activating DO 2 |
| | 3 | 00 04 | Value not valid for DO 3 |
| | 4 | 00 08 | DO 3 will be interlocked by activating DO 4 |

| R3504 | | Value Hex | Mask for interlocking DO 4 against other DOs |
|---|---|---|---|
| | Bit No. | | Same as register R3501, but settings for DO 4. |
| | | ***00 00*** | ***Other DOs will not affect DO 4*** |
| | 1 | 00 01 | DO 4 will be interlocked by activating DO 1 |
| | 2 | 00 02 | DO 4 will be interlocked by activating DO 2 |
| | 3 | 00 04 | DO 4 will be interlocked by activating DO 3 |
| | 4 | 00 08 | Value not valid for DO 4 |

| R3201 | | Register | Switch-on delay for digital outputs |
|---|---|---|---|
| … | | | Each register contains the value of the switching-on delay of a digital output (in milliseconds)<br>***Important:*** The delay is only effective when controlling the output via Modbus commands, not with manual override! |
| R3204 | | R 3201 | Switch-on delay concerning DO 1 |
| | | … | … |
| | | R 3204 | Switch-on delay concerning DO 4 |

| R3211 … R3214 | | Register | Switch-off delay for digital outputs |
|---|---|---|---|
| | | | Each register contains the value of the switching-off delay of a digital output (in milliseconds)<br>***Important:*** The delay is only effective when controlling the output via Modbus commands, not with manual override! |
| | | R 3211 | Switch-off delay concerning DO 1 |
| | | … | … |
| | | R 3214 | Switch-off delay concerning DO 4 |

| R3101 … R3104 | | Register | Minimum time for state 'off' before switching on a digital output again |
|---|---|---|---|
| | | | Each register contains the value of the minimum time for the state 'off' before a digital output can be switched on again (in milliseconds)<br>***Important:*** The delay is only effective when controlling the output via Modbus commands, not with manual override! |
| | | R 3101 | Minimum time for state 'off' (DO 1) |
| | | … | … |
| | | R 3104 | Minimum time for state 'off' (DO 4) |

| R3111 … R3114 | | Register | Minimum time for state 'on' before switching off a digital output again |
|---|---|---|---|
| | | | Each register contains the value of the minimum time for the state 'on' before a digital output can be switched off again (ms).<br>***Important:*** The delay is only effective when controlling the output via Modbus commands, not with manual override! |
| | | R 3111 | Minimum time for state 'on' (DO 1) |
| | | … | … |
| | | R 3114 | Minimum time for state 'on' (DO 4) |

| R2135 | | Value Hex | Setting the mask for 'Safe State' of the DOs |
|---|---|---|---|
| | DO No. | (DO4 .. DO1) | If it is required that the DOs will have a defined state when the bus fails, the corresponding bits of this register must be set to 1. Each DO is assigned to a bit of the register.<br>The settings of this register are stored in non-volatile memory. |
| | | ***00 00*** | ***All DOs will retain their last state before bus failure*** |
| | 1 | 00 01 | Setting in R 2121 determines DO 1 when Safe State is triggered |
| | … | … | … |
| | 4 | 00 08 | Setting in R 2121 determines DO 4 when Safe State is triggered |

| R2121 | | Value Hex | Defining the DO's states for the 'Safe State' mode |
|---|---|---|---|
| | DO No. | (DO4 .. DO1) | In this register, the states are defined which shall apply for the outputs in case of a failure of the Modbus. The prior condition is that the corresponding bits in register R 2135 are set to 1. Each digital output is assigned to a bit of the register.<br>The settings of this register are stored in non-volatile memory. |
| | | ***00 00*** | ***All DOs will be switched OFF if safe state is triggered*** |
| | 1 | 00 01 | DO 1 will be switched ON when safe state is triggered |
| | … | … | … |
| | 4 | 00 08 | DO 4 will be switched ON when safe state is triggered |

*Digital Inputs:*

| R101 (*) | | **Value Hex** | **Status of Digital Inputs** |
|---|---|---|---|
| | DI No. | (DI4 … DI1) | The bits of this register indicate the current status of the digital inputs. The least significant bit is associated with DI1, followed by the other ones up to DI4. |
| | 1 | 00 01 | DI 1 |
| | 2 | 00 02 | DI 2 |
| | 3 | 00 04 | DI 3 |
| | 4 | 00 08 | DI 4 |

| R1100(*) | | **Value Hex** | **Inverting Digital Inputs** |
|---|---|---|---|
| | DI No. | (DI4 … DI1) | Using this register, the 4 digital inputs can be inverted individually. Each DI is assigned to a bit of the register. The assignment corresponds to that of the register R101 (current status of the digital inputs). The settings of this register are stored in non-volatile memory. |
| | | ***00 00*** | ***No DI is inverted*** |
| | 1 | 00 01 | Inverting DI 1 |
| | 2 | 00 02 | Inverting DI 2 |
| | 3 | 00 04 | Inverting DI 3 |
| | 4 | 00 08 | Inverting DI 4 |

| R100 (*) | | **Value Hex** | **Change flag Digital Inputs** |
|---|---|---|---|
| | DI No. | (DI4 … DI1) | The bits of this register are set when the state of a DI has changed. When the register has been read, all bits are automatically reset to zero. Each DI is assigned to a bit of the register. The assignment corresponds to that of the register R101 (current status of the digital inputs). |
| | 1 | 00 01 | Change of DI 1 |
| | … | … | … |
| | 4 | 00 08 | Change of DI 4 |

| **R10101** | | **Register** | **Counter values of the digital inputs** |
|---|---|---|---|
| **…** | | | Each register contains the counter value of a DI. **Important: Counters are only suitable for DC signals!** |
| **R10104** | | R 10101 | Counter value DI 1 |
| | | … | … |
| | | R 10104 | Counter value DI 4 |

| **R10201** | | **Register** | **Prescaler for the counters of the digital inputs** |
|---|---|---|---|
| **…** | | | Each register contains the prescaler of a DI's counter. |
| **R10204** | | R 10201 | Prescaler of counter DI 1 (R10101) |
| | | … | … |
| | | R 10204 | Prescaler of counter DI 4 (R10104) |

| **R10051** | | **Register** | **Counter values (32 Bits) of the digital inputs** |
|---|---|---|---|
| **…** | | | Each two registers contain the 32-bit counter value of a DI (raw value, prescaler has no influence). **Important: Counters are only suitable for DC signals!** |
| **R10058** | R10051 + (R10052) | | Counter value DI 1 |
| | … | | … |
| | R10057 + (R10058) | | Counter value DI 4 |

| **R1101**(*) | | **Value Hex** | **Delay of the edge detection** |
|---|---|---|---|
| | DI No. | (DI4 … DI1) | This register determines for which inputs the detection of a change of the input signal has to be delayed. This is necessary if the DIs have to be driven with AC. The delay time is set in the register R1111. Each DI is assigned to a bit of the register. The assignment corresponds to that of R101. |
| | | ***00 00*** | ***None of the DI signals will be delayed*** |
| | 1 | 00 01 | Signal of DI 1 delayed / smoothed |
| | … | … | … |
| | 4 | 00 08 | Signal of DI 4 delayed / smoothed |

| **R1111**(*) | | **Value Dec** | **Time for the delay of the input signal** |
|---|---|---|---|
| | | | A change of signal which is connected to a DI will be realized only after expiry of this time. The value in the register R1111 multiplied by 10 gives the delay time in milliseconds. |
| | | ***10*** | ***Delay = 100 ms (if activated using R1101)*** |
| | | 4 | Delay = 40 ms (minimum recommended for 50 Hz AC signals) |

*LEDs:*

| **R1335(*)** | | **Value Hex** | **Setting the Mask for DI / DO indicating LEDs (red)** |
|---|---|---|---|
| | DI / DO No. | | If the LEDs that are usually indicating the state of the DIs and DOs shall be driven by means of bus commands instead, the bits of this register have to be set to 0. Controlling the LEDs via bus then can be done with the register R1321. Each DI and DO is assigned to a bit of the register. |
| | | ***00 FF*** | ***all LEDs (red) automatically show the states of DIs and DOs*** |
| | DO 1 | 00 FE | Driving LED DO 1 (red) via bus command |
| | DO 2 | 00 FD | Driving LED DO 2 (red) via bus command |
| | DO 3 | 00 FB | Driving LED DO 3 (red) via bus command |
| | DO 4 | 00 F7 | Driving LED DO 4 (red) via bus command |
| | DI 1 | 00 EF | Driving LED DI 1 (red) via bus command |
| | DI 2 | 00 DF | Driving LED DI 2 (red) via bus command |
| | DI 3 | 00 BF | Driving LED DI 3 (red) via bus command |
| | DI 4 | 00 7F | Driving LED DI 4 (red) via bus command |

| **R1336(*)** | | **Value Hex** | **Setting the Mask for DI / DO indicating LEDs (green)** |
|---|---|---|---|
| | DI / DO No. | | If the LEDs that are usually indicating the state of the DIs and DOs shall be driven by means of bus commands instead, the bits of this register have to be set to 0. Controlling the LEDs via bus then can be done with the register R1322. Each DI and DO is assigned to a bit of the register. |
| | | ***00 FF*** | ***all LEDs (green) automatically show the states of DIs and DOs*** |
| | DO 1 | 00 FE | Driving LED DO 1 (green) via bus command |
| | DO 2 | 00 FD | Driving LED DO 2 (green) via bus command |
| | DO 3 | 00 FB | Driving LED DO 3 (green) via bus command |
| | DO 4 | 00 F7 | Driving LED DO 4 (green) via bus command |
| | DI 1 | 00 EF | Driving LED DI 1 (green) via bus command |
| | DI 2 | 00 DF | Driving LED DI 2 (green) via bus command |
| | DI 3 | 00 BF | Driving LED DI 3 (green) via bus command |
| | DI 4 | 00 7F | Driving LED DI 4 (green) via bus command |

| **R1321(*)** | | **Value Hex** | **Controlling the LEDs (red) via bus command** |
|---|---|---|---|
| | DI-/DO-No. | | Prior condition for this mode of operation is that the corresponding bits in the register R1335 are set to 0. Each LED is assigned to a bit of the register. The assignment corresponds to that of the register R1335 (Setting the Mask for DI / DO indicating LEDs red). |
| | DO 1 | 00 01 | Switching ON LED DO 1 (red) |
| | … | | … |
| | DO 4 | 00 08 | Switching ON LED DO 4 (red) |
| | DI 1 | 00 10 | Switching ON LED DI 1 (red) |
| | … | | … |
| | DI 4 | 00 80 | Switching ON LED DI 4 (red) |

| R1322(*) | | Value Hex | Controlling the LEDs (green) via bus command |
|---|---|---|---|
| | DI-/DO-No. | | Prior condition for this mode of operation is that the corresponding bits in the register R1336 are set to 0. Each LED is assigned to a bit of the register. The assignment corresponds to that of the register R1336 (Setting the Mask for DI / DO indicating LEDs green). |
| | DO 1 | 00 01 | Switching ON LED DO 1 (green) |
| | … | | … |
| | DO 4 | 00 08 | Switching ON LED DO 4 (green) |
| | DI 1 | 00 10 | Switching ON LED DI 1 (green) |
| | … | | … |
| | DI 4 | 00 80 | Switching ON LED DI 4 (green) |

| R1341(*) | | Value Hex | LED Color Red when activated automatically with DI / DO |
|---|---|---|---|
| | DI-/DO-No. | | This register determines whether the LED is lit in red color when the corresponding DI / DO is activated. Prior condition is that the corresponding bits in the register R1335 are set to 1. Each LED is assigned to a bit of the register. The assignment corresponds to that of the register R1335 (Setting the Mask for DI / DO indicating LEDs red). |
| | DO 1 | 00 01 | LED DO 1 lights up red when DO 1 is activated |
| | … | | … |
| | DO 4 | 00 08 | LED DO 4 lights up red when DO 4 is activated |
| | DI 1 | 00 10 | LED DI 1 lights up red when DI 1 is activated |
| | … | | … |
| | DI 4 | 00 80 | LED DI 4 lights up red when DI 4 is activated |

| R1342(*) | | Value Hex | LED Color Green when activated automatically with DI / DO |
|---|---|---|---|
| | DI-/DO-No. | | This register determines whether the LED is lit in green color when the corresponding DI / DO is activated. Prior condition is that the corresponding bits in the register R1336 are set to 1. Each LED is assigned to a bit of the register. The assignment corresponds to that of the register R1336 (Setting the Mask for DI / DO indicating LEDs green). |
| | DO 1 | 00 01 | LED DO 1 lights up green when DO 1 is activated |
| | … | | … |
| | DO 4 | 00 08 | LED DO 4 lights up green when DO 4 is activated |
| | DI 1 | 00 10 | LED DI 1 lights up green when DI 1 is activated |
| | … | | … |
| | DI 4 | 00 80 | LED DI 4 lights up green when DI 4 is activated |

# D4 - Overview of Registers 4DO-R Module

In the following descriptions of the register settings, ***default values***, if any, are ***highlighted***. These settings are suitable for most applications and at the initial commissioning.
The values in the underlined registers are stored in non-volatile memory. These registers should not be written continuously.

**(*) The registers marked with this asterisk can be read or written only individually, not as a contiguous block.**

| **R170** | | **Value Hex** | **Status of push buttons being pressed** |
|---|---|---|---|
| | Push Button No. | (PB4 … PB1) | The bits of this register indicate the state ‘button currently being pressed’ of the four push buttons. The least significant bit is associated with button No. 1, followed by the other ones up to button No. 4. |
| | 1 | 00 01 | Button 1 currently being pressed |
| | 2 | 00 02 | Button 2 currently being pressed |
| | 3 | 00 04 | Button 3 currently being pressed |
| | 4 | 00 08 | Button 4 currently being pressed |

| **R151 (*)** | | **Value Hex** | **Status of channel mode ‘Manually ON’** |
|---|---|---|---|
| | Channel No. | (Ch4 … Ch1) | The bits of this register indicate that one or more channels are switched manually ON. The least significant bit is associated with channel No. 1, followed by the other ones up to channel 4. |
| | 1 | 00 01 | Channel 1 manually ON |
| | 2 | 00 02 | Channel 2 manually ON |
| | 3 | 00 04 | Channel 3 manually ON |
| | 4 | 00 08 | Channel 4 manually ON |

| **R152 (*)** | | **Value Hex** | **Status request of channel mode AUTO** |
|---|---|---|---|
| | Channel No. | (Ch4 … Ch1) | The bits of this register indicate the operation mode ’Auto’ of the four channels. The assignment corresponds to that of the register R170. **Important: The register can also be written, so that the channels can be brought back into automatic mode also by bus command from a higher-level system.** |
| | 1 | 00 01 | Channel 1 AUTO |
| | 2 | 00 02 | Channel 2 AUTO |
| | 3 | 00 04 | Channel 3 AUTO |
| | 4 | 00 08 | Channel 4 AUTO |

| **R153 (*)** | | **Value Hex** | **Status request of channel mode AUTO + Value** |
|---|---|---|---|
| | Channel No. | (Ch4 … Ch1) | The bits in the Low Byte of this register indicate the operation mode ’Auto’ of the four channels. In the high byte, the value of the output is displayed when the mode 'manually overridden' is set, or, respectively, which status the output will assume when it will be switched from automatic to manually overridden (the last value during the manual operation mode is stored in the volatile memory). The assignment corresponds to that of the register R170 (current state of the push buttons being pressed). |
| | 1 | 00 01 | Channel 1 AUTO |
| | 2 | 00 02 | Channel 2 AUTO |
| | 3 | 00 04 | Channel 3 AUTO |
| | 4 | 00 08 | Channel 4 AUTO |

| R150 (*) | | Value Hex | Flag indicating that push buttons have been pressed |
|---|---|---|---|
| | Push Button No. | (PB4 … PB1) | The bits of this register are set when a push button has been pressed. When reading the register, all bits are automatically reset to zero. Each push button is assigned to a bit of the register. The least significant bit is associated with push button No. 1, followed by the other ones up to push button No. 4. |
| | 1 | 00 01 | Status of push button 1 has changed |
| | 2 | 00 02 | Status of push button 2 has changed |
| | 3 | 00 04 | Status of push button 3 has changed |
| | 4 | 00 08 | Status of push button 4 has changed |

| R10170 | | Value Hex | Time for prolonged pushing a button |
|---|---|---|---|
| | | | Changing from the operating mode ‘automatic’ to ‘manual’ and back is done by holding down the push button of the respective channel for a defined time. This time is set by the value in this register for all four channels of the module. The time in the register R 10170 is given decimal in tenths of a second. |
| | | ***30*** | ***Time for prolonged pushing = 3 seconds*** |
| | | | |

| R10173 | | Value Hex | Default operating mode 'Automatic' |
|---|---|---|---|
| | Channel No. | (Ch4 … Ch1) | After a cold start or reset, the settings in this register determine whether the channels are started in the ‘Automatic’ mode. The assignment corresponds to that of the register R170 (current state of the push buttons being pressed). |
| | | ***00 15*** | ***all channels will start in AUTO mode*** |
| | 1 | 00 01 | only channel 1 will start in AUTO mode |
| | 2 | 00 02 | only channel 2 will start in AUTO mode |
| | 3 | 00 04 | only channel 3 will start in AUTO mode |
| | 4 | 00 08 | only channel 4 will start in AUTO mode |

| R10411 | | Value Hex | Delay time between switching of two outputs |
|---|---|---|---|
| | | | Using this register, a delay time can be defined which must elapse between the switching of two outputs at least. Thus, the system perturbations resulting from the switching operations can be reduced. The time is given decimal in hundredths of a second. |
| | | ***10*** | ***Delay time = 100 ms*** |
| | | | |

| R121 | | Value Hex | Controlling the DOs via bus command |
|---|---|---|---|
| | DO No. | (DO4 .. DO1) | Each DO is assigned to a bit of the register. The assignment corresponds to that of the register R135 (setting the mask for manual override of the DOs) |
| | 1 | 00 01 | Activating DO 1 |
| | … | … | … |
| | 4 | 00 08 | Activating DO 4 |

| R111 | | Value Hex | Current state of the DO |
|---|---|---|---|
| | DO No. | (DO4 .. DO1) | This register shows the current status of each DO, no matter whether a DO is activated via bus command, or manually by using the push button. Each DO is assigned to a bit of the register. The assignment corresponds to that of the register R135 (setting the mask for manual override of the DOs) |
| | 1 | 00 01 | State of DO 1 |
| | … | … | … |
| | 4 | 00 08 | State of DO 4 |

| R2135 | | Value Hex | Setting the mask for 'Safe State' of the DOs |
|---|---|---|---|
| | DO No. | (DO4 .. DO1) | If it is required that the DOs will have a defined state when the bus fails, the corresponding bits of this register must be set to 1. Each DO is assigned to a bit of the register. Each DO is assigned to a bit of the register. The assignment corresponds to that of the register R135 (setting the mask for manual override of the DOs). The settings of this register are stored in non-volatile memory. |
| | | ***00 00*** | ***All DOs will retain their last state before bus failure*** |
| | 1 | 00 01 | Setting in R 2121 determines DO 1 when Safe State is triggered |
| | … | … | … |
| | 4 | 00 08 | Setting in R 2121 determines DO 4 when Safe State is triggered |

| R2121 | | Value Hex | Defining the DO's states for the 'Safe State' mode |
|---|---|---|---|
| | DO No. | (DO4 .. DO1) | In this register, the states are defined which shall apply for the outputs in case of a failure of the Modbus. The prior condition is that the corresponding bits in register R 2135 are set to 1. Each digital output is assigned to a bit of the register. The assignment corresponds to that of the register R121 (controlling the DOs via bus command). The settings of this register are stored in non-volatile memory. |
| | | ***00 00*** | ***All DOs will be switched OFF if safe state is triggered*** |
| | 1 | 00 01 | DO 1 will be switched ON when safe state is triggered |
| | … | … | … |
| | 4 | 00 08 | DO 4 will be switched ON when safe state is triggered |

| R1335(*) | | Value Hex | Setting the Mask for DO indicating LEDs (red) |
|---|---|---|---|
| | DO No. | (DO8 .. DO1) | If the LEDs that are usually indicating the state of the DOs and manual override shall be driven by means of bus commands instead, the bits of this register have to be set to 0. Controlling the LEDs via bus then can be done with the register R1321. The least significant bit is associated with LED 1, followed by the other ones up to LED 8. |
| | | 00 00 | Driving LEDs of all DOs (red) via bus command |
| | | ***00 FF*** | ***all LEDs (red) automatically show the states of the DOs*** |
| | 1 | 00 FE | Driving LED DO 1 (red) via bus command |
| | 2 | 00 FD | Driving LED DO 2 (red) via bus command |
| | 3 | 00 FB | Driving LED DO 3 (red) via bus command |
| | 4 | 00 F7 | Driving LED DO 4 (red) via bus command |
| | 5 | 00 EF | Driving LED DO 5 (red) via bus command |
| | 6 | 00 DF | Driving LED DO 6 (red) via bus command |
| | 7 | 00 BF | Driving LED DO 7 (red) via bus command |
| | 8 | 00 7F | Driving LED DO 8 (red) via bus command |

| R1336(*) | | Value Hex | Setting the Mask for DO indicating LEDs (green) |
|---|---|---|---|
| | DO No. | (DO8 .. DO1) | If the LEDs that are usually indicating the state of the DOs shall be driven by means of bus commands instead, the bits of this register have to be set to 0. Controlling the LEDs via bus then can be done with the register R1322. Each DO is assigned to a bit of the register. The assignment corresponds to that of R1335. |
| | | ***00 FF*** | ***all LEDs (green) automatically show the states of the DOs*** |
| | 1 | 00 FE | Driving LED DO 1 (green) via bus command |
| | … | … | … |
| | 8 | 00 7F | Driving LED DO 8 (green) via bus command |

| R1321(*) | | Value Hex | Controlling the LEDs (red) via bus command |
|---|---|---|---|
| | LED No. | (LED 8 .. 1) | Prior condition for this mode of operation is that the corresponding bits in the register R1335 are set to 0. The least significant bit is associated with LED 1, followed by the other ones up to LED 8. |
| | 1 | 00 01 | Switching ON DO LED 1 (red) |
| | … | … | … |
| | 8 | 00 80 | Switching ON DO LED 8 (red) |

| R1322(*) | | Value Hex | Controlling the LEDs (green) via bus command |
|---|---|---|---|
| | LED No. | (LED 8 .. 1) | Prior condition for this mode of operation is that the corresponding bits in the register R1336 are set to 0. Each LED is assigned to a bit of the register. The assignment corresponds to that of the register R1321 (Controlling the LEDs (green) via bus command). |
| | 1 | 00 01 | Switching ON DO LED 1 (green) |
| | … | … | … |
| | 8 | 00 80 | Switching ON DO LED 8 (green) |

| R1341(*) | | Value Hex | LED Color Red when activated automatically with DO |
|---|---|---|---|
| | LED No. | (LED 8 .. 1) | This register determines whether the LED is lit in red color automatically with the DO (state and auto/override indication). Prior condition is that the corresponding bits in the register R1335 are set to 1. Each LED is assigned to a bit of the register. The assignment corresponds to that of the register R1321 (Controlling the LEDs (red) via bus command). |
| | | ***00 00*** | ***None of the LEDs lights up red automatically with DO*** |
| | 1 | 00 01 | DO LED 1 lights up red automatically with DO |
| | … | … | … |
| | 8 | 00 80 | DO LED 8 lights up red automatically with DO |

| R1342(*) | | Value Hex | LED Color Green when activated automatically with DO |
|---|---|---|---|
| | LED No. | (LED 8 .. 1) | This register determines whether the LED is lit in green color automatically with the DO (state and auto/override indication). Prior condition is that the corresponding bits in the register R1336 are set to 1. Each LED is assigned to a bit of the register. The assignment corresponds to that of the register R1322 (Controlling the LEDs (green) via bus command). |
| | | ***00 FF*** | ***Every LED lights up in green color automatically with DO*** |
| | 1 | 00 01 | DO LED 1 lights up green automatically with DO |
| | … | … | … |
| | 8 | 00 80 | DO LED 8 lights up green automatically with DO |

# D5 - Overview of Registers 8AI Module

In the following descriptions of the register settings, ***default values***, if any, are ***highlighted***. These settings are suitable for most applications and at the initial commissioning.
The values in the underlined registers are stored in non-volatile memory. These registers should not be written continuously.

**(*) The registers marked with this asterisk can be read or written only individually, not as a contiguous block.**

| **R501** | | **Register** | **Values of the analog inputs** |
|---|---|---|---|
| **…** | | | Each register contains the value of an analog input.<br>**Important:** The values read from these registers should be handled as ***SINT (signed integer)***, because depending on the configured sensor type, the characteristics of the sensor is already taken into account and the measurement can lead to the display of negative values (below 0°C). |
| **R508** | | R 501 | Value of AI 1 |
| | | … | … |
| | | R 508 | Value of AI 8 |

| **R500 (*)** | | **Value Hex** | **Flag indicating a change at analog inputs** |
|---|---|---|---|
| | Input No. | (AI8 … AI1) | The bits of this register are set when the value of an analog input has changed by more than the value of the delta determined in registers R1591...R1598. When the register has been read, all bits are automatically reset to zero. Each analog input is assigned to a bit of the register. The least significant bit is associated with analog input No. 1, followed by the other ones up to analog input No. 8. |
| | 1 | 00 01 | Change of value at analog input AI 1 |
| | 2 | 00 02 | Change of value at analog input AI 2 |
| | 3 | 00 04 | Change of value at analog input AI 3 |
| | 4 | 00 08 | Change of value at analog input AI 4 |
| | 5 | 00 10 | Change of value at analog input AI 5 |
| | 6 | 00 20 | Change of value at analog input AI 6 |
| | 7 | 00 40 | Change of value at analog input AI 7 |
| | 8 | 00 80 | Change of value at analog input AI 8 |

| **R1591** | | **Register** | **Delta value for the analog inputs** |
|---|---|---|---|
| **…** | | | Each register contains the value by which an analog input has to change, in order that the change will be indicated by the flag in register R500. The value of Delta is of the same dimension as the analog value itself (R501 ... R508). If Delta is zero, the changing flag never will be set. |
| **R1598** | | R 1591 | Delta value for the analog input AI 1 |
| | | … | … |
| | | R 1598 | Delta value for the analog input AI 8 |

| **R1501** | | **Register** | **Types of sensors connected to the analog inputs** | |
|---|---|---|---|---|
| **…** | | | Each register contains the type of sensor which is connected to an analog input, e.g. 0..10V or Pt1000 | |
| **R1508** | | R 1501 | Type of sensor AI 1 | |
| | | … | … | |
| | | R 1508 | Type of sensor AI 8 | |
| | | | ***Valid values:*** | ***Units of measured values:*** |
| | | | 0 = 0…10 V | mV (1000 = 1 V) |
| | | | | |
| | | | 2 = Resistance 0…5 kΩ | Ω/10 (1000 = 100.0 Ω) |
| | | | 3 = Resistance 0…15 kΩ | Ω (1000 = 1000 Ω) |
| | | | 4 = in preparation | |
| | | | 5 = Pt 100 | °C/10 (1000 = 100.0°C) |
| | | | 6 = Pt 1000 | °C/10 (1000 = 100.0°C) |
| | | | 7 = Ni 1000 | °C/10 (1000 = 100.0°C) |
| | | | 8 = Ni 1000 L&G | °C/10 (1000 = 100.0°C) |
| | | | 9 = KTY81-110 | °C/10 (1000 = 100.0°C) |
| | | | 10 = KTY81-210 | °C/10 (1000 = 100.0°C) |
| | | | 11 = NTC 20k | °C/10 (1000 = 100.0°C) |
| | | | 12 = NTC 10k | °C/10 (1000 = 100.0°C) |
| | | | 50 = KP10 / LM235 | °C/10 (1000 = 100,0°C) |

# D6 - Overview of Registers 8AO Module

In the following descriptions of the register settings, ***default values***, if any, are ***highlighted***. These settings are suitable for most applications and at the initial commissioning.
The values in the underlined registers are stored in non-volatile memory. These registers should not be written continuously.

**(*) The registers marked with this asterisk can be read or written only individually, not as a contiguous block.**

| R152 (*) | | Value Hex | Status request of switch position AUTO |
|---|---|---|---|
| | Switch No. | (S8 … S1) | The bits of this register indicate the state 'Auto' of the switches. The least significant bit is associated with switch No. 1, followed by the other ones up to switch No. 8. |
| | 1 | 00 01 | Switch 1 AUTO |
| | 2 | 00 02 | Switch 2 AUTO |
| | 3 | 00 04 | Switch 3 AUTO |
| | 4 | 00 08 | Switch 4 AUTO |
| | 5 | 00 10 | Switch 5 AUTO |
| | 6 | 00 20 | Switch 6 AUTO |
| | 7 | 00 40 | Switch 7 AUTO |
| | 8 | 00 80 | Switch 8 AUTO |

| R150 (*) | | Value Hex | Flag indicating a change of switch positions |
|---|---|---|---|
| | Switch No. | (S8 … S1) | The bits of this register are set when the state of a switch has changed. When the register has been read, all bits are automatically reset to zero. Each switch is assigned to a bit of the register. The assignment corresponds to that of the register R152 (current positions of the switches). |
| | 1 | 00 01 | Position of switch 1 has changed |
| | … | … | … |
| | 8 | 00 80 | Position of switch 8 has changed |

| R160 (*) | | Value Hex | Flag indicating a change of potentiometer's setting values |
|---|---|---|---|
| | Poti No. | (P8 … P1) | The bits of this register are set when the setting value of a potentiometer has changed. When the register has been read, all bits are automatically reset to zero. Each potentiometer is assigned to a bit of the register. The assignment corresponds to that of the register R152 (current positions of the switches). |
| | 1 | 00 01 | Setting value potentiometer 1 has been changed |
| | … | … | … |
| | 8 | 00 80 | Setting value potentiometer 8 has been changed |

| R161 | | Register | Setting values of the potentiometers |
|---|---|---|---|
| … | | | Each register contains the setting value of a potentiometer (Range of values 0…1000) |
| R168 | | R 161 | Setting value potentiometer 1 |
| | | … | … |
| | | R 168 | Setting value potentiometer 8 |

| R521<br>…<br>R528 | | Register | **Controlling the AOs via bus command** |
|---|---|---|---|
| | | | Each register contains the control value of an analog output (values 0 ... 1000 correspond to 0 ... 10V) |
| | | R 521 | Control value for AO 1 |
| | | … | … |
| | | R 528 | Control value for AO 8 |

| R511<br>…<br>R518 | | Register | **Actual values of the AO** |
|---|---|---|---|
| | | | Each register contains the actual value of an analog output |
| | | R 511 | Actual value of AO 1 |
| | | … | … |
| | | R 518 | Actual value of AO 8 |

| R2535 | | Value Hex | **Setting the mask for 'Safe State' of the AOs** |
|---|---|---|---|
| | AO No. | (AO8 .. AO1) | If it is required that the AOs will have a defined value when the bus fails, the corresponding bits of this register must be set to 1. Each AO is assigned to a bit of the register. The assignment corresponds to that of the register R152 (current positions of the switches). The settings of this register are stored in non-volatile memory. |
| | | ***00 00*** | ***All AOs will retain their last value before bus failure*** |
| | 1 | 00 01 | Value in R 2521 will determine AO 1 when safe state is triggered |
| | … | … | … |
| | 8 | 00 80 | Value in R 2528 will determine AO 8 when safe state is triggered |

| R2521<br>…<br>R2528 | | Register | **Defining the AO's values for the 'Safe State' mode** |
|---|---|---|---|
| | | | When the Modbus fails, the outputs will assume the values that are set in these registers. Prior condition for this mode of operation is that the corresponding bits in the register R2535 are set to 1. Each register contains the control value of one AO. The settings of this registers are stored in non-volatile memory. |
| | | R 2521 | Safe state value for AO 1 (values 0...1000 ≡ 0…10V) |
| | | … | … |
| | | R 2528 | Safe state value for AO 8 (values 0...1000 ≡ 0…10V) |

# D7 - Overview of Registers 4DI2DO-R-3P Module

In the following descriptions of the register settings, ***default values***, if any, are ***highlighted***. These settings are suitable for most applications and at the initial commissioning.
The values in the underlined registers are stored in non-volatile memory. These registers should not be written continuously.

**(*) The registers marked with this asterisk can be read or written only individually, not as a contiguous block.**

*Digital Outputs:*

| R151 (*) | | Value Hex | Status request of switch position 'Man.ON' / 'UP' |
|---|---|---|---|
| | Switch No. | (S4 … S1) | The bits of this register indicate whether the switches are in the upper position, i.e. the 'manual override ON' state (switches 1 and 3) or the 'UP' position (switches 2 and 4). The least significant bit is associated with switch No. 1, followed by the other ones up to switch No. 4. |
| | 1 | 00 01 | Switch 1 (channel 1) ‚manually overridden ON' |
| | 2 | 00 02 | Switch 2 (channel 1) ‚UP' |
| | 3 | 00 04 | Switch 3 (channel 2) ‚manually overridden ON' |
| | 4 | 00 08 | Switch 4 (channel 2) ‚UP' |

| R152 (*) | | Value Hex | Status request of switch position AUTO |
|---|---|---|---|
| | Switch No. | (S4 … S1) | The bits of this register indicate whether the switches are in the lower position, i.e. the 'auto mode' state (switches 1 and 3) or the 'DOWN' position (switches 2 and 4). The least significant bit is associated with switch No. 1, followed by the other ones up to switch No. 4. |
| | 1 | 00 01 | Switch 1 (channel 1) ‚auto mode' |
| | 2 | 00 02 | Switch 2 (channel 1) ‚DOWN' |
| | 3 | 00 04 | Switch 3 (channel 2) ‚auto mode' |
| | 4 | 00 08 | Switch 4 (channel 2) ‚DOWN' |

| R153 (*) | | Value Hex | Status request of switch position AUTO and Manually ON in one single register |
|---|---|---|---|
| | Switch No. | (S4 … S1) | The bits of this register indicate whether the switches are in the upper position (i.e. the 'manual override ON' state or the 'OPEN' position, or in the lower position ('auto mode' or 'CLOSE'). The least significant bit of each byte is associated with switch No. 1, followed by the other ones up to switch No. 4. The low byte shows the state 'Auto'/'Close', and the high byte the state 'Manually ON'/'Open'. |
| | 1 | 00 01 | Switch 1 (channel 1) ‚auto mode' |
| | … | | Switch 2 (channel 1) ‚DOWN' |
| | … | | Switch 3 (channel 2) ‚auto mode' |
| | 4 | 00 08 | Switch 4 (channel 2) ‚DOWN' |
| | 1 | 01 00 | Switch 1 (channel 1) ‚manually overridden ON' |
| | … | | Switch 2 (channel 1) ‚UP' |
| | … | | Switch 3 (channel 2) ‚manually overridden ON' |
| | 4 | 08 00 | Switch 4 (channel 2) ‚UP' |

| R150 (*) | | **Value Hex** | **Flag indicating a change of switch positions** |
|---|---|---|---|
| | Switch No. | (S4 … S1) | The bits of this register are set when the state of a switch has changed. When the register has been read, all bits are automatically reset to zero. Each switch is assigned to a bit of the register. The assignment corresponds to that of the registers R151 and R152 (current positions of the switches). |
| | 1 | 00 01 | Position of switch 1 has changed |
| | … | … | … |
| | 4 | 00 08 | Position of switch 4 has changed |

| R111 | | **Value Hex** | **Current state of the DO** |
|---|---|---|---|
| | DO No. | (DO4 .. DO1) | This register shows the current status of each DO, no matter whether a DO is activated via bus command, or manually by using the switch. Each DO is assigned to a bit of the register. |
| | 1 | 00 01 | State of DO 1 |
| | … | … | … |
| | 4 | 00 08 | State of DO 4 |

| R1800(*) … R1801(*) | | **Register** | **Target position in %** |
|---|---|---|---|
| | | | Each register contains the target position for a blind in %. |
| | | R 1800 | Target position for blind 1 (value in %) |
| | | R 1801 | Target position for blind 2 (value in %) |

| R1820(*), R1821(*) | | **Value Hex** | **Status request of channels 1 and 2** |
|---|---|---|---|
| | | | Reading this register shows the current status of each DO. Furthermore, by sending a Modbus command, an initial run (open or close) can be triggered. |
| | | 00 00 | normal operation |
| | | 00 10 | manually overridden, holding position |
| | | 00 11 | manually overridden, open |
| | | 00 12 | manually overridden, close |
| | | 00 41 | Delay time for switching the drive on again is active |
| | | 00 42 | Delay time for switching the drive to the other direction is active |
| | | 00 80 | Signaling that initial run is active |
| | | 00 81 | Command for initial run to 0% (write command only) |
| | | 00 82 | Command for initial run to 100% (write command only) |

| R1830(*), R1831(*) | | **Value Hex** | **Status request of operation, channels 1 and 2** |
|---|---|---|---|
| | | | This register shows the current operation of each DO. A value is assigned to each state. |
| | | 00 00 | Holding position |
| | | 00 01 | Open |
| | | 00 02 | Close |

| R1840(*), R1841(*) | | **Register** | **Aktual position in %** |
|---|---|---|---|
| | | | Each register shows the current position of a blind (%). |
| | | R 1840 | Current position of blind 1 in % |
| | | R 1841 | Current position of blind 2 in % |

| R1890(*), R1891(*) | | Register | Current timer value of motion, blind 1 and 2 |
|---|---|---|---|
| | | | Each register shows the current timer value of the motion of a blind. After the drive has come to a halt, the value remains in the register until a new motion is triggered and the timer starts at 0 again. |
| | | R 1890 | Current timer value of motion, blind 1 |
| | | R 1891 | Current timer value of motion, blind 2 |

| R1900 | | Value Hex | Setting the mask for enabling the channels |
|---|---|---|---|
| | Jal. No. | (Jal.2 .. Jal.1) | |
| | | ***00 FF*** | ***Both blinds can be switched on, via Modbus command and also using the switches on the module, as well.*** |
| | 1 | 00 01 | Only blind 1 can be switched |
| | 2 | 00 02 | Only blind 2 can be switched |

| R1910(*) … R1911(*) | | Register | Prescaler for the timers |
|---|---|---|---|
| | | | Each register contains the prescaler value for a channel's timers. This value acts as a factor for all times. The default setting is 10; with this setting all runtimes are treated as seconds. Increasing or reducing the timer's prescaler stretches all times by the corresponding factor.<br>Example: If this prescaler is set to 1 instead of 10, all times must be entered in tenths of a second instead of seconds. In this way, however, greater positioning accuracy can be achieved, especially with short runtimes. |
| | | ***10*** | ***If a value of 10 is set, all configured times correspond to the unit seconds*** |
| | | R 1910 | Prescaler value for timers blind 1 |
| | | R 1911 | Prescaler value for timers blind 2 |

| R1920(*) … R1921(*) | | Register | Runtime 'Open' |
|---|---|---|---|
| | | | Each register contains the value of how long the opening runtime should be for a blind |
| | | ***60*** | |
| | | R 1920 | Opening runtime for blind 1 |
| | | R 1921 | Opening runtime for blind 2 |

| R1930(*) … R1931(*) | | Register | Runtime 'Close' |
|---|---|---|---|
| | | | Each register contains the value of how long the closing runtime should be for a blind |
| | | ***60*** | |
| | | R 1930 | Closing runtime for blind 1 |
| | | R 1931 | Closing runtime for blind 2 |

| | | | |
|---|---|---|---|
| **R1940(*)** | | **Register** | **Additional runtime for direction OPEN** |
| … | | | Each register contains the value by how much the set opening runtime shall be extended when moving a blind to the 100% position (fully open). |
| **R1941(*)** | | ***0*** | |
| | | R 1940 | Additional runtime (open) for blind 1 |
| | | R 1941 | Additional runtime (open) for blind 2 |

| | | | |
|---|---|---|---|
| **R1950(*)** | | **Register** | **Additional runtime for direction CLOSE** |
| … | | | Each register contains the value by how much the set closing runtime shall be extended when moving a blind to the 0% position (fully closed). |
| **R1951(*)** | | ***0*** | |
| | | R 1950 | Additional runtime (close) for blind 1 |
| | | R 1951 | Additional runtime (close) for blind 2 |

| | | | |
|---|---|---|---|
| **R1970(*)** | | **Register** | **Delay time OFF → ON** |
| … **R1971(*)** | | | Each register contains the value of how long the delay time (halt) shall be before a blind's motion can be activated again |
| | | ***2*** | |
| | | R 1970 | Delay time for switching on again blind 1 |
| | | R 1971 | Delay time for switching on again blind 2 |

| | | | |
|---|---|---|---|
| **R1980(*)** | | **Register** | **Delay time 'Inversion of direction'** |
| … **R1981(*)** | | | Each register contains the value of how long the delay time (halt) shall be until a blind can be moved into the opposite direction. If the OFF → ON delay time (R1970/1971) is greater than the delay for the inversion of direction, then the longer OFF → ON delay time will be effective. |
| | | ***2*** | |
| | | R 1980 | Delay time, inversion of direction for blind 1 |
| | | R 1981 | Delay time, inversion of direction for blind 2 |

| | | | |
|---|---|---|---|
| **R1990(*)** | | **Value Hex** | **Configuring the DI's as limit switches** |
| | DI No. | (DI4 .. DI1) | With the help of this configuration register, the four DIs can be defined to be used as limit switches. Doing so, the drive will switch off when an end position is reached. At the same time, the position of the blind (which is constantly calculated in the module) is corrected to 0% (closed) or 100% (opened) depending on the end position. If no end position is reached in automatic mode within the configured runtimes (open/close runtime plus additional time, if configured), the drive will switch off, anyhow, for safety reasons, but not in manually overridden mode. |
| | | ***00 00*** | ***DI's are not used for limit switches*** |
| | 1 | 00 01 | End position CLOSED of blind 1 |
| | 2 | 00 02 | End position OPENED of blind 1 |
| | 3 | 00 04 | End position CLOSED of blind 2 |
| | 4 | 00 08 | End position OPENED of blind 2 |

| R1991(*) | | Value Hex | Configuring the DI's for controlling open/close |
|---|---|---|---|
| | DI No. | (DI4 .. DI1) | With the help of this configuration register, the four DIs can be defined to be used for controlling the outputs using externally connected switches. Doing so, the outputs will be controlled in exactly the same way as with the switches on the module. Any configured runtimes are not taken into account – as is also the case in manually overridden mode. |
| | | ***00 00*** | ***Controlling the blind by means of the DI's is deactivated*** |
| | 1 | 00 01 | DI1 activates opening of blind 1 |
| | 2 | 00 02 | DI2 activates closing of blind 1 |
| | 3 | 00 04 | DI3 activates opening of blind 2 |
| | 4 | 00 08 | DI4 activates closing of blind 2 |

*Digital Inputs:*

| R101 (*) | | Value Hex | Status of Digital Inputs |
|---|---|---|---|
| | DI No. | (DI4 … DI1) | The bits of this register indicate the current status of the digital inputs. The least significant bit is associated with DI1, followed by the other ones up to DI4. |
| | 1 | 00 01 | DI 1 |
| | 2 | 00 02 | DI 2 |
| | 3 | 00 04 | DI 3 |
| | 4 | 00 08 | DI 4 |

| R1100(*) | | Value Hex | Inverting Digital Inputs |
|---|---|---|---|
| | DI No. | (DI4 … DI1) | Using this register, the 4 digital inputs can be inverted individually. Each DI is assigned to a bit of the register. The assignment corresponds to that of the register R101 (current status of the digital inputs). The settings of this register are stored in non-volatile memory. |
| | | ***00 00*** | ***No DI is inverted*** |
| | 1 | 00 01 | Inverting DI 1 |
| | 2 | 00 02 | Inverting DI 2 |
| | 3 | 00 04 | Inverting DI 3 |
| | 4 | 00 08 | Inverting DI 4 |

| R100 (*) | | Value Hex | Change flag Digital Inputs |
|---|---|---|---|
| | DI No. | (DI4 … DI1) | The bits of this register are set when the state of a DI has changed. When the register has been read, all bits are automatically reset to zero. Each DI is assigned to a bit of the register. The assignment corresponds to that of the register R101 (current status of the digital inputs). |
| | 1 | 00 01 | Change of DI 1 |
| | … | … | … |
| | 4 | 00 08 | Change of DI 4 |

| R1101(*) | | Value Hex | Delay of the edge detection |
|---|---|---|---|
| | DI No. | (DI4 … DI1) | This register determines for which inputs the detection of a change of the input signal has to be delayed. This is necessary if the DIs have to be driven with AC. The delay time is set in the register R1111. Each DI is assigned to a bit of the register. The assignment corresponds to that of R101. |
| | | ***00 00*** | ***None of the DI signals will be delayed*** |
| | 1 | 00 01 | Signal of DI 1 delayed / smoothed |
| | … | … | … |
| | 4 | 00 08 | Signal of DI 4 delayed / smoothed |

| R1111(*) | | Value Dec | Time for the delay of the input signal |
|---|---|---|---|
| | | | A change of signal which is connected to a DI will be realized only after expiry of this time. The value in the register R1111 multiplied by 10 gives the delay time in milliseconds. |
| | | ***10*** | ***Delay = 100 ms (if activated using R1101)*** |
| | | 4 | Delay = 40 ms (minimum recommended for 50 Hz AC signals) |

# D8 - Overview of Registers which all modules have in common

In the following descriptions of the register settings, ***default values***, if any, are ***highlighted***. These settings are suitable for most applications and at the initial commissioning.
The values in the underlined registers are stored in non-volatile memory. These registers should not be written continuously.

**(*) The registers marked with this asterisk can be read or written only individually, not as a contiguous block.**

| R 2 (*) | | Value Dec | Setting the baud rate |
|---|---|---|---|
| | | | Using this register, the baud rate is set. So that this setting will take effect, the automatic baud rate detection (autobaud) must be deactivated in register R 3.<br>**Note:** This register is not suitable to display the current baud rate if autobauding is enabled. For this purpose, the register R 22 may be used. |
| | | 1 | 57.600 Baud |
| | | 2 | 38.400 Baud |
| | | 3 | 19.200 Baud |
| | | 4 | 9.600 Baud |

| R 3 (*) | | Value Dec | Automatic baud rate detection |
|---|---|---|---|
| | | | The setting in this register determines whether autobauding should be enabled or whether the module operates at a fixed baud rate, which is configured in register R 2. |
| | | 0 | Autobaud function is disabled |
| | | 1 | Autobaud is enabled during the first 5 minutes after a cold start |
| | | ***255*** | ***Autobaud function is enabled*** |

| R 4 (*) | | Value | Bus Timeout |
|---|---|---|---|
| | | | If no valid bus telegram is received for the time which is set in this register, the LED ‘Bus’ starts flashing in red color. Possibly existing outputs will assume the states/values that are defined as "Safe State" (see registers R 2535 and R 2521 ... R 2528 at romod 8AO or registers R 2135 and R 2121 at romod 8DO [-R], 4DIO-R and 4DO-R). As soon as bus telegrams are received again, the outputs will revert to their states sent via the Modbus to the module. Moreover, the LED flashes green again. The value in register R 4 is given in decimal, the unit is ‘seconds’. |
| | | ***60*** | ***Bus timeout = 60 seconds*** |
| | | 0 | Timeout and Safe State function disabled |
| | | | |

| R 6 (*) | | Value Dec | Sending a command to the module |
|---|---|---|---|
| | | | By means of this register, functions like lamp test and the reset of counters, masks or even the entire module can be triggered by sending a command to the device. |
| | | 1 | Resets the module via watchdog (incl. reset of all masks to default values!) |
| | | 10 | Lamp test (short time) |
| | | 11 | Lamp test (longer time) |
| | | 20 | Resets all masks to default values |
| | | 30 | Resets all counter values to zero |
| | | 255 | Resets all EEPROM parameters to default |
| | | 275 | = commands 20 + 255 |
| | | 285 | = commands 30 + 255 |
| | | 306 | = commands 20 + 30 + 255 + 1 |

| R210 (*) | | Value Hex | Controlling the two freely usable status LEDs |
|---|---|---|---|
| | LED Nr. | (L2 … L1) | Using the bits of this register, both freely-usable status LEDs can be enabled via bus command. Each color (red and green) of each LED is assigned to a bit of the register. |
| | 1 | 00 01 | Switching ON LED 1 (left) in green color |
| | | 00 02 | Switching ON LED 1 (left) in red color |
| | 2 | 00 04 | Switching ON LED 2 (right) in green color |
| | | 00 08 | Switching ON LED 2 (right) in red color |

| R 1 (*) | | Value Dec | Reading the set bus address |
|---|---|---|---|
| | | | With this register the adjusted address of the module can be read via the bus. |

| R 10 (*) | | Value Dec | Reading the type of module |
|---|---|---|---|
| | | | This register contains the type of module in a coded form. The values have the following meaning: |
| | | 5116 | romod 16 DI |
| | | 5008 | romod 8 DO |
| | | 5508 | romod 8 DO-R |
| | | 5504 | romod 4 DIO-R |
| | | 5404 | romod 4 DO-R |
| | | 5308 | romod 8 AI |
| | | 5208 | romod 8 AO |
| | | 5514 | romod 4DI2DO-R-3P |

| R 12 (*) | | Value Dec | Reading the firmware version |
|---|---|---|---|
| | | | Using this register, the firmware version of the module can be read via the bus. |

| R 22 (*) | | Value Dec | Reading the current baud rate |
|---|---|---|---|
| | | | By means of this register, the baud rate with which the module is currently communicating can be read. Doing so, it does not matter whether the baud rate has been fixed using the registers R2 and R3, or it has been identified by the autobaud function. |
| | | 1 … 4 | Meaning of the values identical to register R2 |