DREHMO
VALVE ACTUATORS

A member of the AUMA Group

MODBUS loop redundant board for *i-matic* actuators

Complementary operating manual
for devices with MODBUS loop redundancy

INFORMATION

This installation manual has to be used in conjunction with the actuator operating manual!

This manual must be kept for future use.

Document history

File revision	Date	Changes
0	2009-11-15	First release (T-OF)
1	2013-09-06	Description of revised process image. FO signals added. Command STOP added. Enable signals and ESD signal moved. (T-OF)
2	2014-07-07	Added description for firmware download via IrDA interface. Changed pictures of interface board to current version. Updated descriptions for diagnosis LEDs. (T-OF) Update Bus connection
3	2016-02-18	Added signal ESD active to process image, starting with FW rev. V2.02.0010. (T-OF)

Contact

DREHMO GmbH
Zum Eichstruck 10
57482 Wenden
Germany

Service
Tel.: +49 2762 9850-206
Fax: +49 2762 9850-205
E-Mail: drehmo@drehmo.com

Table of contents

1 Warnings and notes

1.1 Standards / directives

DREHMO products are designed and manufactured in compliance with recognized standards and directives. This is certified in a declaration of incorporation and a declaration of conformity.
The end user or the contractor must ensure that all requirements with respect to assembly, electrical connection, and commissioning at the place of installation are met.
They include among others:

- Applicable configuration directives for fieldbus applications.
- National regulations, laws, and prescriptions.

1.2 Commissioning (Electrical connection)

During operation of electrical devices it is unavoidable that certain parts carry dangerous voltages. All personnel working with this device must be familiar with the safety and warning instructions in this manual and observe the instructions given. Safety instructions and warning signs on the device must be observed to avoid personal injury or property damage.

1.3 Maintenance

Maintenance directives have to be carefully attended. Otherwise a safe operation of the actuator or control unit can't be assured.

1.4 Warnings and notes

Read these instructions carefully before installation and commissioning. Failure to follow them may lead to personal injury or to material damage.

The following signs draw special attention to safety-relevant procedures in these operation instructions:

This symbol signifies „additional information".
Failure to observe may lead to damage occurring.

This symbol signifies „attention".
Failure to observe may result in damage and personal injury.

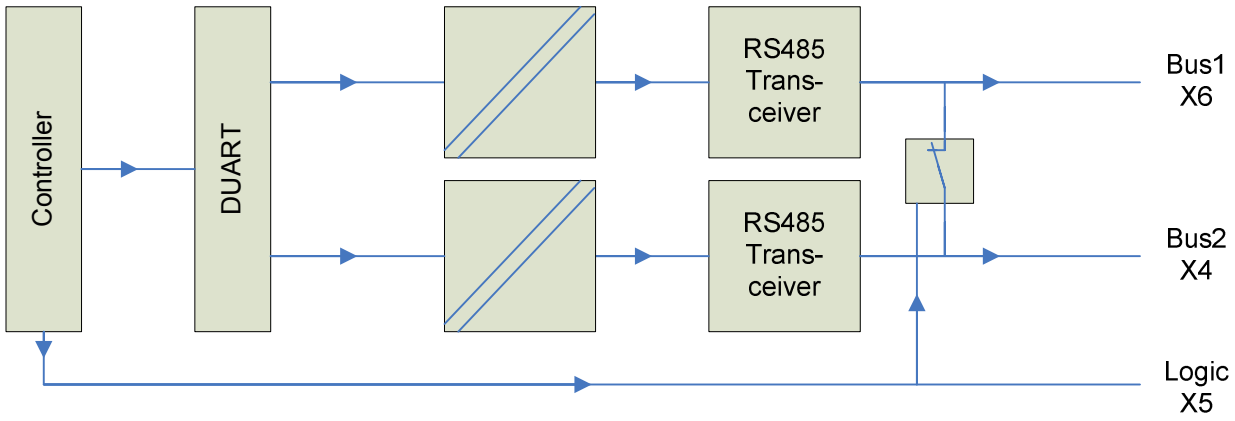
This symbol signifies „warning!"
Failure to observe may result in damage and severe personal injury.

2 Preface

2.1 Structure of the interface board

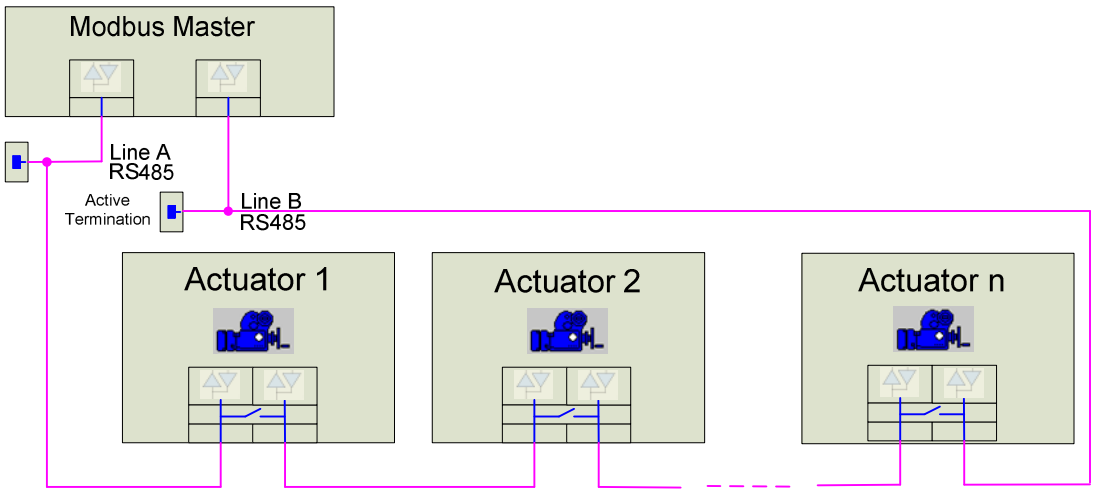
The MODBUS interface board DiM-17 is equipped with two galvanically separated autonomous RS485 interfaces. In conjunction with the integrated powerful controller a reapeater functionality is given. This allows to extend the RS485 communication over larger distances.

In addition the board is equipped with a relay which connects the attached segments in case of a loss of the repeater functionality to increase the availability.



2.2 Repeater feature

The repeater within each interface separates the network into segments. Each connection between two actuators can therefore be seen as a single point to point connection. The repeater reconditions the MODBUS signal with a delay of 0.5 tBit.



2.3 Transmission technique/Physical layer

Data is transmitted by means of a physical connection over a twisted pair two wire cable. The interface board supports transmission rates up to 115200 Baud.
Bus access is handled in master/slave mode. Only one master can be active at a time (Mono master mode). The master acts with polling mode and a request / response cycle.
In one master system theoretically 247 slaves can be addressed.
The used protocol is MODBUS RTU.

2.4 Protection functions / Data secure mechanisms

As protection mechanisms against data violation MODBUS RTU implements a parity check for each byte and a 16 bit CRC for every MODBUS telegram.

In addition a watchdog within the slaves monitors the correct connection to the master. The behavior of the actuator as well as the timeout value is parameterizable.

The master should also implement a communication monitoring resulting in a failure signalization in case of communication loss or malfunction.

3 Electrical connection

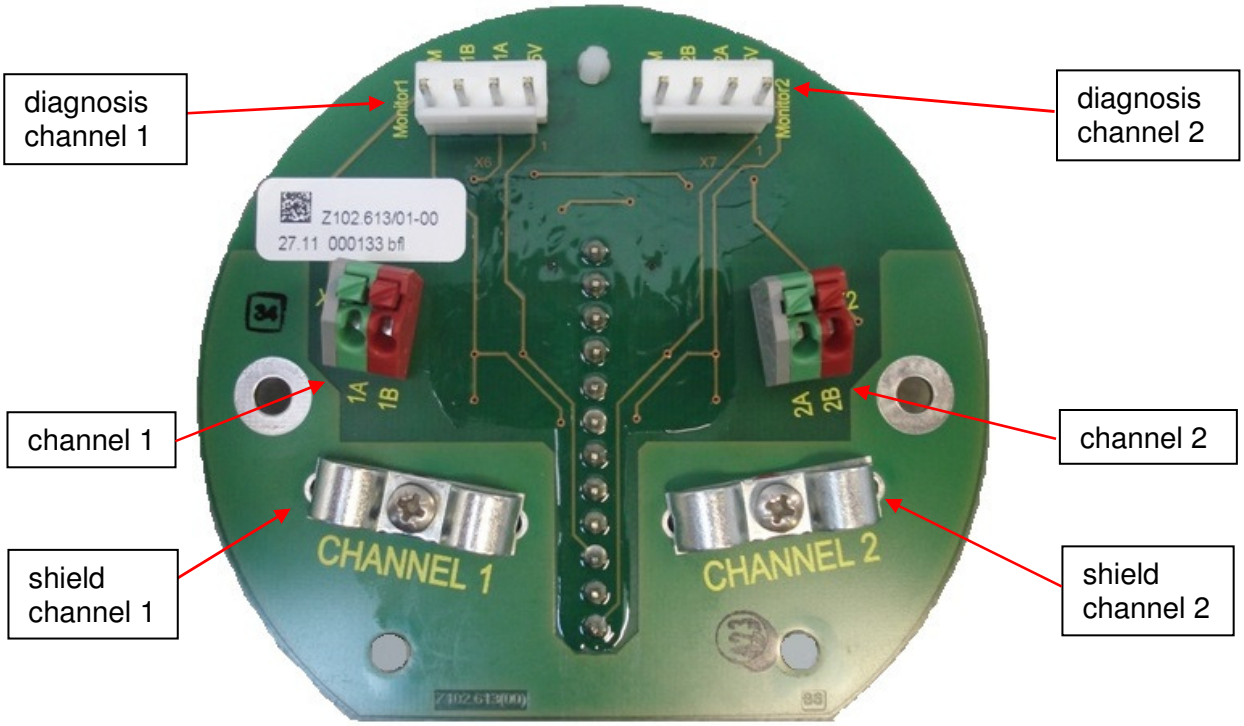
3.1 Mains connection (Standard)

Work on electrical equipment and electrical installation work on actuators must be carried out by electricians or under supervision by fully qualified engineers, in accordance with the valid electrical regulations.
Wiring should be carried out according to the enclosed wiring diagram. All control cables shall be shielded to guarantee the electromagnetic compatibility of the actuator. The main power cable need not be shielded.
The overcurrent protection of the actuator has to be installed inside the power network. For rated values, see design data.

Pay special attention to the grounding of the actuator (refer to wiring diagram). Electrical protection is not obtained until all covers are closed.

3.2 Bus connection (Standard)

Wiring is carried out according to the wiring diagram supplied with the actuator. The locations of the connection terminals are shown in the following picture:



Connection data:

Strip length:	9 mm
Wire insertion angle relative to PCB:	45°
Connection technology:	Phoenix Contact PTSA 1,5/ 2-3,5-Z
Cross section (solid-conductor):	0.5 to 1.5 mm²
Cross section (multi-conductor):	0.5 to 1.5 mm²
Cross section (multi-conductor):	0.5 to 1 mm² (ferrule without plastic shroud)

Pay attention to the ESD protection of the bus circuit board. Especially good personal earthing is required.
If the bus circuit board is disassembled from its housing transport and storage must meet ESD requirements.

3.3 Shield connection

The strain-reliefs in front of the terminal connections for the fieldbus can be used to connect the cable shields to ground instead of the preferred usage of EMC cable glands.

3.4 Bus termination

RS485 networks have to be terminated at the beginning and the end of a segment, to avoid reflections on the line and for a conditioning of the signals. The termination is automatically controlled by the loop redundant interface itself depending on the communication state. Therefore a separate switch for controlling the terminators is obsolete.

3.5 Lightning protection (option)

The connection board can be equipped with dedicated components for lightning protection as an option.

3.6 Bus cable

Only cables according to the specification for RS-485 (MODBUS RTU) should be used: [1]

Impedance	135 to 165 Ohm, at a test frequency of 3 to 20 MHz
Line capacity	< 30 pF per meter
Wire diameter	> 0,64 mm
Wire gauge	> 0,34 mm² (equivalent AWG 22), max. 1,5 mm²
Loop impedance	< 110 Ohm per km
Shielding	Copper mesh screen or mesh screen with foil screen

Respect a distance of minimum 20 cm between the bus cable and other cables. If possible, bus cables should be laid in a separate, conductive, and earthed cable tray.
Make sure to avoid potential differences between the individual devices on the bus (perform a potential equalization).

There is not standardized color marking for RS485 wiring.
Usually the marking is a follows: P/B = brown and N/A = white

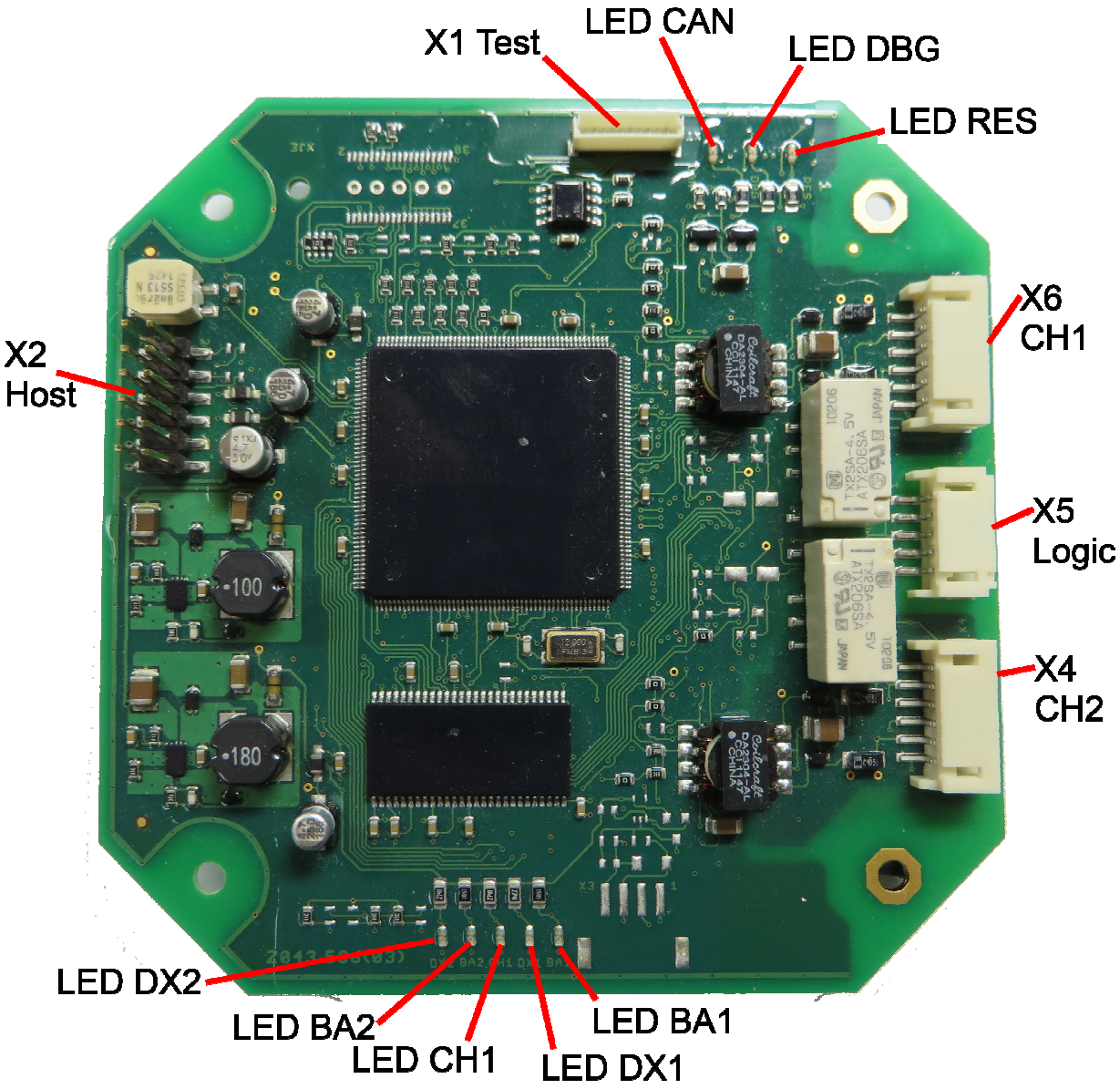
The maximum values at a given transmission rate in conjunction with the above given cable parameters are as follows:

Bit rate [kbit/s]	Bit time	Max. segment length [m]	Max. stub length [m]
300	3.3 ms	1200	500
600	1.7 ms	1200	500
1200	833.3 µs	1200	500
2400	416.7 µs	1200	500
4800	208.3 µs	1200	500
9600	104 µs	1200	500
19200	52 µs	1200	500
38400	26 µs	1200	100
57600	17.36 µs	1200	100
115200	8,68 µs	1000	33

[1] See reference: ‚Modbus over serial line'

4 Jumper / LED's of the interface board

4.1 Location of the components on the interface board



4.2 Connectors

The interface board is equipped with several connectors. The function of the connectors is as follows:

Connector	Meaning	Description
X1	TEST	Test connector for diagnosis purposes via a signal converter and a terminal program. Also the firmware update of the interface board can be done via this connector.
X2	HOST	Connector to host system. The power supply and the communication with the host system is done via this connector. To ensure a secure communication to the host system the pins 1-2 and 3-4 must be shortened with a jumper.
X4	RS485 CH2	RS485 interface channel 2.
X5	RING/LWL	Connector for other components. E.g. a fiber optics converter or a bus interface board can be connected via this plug.
X6	RS485 CH1	RS485 interface channel 1.

4.3 Diagnosis LED's

4.3.1 LED RES

This LED indicates the state of the RESET signal of the controller. Is this LED off the RESET signal is activated. A normal program flow is not possible in this case. For a correct execution of the application the LED has to be constantly on.

4.3.2 LED DBG

This LED indicates the correct program execution flow with a flash rate of 1Hz. If the LED keeps off, the user program is not executed. In this case the interface board either has a malfunction, the firmware is missing or the bootloader mode for a firmware download is activated.

4.3.3 LED CAN

This LED indicates the state of the CAN communication to the main board. If this LED is constantly on, the communication is carried out with no failure. If this LED is off the communication is disturbed.

4.3.4 LED CH1

The LED indicates the primary channel from which commands are accepted. If LED CH1 is on then channel 1 is the primary channel. If the LED is off channel 2 is the primary channel.

4.3.5 LED BA1+BA2

This LED's indicate active MODBUS bus communication over the respective channel. The LED is on if valid Modbus telegrams with correct checksum are detected on the respective channel. (Valid baudrate and framing)

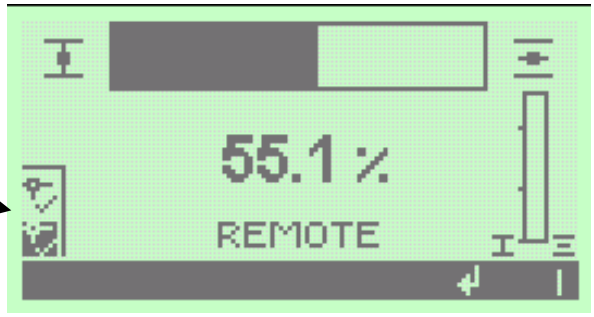
4.3.6 LED DX1+DX2

This LED's indicate valid Modbus communication to the own address. This LED is on if valid Modbus telegrams to the own address are received from the respective channel.
(Data exchange)

4.4 Diagnosis via LCD Display of the actuator

In addition to signalize the communication state via the LED's, the state is graphically indicated on the LCD display of the actuator. When using the loop redundant MODBUS interface 2 symbols are shown whereas the upper one icon indicates the state of channel 1 and the lower one the state of the channel 2.
The active channel (channel from which signals will be used to control the actuator) is displayed inverse (meaning bright icon on dark background).

Fieldbus state



Symbol	Meaning
	Bus not connected or wrong baud rate is selected, no valid MODBUS telegrams detected.
	Bus ok, valid MODBUS telegrams detected. Slave is not addressed directly by the master via this channel.
	Bus ok, the slave is addressed directly by the master via this channel.

5 Communication specific parameters MODBUS RTU

Each device in the MODBUS is accessed via its fieldbus address (Field device address). For each bus system this address has to be unique. When delivered to the customer the address is set to the default value of 247. It is possible to specify another address via customer specific parameterization upon request during ordering process.

5.1 Communication parameters MODBUS RTU

BUS-Address:	1 to 247
Transmission rates:	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Bit/s
Parity:	According to MODBUS RTU specification Even parity or odd parity with 1 stop bit No parity with 2 stop bits In addition the stopbits can be parameterized to a non specification conform value.
Connection watchdog timeout:	0,1 to 25,5 s
Frame per byte:	1 Start bit + 8 Data bits + 1 Parity Bit + 1 Stop bit or 1 Start bit + 8 Data bits + 2 Stop bit,

The communication specific parameters are set „non-intrusive“ via the actuators local operation display or via a parameterization tool. The parameters are stored in an EEPROM to prevent from loss in case of power failure.
MODBUS does not support an automatic detection of the communication parameters. Therefor the settings within the device have to match those of the host (master).
The communication settings are also used to re-condition the bus signals by the repeater. For this reason correct communication settings are also essential for a reliable repeater function.

Default values:
Address 247, 38400 Bit/s, no parity, 2 stop bits, Watchdog timeout 5s.

5.1.1 Parameter settings using the display

The MODBUS specific parameters can be set using the actuators display. The parameters can be found beneath the menu item

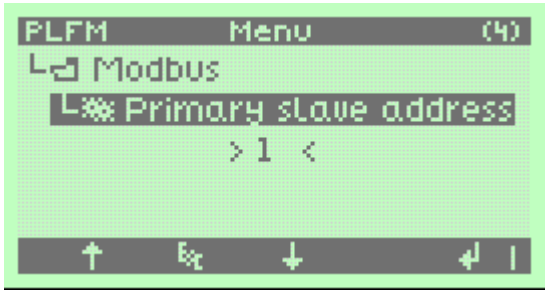
Menu -> Parameter -> DCS/PLC System -> Interface -> MODBUS

For further information regarding the operation of the display please refer to the i-matic instruction manual.

5.1.1.1 Primary slave address

Description This parameter defines the address with which the primary channel of the modbus interface can be addressed.

Range *1..247*

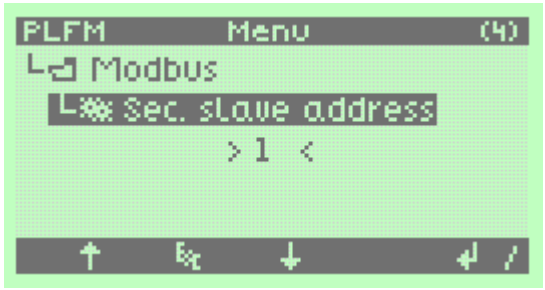


Remark The value 247 is reserved for new devices and should not be used in a real installation.

5.1.1.2 Secondary slave address

Description This parameter defines the address with which the secondary channel of the modbus interface can be addressed.

Range *1..247*

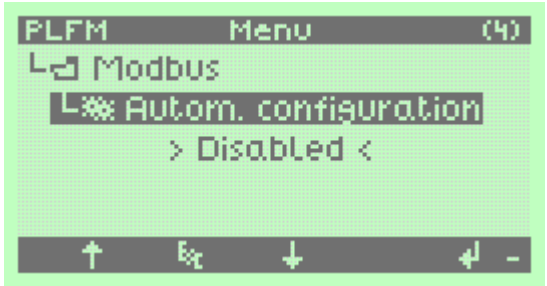


Remark The value 247 is reserved for new devices and should not be used in a real installation. The secondary address is only used with the master/slave version of the interface.

5.1.1.3 Automatic configuration

Description With this setting the automatic bus configuration can be enabled. If the automatic configuration is enabled the communication speed (Baudrate) and address settings will be detected automatically.

Range *Disabled / Enabled*



Remark The automatic configuration will only work with the loop redundant version if the interface. With all other versions this item will be ignored. If the automatic configuration is enabled the following parameters are obsolete:

- Primary / secondary slave address
- Baudrate
- Parity
- Stopbits

The automatic configuration will only work with a serial frame of 11 bits / even parity and 1 stopbit.

The detected communication settings will be stored in the interface memory. After a restart of the interface the settings will be used for communication.

The detected communication speed and slave address can be determined in the menu tree Actual values / Diagnosis.

5.1.1.4 Reset automatic configuration

Description: Resets the detected communication settings and starts the automatic detection.

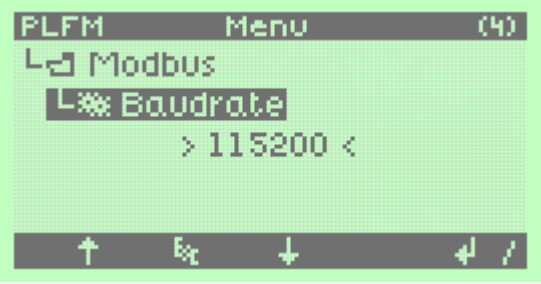
Range: *No / Yes*

Remark: To restart the detection the entry Yes has to be selected. If the reset was recognized by the control logic the display will return to No.

5.1.1.5 Baudrate

Description: Communication parameter speed.

Range: *115200 / 57600 / 38400 / 19200 / 9600 / 4800 / 2400 / 1200 / 600 / 300*



Remark: This parameter will be ignored if the loop redundant version is selected and the automatic configuration is enabled.

5.1.1.6 Parity

Description Communication parameter parity.

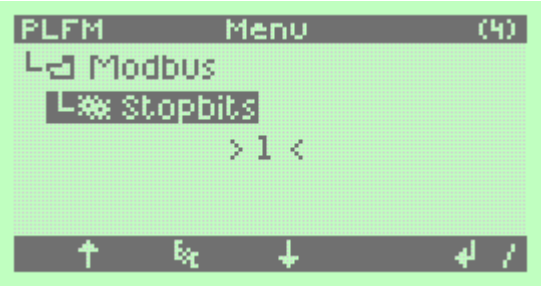
Range *None / Even / Odd*

Remark This parameter will be ignored if the loop redundant version is selected and the automatic configuration is enabled.

5.1.1.7 Stopbits

Description Communication parameter stopbits.

Range *1 .. 2*

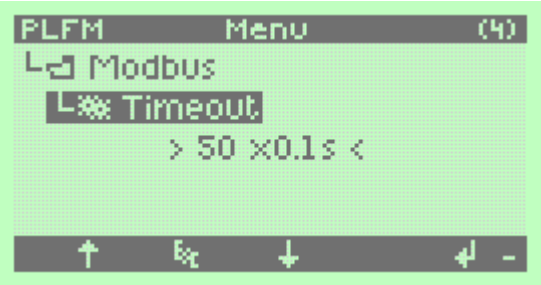


Remark This parameter will be ignored if the loop redundant version is selected and the automatic configuration is enabled.

5.1.1.8 Timeout

Description Watchdog time for communication monitoring in 0.1s. After expiration of this time the actuator will execute the parameterized fail safe reaction.

Range *1..255 x 0.1s*

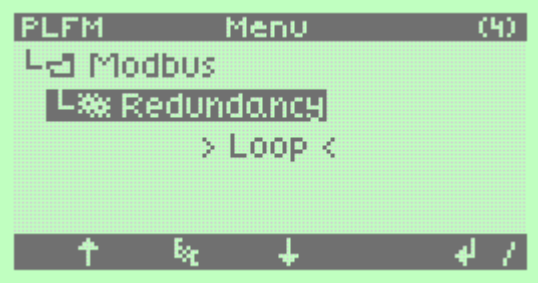


Remark

5.1.1.9 Redundancy

Description: With this parameter the interface is adapted to different redundancy concepts.

Range: *Loop / Line reply act. Channel / Line reply both channels / Master/Slave*

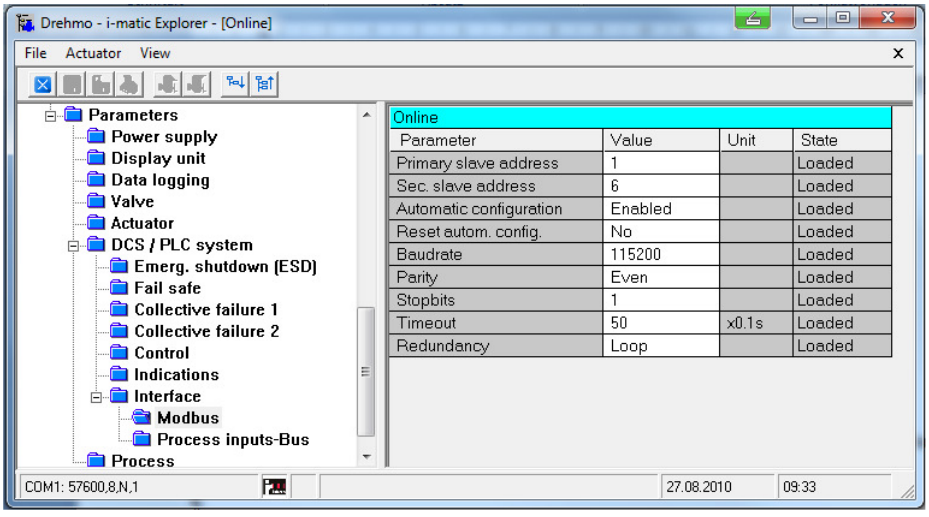


Remark

- Loop: Interface acts like a repeater. Connection between two devices can be seen as a point to point connection. The loop starts at the master going to every device and ends at the master.
- Line reply act. channel: The interface can be accessed over two independent connections with the same address. The reply of the device will only be issued over the request channel.
- Line reply both channels: The interface can be accessed over two independent connections with the same address. The reply of the device will issued over both channels.
- Master/Slave: The interface is equipped with two independent modbus channels. The addresses of the channels can be set individually.

5.1.2 Parameter settings using a parameterization tool

In addition to set the parameters using the display, parameters can also be set via the parameterization tool i-matic Explorer.



6 MODBUS

For commissioning of a MODBUS slave usually no specific configuration of the master my means of a configuration file is necessary. The MODBUS RTU transmission is based on a simple protocol which consists of the slave address, a function code, address values, payload and checksum.

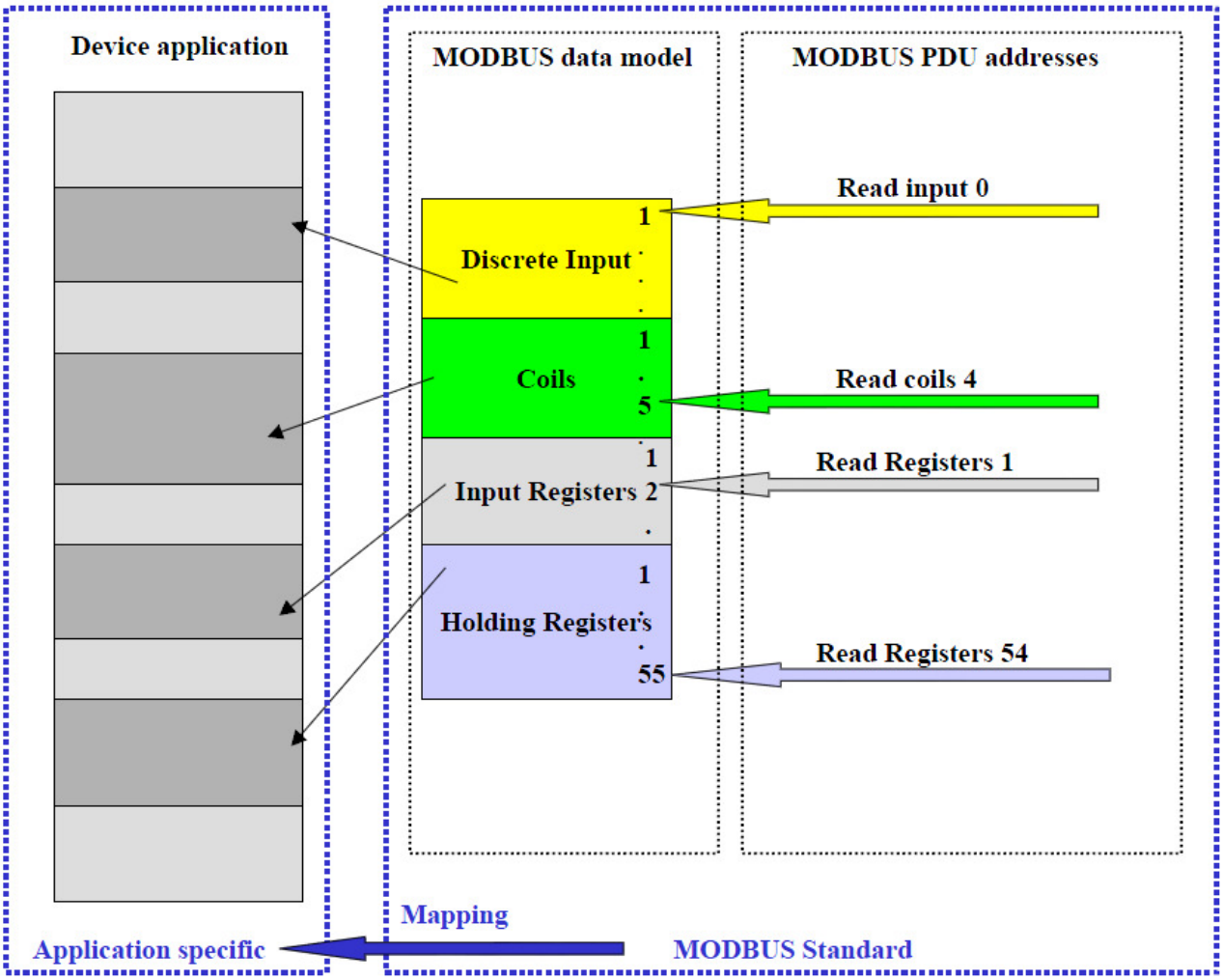
6.1 MODBUS protocol layer

6.1.1 Supported function codes

Function	Function-code	Meaning
Write Single Coil	05 (0x05)	Sets a single bit in the slave to ON or OFF
Write Multiple Coils	15 (0x0F)	Sets a count of continuous bits in the slave to ON or OFF
Read Coils	01 (0x01)	Reads back the state of continuous output bits back from the slave
Read Discrete Inputs	02 (0x02)	Reads back the state of continuous input bits from the slave
Write Single Register	06 (0x06)	Writes data (16bit) to a single holding register in the slave
Write Multiple Register	16 (0x10)	Writes a count of data (x times 16bit) to continuous holding registers in the slave
Read Input Registers	04 (0x04)	Reads the data from continuous input (16 bit) registers in the slave
Read Holding Registers	03 (0x03)	Reads back a count of data (x times 16bit) from continuous holding registers in the slave
Read Exception Status	07 (0x07)	Reads the content of 8 exception status outputs of the slave
Diagnostics	08 (0x08)	Diagnostic functions for checking the communication status between master and slave
Report Slave ID	17 (0x11)	Reads identification information from the slave for stand alone configuration of the master

6.1.2 MODBUS addressing model

The MODBUS specification differs between two different addressing modes. The MODBUS data model address and the MODBUS PDU address which has always an offset of -1 to the MODBUS data model address. All in this document mentioned addresses are directly specified as the address which has to be used in the MODBUS PDU. This is the reason that in some cases the offset of 1 has to be subtracted to access the desired data. The following extract from the MODBUS standard describes this:



6.1.3 Valid Offsets / Subfunction codes

Object	Function codes	Offset (decimal)	Offset (hex)
Coil *)	Write Single Coil (05) Write Multiple Coils (15) Read Coils (01)	0..262	0..106
Holding Register	Write Single Register (06) Write Multiple Register (16) Read Holding Registers (03)	1000..1002	3E8..3EA
Discrete Inputs *)	Read Discrete Inputs (02)	0..1028	0..404
Input Register	Read Input Registers (04)	1000..1008	3E8..3F0

*) For further use. At present no function.

08 (0x08) Diagnostic

Subfunction code	Subfunction	Meaning
00 (0x00)	Return query data	The data passed in the request data field will be returned within the response (loop back).
10 (0x0A)	Clear counter and diagnostic register	Clear all counters and diagnostic registers. Counters are also cleared upon power up.

11 (0x0B)	Return bus message count	The response data field returns the quantity of messages that the remote device has detected on the communications system since its last restart, clear counters operation, or power–up.
12 (0x0C)	Return bus communication error count	The response data field returns the quantity of CRC errors encountered by the remote device since its last restart, clear counters operation, or power–up.
13 (0x0D)	Return bus exception error count	The response data field returns the quantity of MODBUS exception responses returned by the remote device since its last restart, clear counters operation, or power–up.
14 (0x0E)	Return slave message count	The response data field returns the quantity of messages addressed to the remote device, or broadcast, that the remote device has processed since its last restart, clear counters operation, or power–up.
15 (0x0F)	Return slave no response count	The response data field returns the quantity of messages addressed to the remote device for which it has returned no response (neither a normal response nor an exception response), since its last restart, clear counters operation, or power–up.
16 (0x10)	Return slave NAK count	The response data field returns the quantity of messages addressed to the remote device for which it returned a Negative Acknowledge (NAK) exception response, since its last restart, clear counters operation, or power–up.
17 (0x11)	Return slave busy count	The response data field returns the quantity of messages addressed to the remote device for which it returned a Slave Device Busy exception response, since its last restart, clear counters operation, or power–up.
18 (0x12)	Return bus character overrun count	The response data field returns the quantity of messages addressed to the remote device that it could not handle due to a character overrun condition, since its last restart, clear counters operation, or power–up. A character overrun is caused by data characters arriving at the port faster than they can be stored, or by the loss of a character due to a hardware malfunction.

6.2 Cyclic data

6.2.1 Input register

Input data (Data transferred from the actuator to the master)

Register	Bit	Signal	Meaning
1000	0	Failure motor temperature	Motor is too hot => forced disconnection
	1	Phase failure	One of the three phases is missing
	2	Mode REMOTE	Actuator can be operated via remote commands
	3	Mode LOCAL	Actuator can be operated locally
	4	Intermediate position 1	indication active between CLOSE and Intermediate position 1
	5	Intermediate position 2	indication active between intermediate position 2 and OPEN
	6	Torque in the OPEN direction	Tripping torque in the OPEN direction exceeded
	7	Torque in the CLOSE direction	Tripping torque in the CLOSE direction exceeded
	8	Final position OPEN	Final position indication OPEN according to parameterization
	9	Final position CLOSE	Final position indication CLOSE according to parameterization
	10	Spare	
	11	Not ready REMOTE	Combined indication as an logical OR-operation of the following signals: Not REMOTE; Phase fault; Motor temperature; Hardware fault; Combined sensor fault, System test fault
	12	Actuator moves OPEN	Operation indication OPEN
	13	Actuator moves CLOSE	Operation indication CLOSE
	14	Collective fault 2	Collective fault 2 according to parameterization
	15	Collective fault 1	Collective fault 1 according to parameterization
1001		Actual position	Feedback of actual poition (CLOSE = 0 Dez / OPEN = 1000 Dez) [1]
1002	0-1	Spare	
	2	Mode REMOTE	Actuator can be operated via remote commands
	3	Spare	
	4	Actuator moves	Actuator is electrically moved towards OPEN or CLOSE
	5	Handwheel operation	Actuator is moved by handwheel
	6	Operates REMOTE	Actuator is moved electrically in mode REMOTE
	7	Operates LOCAL	Actuator is moved electrically in mode LOCAL
	8	Final position CLOSE	Final position indication CLOSE according to parameterization
	9	Final position OPEN	Final position indication OPEN according to parameterization

[1] Depending on parameterization an overrun of the limit position results in an overflow of the given data range

Register	Bit	Signal	Meaning
	10	Mode REMOTE	Actuator can be operated via remote commands
	11	Torque in CLOSE direction	Tripping torque in the CLOSE direction exceeded
	12	Torque in OPEN direction	Tripping torque in the OPEN direction exceeded
	13	Phase failure	One of the three phases is missing
	14	Not ready REMOTE	Combined indication as an logical OR-operation of the following signals: Not REMOTE; Phase fault; Motor temperature; Hardware fault; Combined sensor fault, System test fault.
	15	Collective fault 1	Collective fault 1 according to parameterization
1003	0-7	Reserve	
	8	Intermediate position 1	Actuator is in parameterized intermediate position 1
	9	Intermediate position 2	Actuator is in parameterized intermediate position 2
	10	Intermediate position 3	Actuator is in parameterized intermediate position 3
	11	Intermediate position 4	Actuator is in parameterized intermediate position 4
	12	Intermediate position 5	Actuator is in parameterized intermediate position 5
	13	Intermediate position 6	Actuator is in parameterized intermediate position 6
	14	Intermediate position 7	Actuator is in parameterized intermediate position 7
	15	Intermediate position 8	Actuator is in parameterized intermediate position 8
1006	13	ESD active	Emergency shutdown is forced by REMOTE signal. (Starting with interface board firmware version V2.02.0010)
1008	0	FO Channel 1 enabled	FO module channel 1 is activated
	1	FO channel 1 data exchange	Active communication over FO channel 1
	2	Failure FO channel 1	Optical receiving signal (channel 1) incorrect (no or insufficient Rx receive level) or RS-485 format error (incorrect bit(s))
	3	FO budget channel 1	Warning: FO cable system reserve reached (critical or permissible Rx receive level)
	4	FO Channel 2 enabled	FO module channel 2 is activated
	5	FO channel 2 data exchange	Active communication over FO channel 2
	6	Failure FO channel 2	Optical receiving signal (channel 2) incorrect (no or insufficient Rx receive level) or RS-485 format error (incorrect bit(s))
	7	FO budget channel 2	Warning: FO cable system reserve reached (critical or permissible Rx receive level)
	8	FO module present	FO module is present
	9-15	Reserve	

6.2.2 Output register

Output data (Data transferred from the master to the actuator)

Register	Bit	Signal	Meaning
1000	0..7	Spare	
	8	Command OPEN	Moves the actuator in open direction. In case of activated positioner V005 only if command AUTO = 0.
	9	Command CLOSE	Moves the actuator in close direction. In case of activated positioner V005 only if command AUTO = 0.
	10	Command AUTO (V005)	Activates the integral 3-point position controller (actuator is positioned according to comparison of setpoint value with actual position value)
	11	Fault acknowledge	Reset mechanism for dedicated stored faults (e.g. torque, phase errors) as described in actuator operation manual.
	12	Command STOP	Stops the actuator (e.g. in REMOTE command latch mode). In case of activated positioner V005 only if command AUTO = 0.
	13-15	Spare	
1001		Position setpoint	Position setpoint for internal positioner (ZU = 0 Dec / AUF = 1000 Dec)
1002	0	Intermediate position 1	Moves the actuator with the multiport valve option to intermediate position 1
	1	Intermediate position 2	Moves the actuator with the multiport valve option to intermediate position 2
	2	Intermediate position 3	Moves the actuator with the multiport valve option to intermediate position 3
	3	Intermediate position 4	Moves the actuator with the multiport valve option to intermediate position 4
	4	Intermediate position 5	Moves the actuator with the multiport valve option to intermediate position 5
	5	Intermediate position 6	Moves the actuator with the multiport valve option to intermediate position 6
	6	Intermediate position 7	Moves the actuator with the multiport valve option to intermediate position 7
	7	Intermediate position 8	Moves the actuator with the multiport valve option to intermediate position 8
	8	Enable local operation	Enables local operation. The behavior depends on the parameter “Lock display unit”.
	9	Enable LOCAL OPEN	Enables local operation of the actuator in OPEN direction. The behavior depends on the parameter “Lock display unit”.
	10	Enable LOCAL CLOSE	Enables local operation of the actuator in CLOSE direction. The behavior depends on the parameter “Lock display unit”.
	11	Reserve	

	12	Reserve	
	13	Reserve	
	14	Command ESD	Emergency shutdown command
	15	Reserve	

6.3 Special function codes

6.3.1 Read exception-Status (Function code 07)

Bit	Signal	Meaning
0	Ready REMOTE	Combined indication as an logically AND-operation of the following signals: REMOTE; No Phase fault; No Motor temperature; No Hardware fault; No Combined sensor fault, No System test fault.
1	Mode REMOTE	Actuator can be operated via remote commands
2	Actuator moves CLOSE	Operation indication CLOSE
3	Actuator moves OPEN	Operation indication OPEN
4	Final position CLOSE	Final position indication CLOSE according to parameterization
5	Final position OPEN	Final position indication OPEN according to parameterization
6	Torque in CLOSE direction	Tripping torque in the CLOSE direction exceeded
7	Torque OPEN	Tripping torque in the OPEN direction exceeded

6.3.2 Report Slave ID (Function code 17)

Byte	Wert	Meaning	Description
0	6	i-matic V003 without internal positioner	Slave ID (Coding of the actuator type)
	7	i-matic V005 with internal positioner	
1	0	Run indicator: Not ready REMOTE	Run Indicator Status
	255	Run indicator: Ready REMOTE	
2-19		Manufacturer	„Drehmo GmbH“
20-37		Electronic Code	„iM00X-XX-XXX-XXX
38-50		Firmware Version	„V1.XXXX/XXXX
51-70		TAG/KKS	Plant identification code
71-83		Serial number 1	Serial number
84-96		Serial number 2	Serial number repeated

7 System functions

Following chapters describe deeper interventions into system functions. Thus the described actions should be carried out only by professional well trained personnel. Faulty operation or failures could result in major damages.

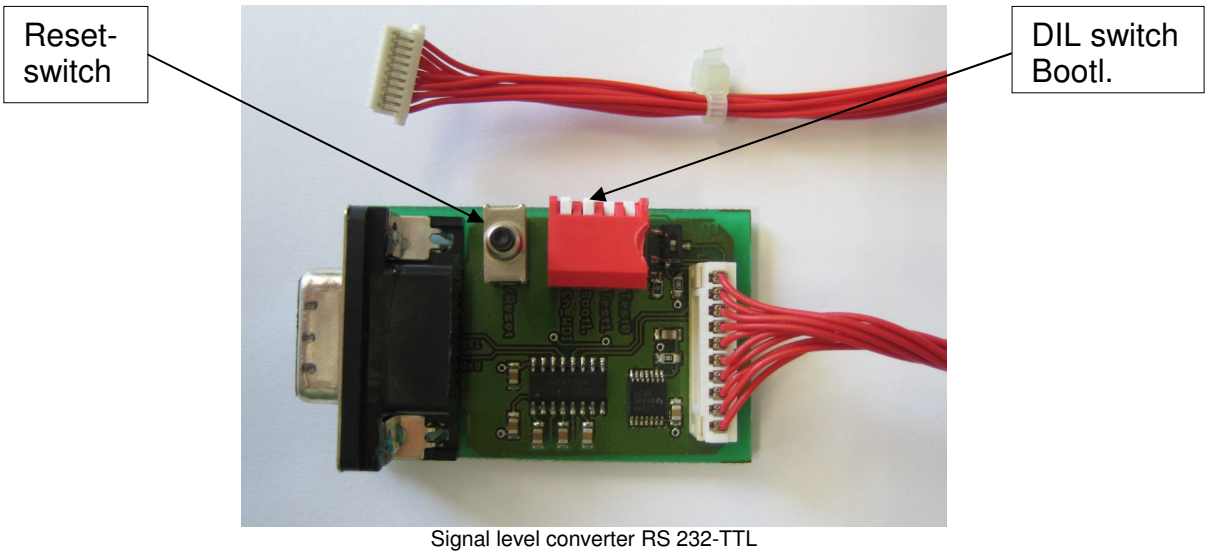
7.1 Firmware download

The controller located on the interface board offers the possibility to update the firmware for system treatment or for the implementation of new functionality.

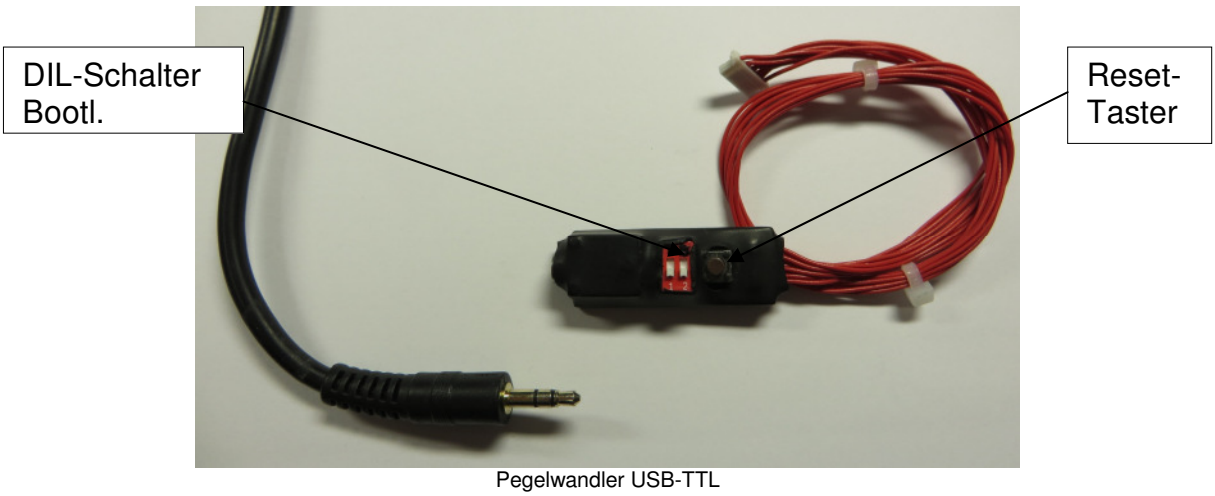
7.1.1 Required items

- Signal level converter RS232 – TTL (TTL equipped with 3.3V logic)
- Interface cable for test plug with reset switch
- 9-pole Sub-D cable for connecting the signal level converter to the serial communication port of a PC
- PC equipped with Windows operating system
- Programming software i-matic Explorer or FlashMagic Tool http://www.flashmagictool.com/
- HEX-File with new firmware

If the PC is not equipped with a 9-pole Sub-D RS232 Com-Port an additional USB to RS232 interface cable is necessary.



Signal level converter RS 232-TTL

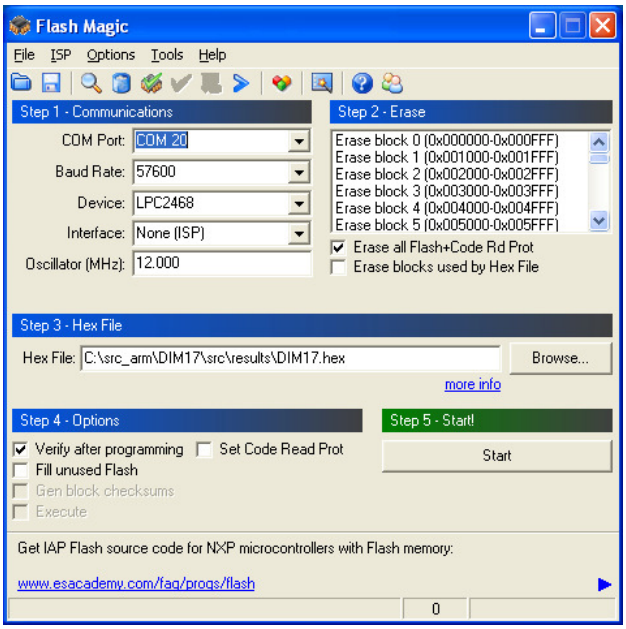


Pegelwandler USB-TTL

7.1.2 Step by step description

1.) Power off actuator to avoid serious damages to the electronic due to high signal differences
2.) Connect the serial Com-Port of the PC to the 10-pole TEST connector of the interface board
3.) Set the DIL switch Bootl. on the signal level converter board in position ON (all other switches have to stay in OFF position) to enable the bootloader routines.
4.) Power on the actuator
5.) Start PC Firmware Download Tool

Downloading firmware using FlashMagic Tool



Step 1 - Communications

1.) Select the used communication port to which the RS232/TTL level converter is connected.
2.) Choose the transmission speed. The transmission speed 115200 is the highest selectable speed. This speed can only be used under ideal circumstances. A save and secure

connection can be achieved by selecting a speed of 57600 Baud. If the connection still fails during the transmission it is advised to reduce the speed further down.
3.) Select the controller. The interface board is equipped with a LPC2468 controller from NXP which has to be selected in the combo box.
4.) Select None (ISP) for the interface.
5.) Select the oscillator frequency to 12.000 MHz.

Step 2 – Erase

1.) Check *Erase all Flash+Code Rd Prot*
2.) Uncheck *Erase Blocks used by Hex File*

Step 3 – Hex File

1.) Select the Hex File which contains the binary data for the firmware download.

Step 4 – Options

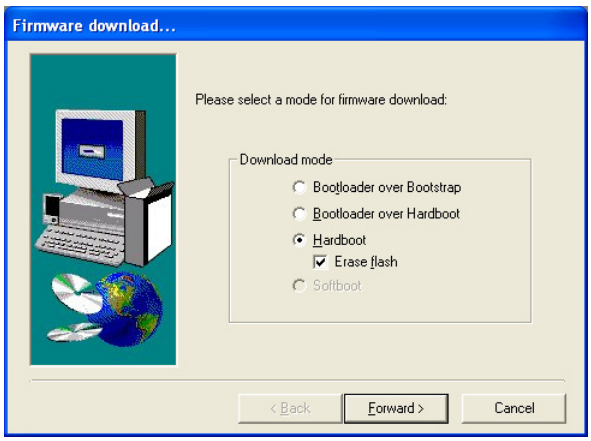
1.) Check *Verify after programming*
2.) Uncheck *Set Code Read Prot* und *Fill unused Flash*

Step 5 – Start!

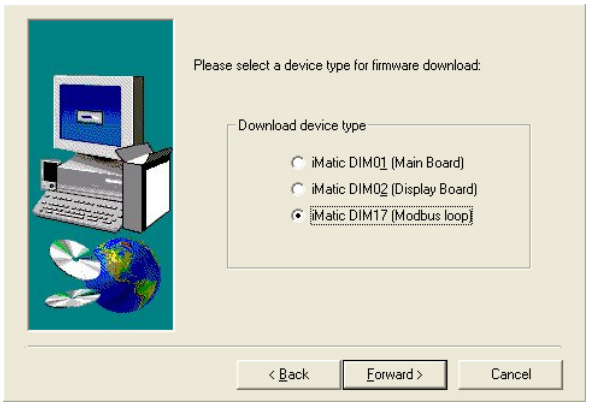
1.) Press the reset switch on the signal level converter board and release it. Immediately press the Start Button on the GUI of the FlashMagic tool.
2.) Firmware download starts. The progress will be displayed in the status line.
3.) When the download is finished, the text *Finished* will be displayed for a short time in the status line.
4.) Power off the actuator and remove the connection to the PC afterwards.
5.) Set the switch Bootl. located on the signal level converter board back to OFF position. The signal level converter board now can be used for diagnosis purposes.

Downloading firmware using *i-matic* Explorer

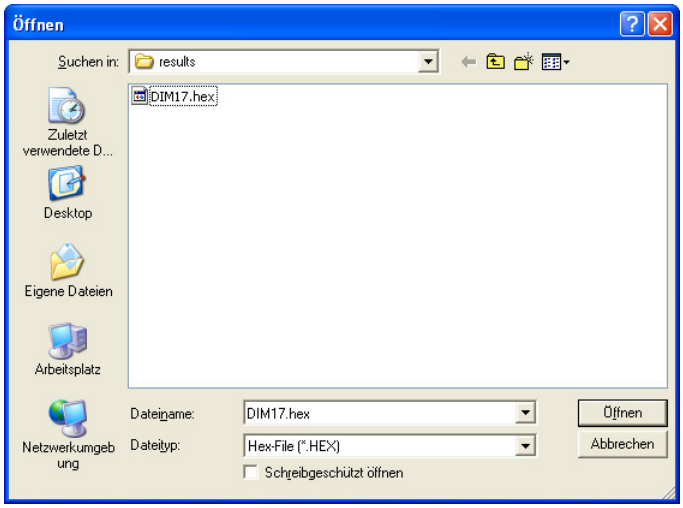
1.) Select the used communication port to which the RS232/TTL Level converter is connected. Choosing communication port is done via menu entry *Extras → Options*. Within the option tree the entry *Communication -> Port* has to be selected.
2.) Choose the transmission speed for the entry LPCProg. The transmission speed 115200 is the highest selectable speed. This speed can only be used under ideal circumstances. A save and secure connection can be achieved by selecting a speed of 57600 Baud. If the connection still fails during the transmission it is advised to reduce the speed.
3.) Set the oscillator frequency in kHz. The controller of the interface board is equipped with an oscillator frequency of 12000 kHz.
4.) Close the Options dialog by pressing OK button.
5.) Choose the firmware download function by selecting the menu entry *Service -> Firmware download…*
6.) Select the mode to be used for Firmware download. Select option *Hardboot* and activate *Erase flash* machen. Click in *Next.*



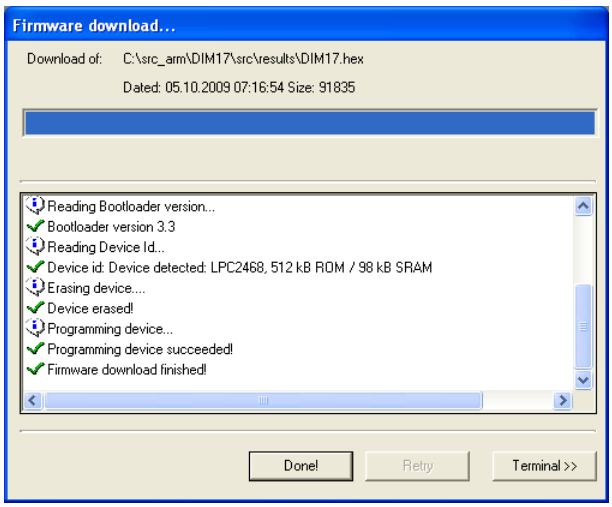
7.) Choose the target for firmware download in the displayed dialog and proceed by clicking OK.



8.) Choose the Hex File containing the binary data for download.



9.) By clicking the Open-Button the download will be started.



10.) Press and release the reset switch at the cable connected to the TEST connector as long as the step *synchronizing* is displayed.
11.) Firmware download starts. The progress will be displayed.
12.) When the download is finished this will be displayed too.
13.) Power off the actuator and remove the connection to the PC afterwards.
14.) Set the switch BootI. located on the signal level converter board back to OFF position. The signal level converter board now can be used for diagnosis purposes.

7.1.3 Firmwaredownload using IrDA Converter

In addition to the described procedure it is possible to update the firmware without opening the actuator housing using an IrDA or Bluetooth converter (Depending on the actuator equipment).

A detailed description of the update procedure can be found in the additional i-matic Explorer user manual.

8 Appendix

8.1 Reference

- MODBUS over Serial Line, Protocol & Implementation guide, V 1.02
- Modicon, MODBUS Protocol Reference Guide, Rev J, June 1996
- MODBUS Application Protocol Specification V1.1b
- MODBUS messaging on TCP/IP implementation guide V1.0b

All documents can be obtained as PDF-Download at www.modbus.org