Modbus 2 Library for Saia PCD©

USER MANUAL

Nicolas Bovigny, Engiby sàrl, CH-1726 Farvagny-le-Petit

This page is intentionally left blank.
Remove this text from the manual
template if you want it completely blank.

This page is intentionally left blank.
Remove this text from the manual
template if you want it completely blank.

Introduction

1 Introduction

Welcome to the help of the **Modbus 2.8** Library of Engiby sàrl.

Version 2.8.036, 30.03.2023

Please read Using Condition before to use this library.

For any question, order or technical support, see this topic Hardware and Software Reference

New in Version 2.8
With the version 2.8, new powerful features have been added in the Modbus library:
- Support of NG-Configurator with configuration of Modbus telegrams in an Excel file
- Support of NG-Trace with 2 buffer formats:
    - Modbus (Trace of decoded Modbus telegrams)
    - Modbus Raw (Trace of raw data)
- Support of NG-ModLink (Add-on tool to test Modbus Slaves connected to PCD)
- Support of PCD3.T666 on PG5 V2.1, 2.2 and 2.3
- Specific Fboxes for Belimo devices
- Specific Fboxes for iSMA RIO devices
- Specific Fboxes for GFAE RIO devices
- Specific Fboxes for Thermokon Room Sensor
- Specific Fboxes for Siemens QFA/QPA Room Sensor

1.1 Using conditions

Engiby Sàrl, CH-1580 Avenches is the original author of this communication driver library for the MODBUS protocol on Saia PCD systems of Saia-Burgess Controls AG. Engiby owns all copyrights and utilization rights on these communication routines.

The library is distributed to Saia PCD integrators under license. The license allows the integrator to use the library for the creation and the maintenance of PCD applications in the specified conditions. The library and/or its algorithms cannot be copied, transmitted or resold to others without preliminary agreement of Engiby.

Updates of the library for new feature are available at Engiby upon request. Updates are mandatory for the use under new PG5 versions.

Overview of the Modbus and PGx versions:

Modbus versions	PGx versions
2.0.xxx	PG4 versions 2.0.2xx. Not anymore supported.
2.1.xxx	Not used
2.2.0xx and 2.2.1xx (Modbus/TCP Slave only)	PG4 versions 2.0.2xx and PG5 versions 1.0.xxx and PG5 versions 1.1.xxx. Not anymore supported.
2.2.2xx (Modbus/TCP Master and Slave)	PG5 versions 1.0.xxx and PG5 versions 1.1.xxx. Not anymore supported.

2.3.1xx	PG5 versions 1.0.xxx and PG5 versions 1.1.xxx. Not anymore supported. PG5 versions 1.2.xxx. Not anymore supported.
2.3.2xx	PG5 versions 1.2.xxx. Not anymore supported.
2.4.xxx	PG5 versions 1.2.xxx. Not anymore supported. PG5 versions 1.3.xxx. Not anymore supported.
2.5.xxx	PG5 versions 1.3.120. Not anymore supported. PG5 versions 1.4.xxx
2.6.xxx	PG5 versions 1.4.xxx and PG5 versions 2.0.xxx
2.7.0xx	PG5 versions 1.4.xxx and PG5 versions 2.0.xxx and PG5 versions 2.1.2xx
2.7.3xx and 2.7.4xx	PG5 versions 1.4.xxx and PG5 versions 2.0.xxx and PG5 versions 2.1.3xx and 2.1.4xx
2.7.5xx	PG5 versions 1.4.xxx and PG5 versions 2.0.xxx and PG5 versions 2.1.3xx and 2.1.4xx and PG5 versions 2.2.xxx
From 2.7.6xx	PG5 versions 1.4.xxx up to 2.673 PG5 versions 2.0.xxx and PG5 versions 2.1.3xx and 2.1.4xx and PG5 versions 2.2.xxx and PG5 versions 2.3.xxx
From 2.8.xxx	PG5 versions 2.1.3xx and 2.1.4xx and PG5 versions 2.2.xxx and PG5 versions 2.3.xxx

Engiby sàrl warranties the functioning of the routines according to the description made in the user's manual and/or the help system of the corresponding version.

No warranty of good functioning can be given in case of:

- modifications of the SAIA hardware or software
- modifications of the partner device using this protocol
- difference in the interpretation and use of the Modbus telegrams
- incompatibility regarding data format, address range or media type
- other restrictions and incompatibilities already known and mentioned in the manual
- modification of the library by the user

As the driver needs components belonging to external companies, Engiby cannot warranty a good functioning in any case. Engiby ensure to make all reasonable efforts to adapt the driver where necessary as to work correctly with the foreseen partner devices.

Neither Engiby sàrl nor the distributors of this software carries any responsibility for the use, the results of use, the correctness, accuracy, reliability or fitness of this software for any particular purpose, and accept no responsibility for its use or misuse.

When using this library, the above restrictions must be applied to subcontractors and to the final user of the application.

1.2 Hard- and software suppliers and technical support

For any question, order or technical support, please contact:
Engiby sàrl
Route Saint-Claude 31
CH - 1726 Farvagny-le-Petit
Tel + 41 26 676 01 21
Mail: support@engiby.ch
Web: www.engiby.ch

Engiby head office:
Engiby sàrl
Route des Noyers 25
CH - 1782 Formangueires (La Sonnaz)

Supplier of Saia PCD hardware and development tool S-Fup for Windows for Switzerland :
SAIA-Burgess Controls AG
CH - 1762 Givisiez

SAIA PCD products are developed by SAIA-Burgess Controls AG - Switzerland and are distributed in all European countries. Please refer to SAIA brochures for addresses of distributors and further information about SAIA products.

1.3 Hardware and Software Reference

The Modbus 2 library has been developed for use with the PG5 programming tools of Saia-Burgess Controls AG. The connections between Saia PCD and any other hardware accepting MODBUS or JBUS protocol, version RTU (binary), ASCII or TCP are possible. JBUS is a sub-unit of the MODBUS functions introduced by April. TCP is an adaptation of the RTU version for the use with TCP protocol (e.g. over Ethernet) initially defined by Schneider. The library also support an UDP implementation which works is simular as TCP (sometimes even better), but with less overhead.

The Modbus 2 library (version 2.x.xxx) is based on the following software and documents :

SAIA
PG5 Version 2.1.xxx, 2.2.xxx and 2.3.xxx
POPG4008 Symbol Naming Conventions

FW versions
Due to the compatibility ensured by SAIA between PCD systems, the firmware of all PCD systems supporting the same functionality as the tested systems as well as newer firmware should works with this library. This statement can however not be considered as a warrantee for the user. Please contact the technical support of Saia-Burgess AG for compatible Hard and Firmware and for possible restrictions.

AEG Reference
Modicon Modbus Protocol Reference Guide PI-MBUS-300 Rev. J

GSY Automation Industrielle

Documentation `Système de Communication Modbus`

Modbus organization
The Modbus specification and other information are available from the Modbus-IDA Organization on Internet.
Go to www.modbus.org

1.4 Restrictions

This topic lists some restrictions know at the time of editions. The list is not exhaustive. Some mentioned restrictions may be solved by new hardware or new firmware from Saia-Burgess Control.

Baud rate restrictions

110, 300 and 600 bds	Not supported on PCD2.M480 Not supported on PCD3.xxxx
57,6 and 115,2 kbds	On PCD2.M480, only for ports 0,1 and 6 On PCD3, not supported on PCD3.F2xx modules (Slot x, Ch y)

Restriction for the mode RTU Fast
This mode can only be used on system supporting the System Functions. All PCD3 and the PCD2.M480 systems support system functions. Other systems with recent hardware can be updated. Please contact SAIA to check this point or for a firmware update.

Runtime restriction
Since the present driver is executed at the user application level (IL instructions) of the PCD, the protocol is not supported if the PCD is not in RUN (e.g. HALT or STOP).
The performances of the driver are also affected by the other parts of the user application. The PCD memory (variables, code, DB, Texts) used by the driver is also shared with the user application.

PCD3.T666
The Smart RIO T666 is supported as Master and Slave since library version 2.8.008 with following restrictions:
- The ODM timeout cannot be adjusted. It is fixed to 1 sec. Firmware prior to 1.28.37 may have problem with these firmware.
- The port 502 for Modbus slave is not allowed on T666 (locked by FW).

See also Using Conditions
Functions supported by the Slave
Function supported by the Master

This page is intentionally left blank.
Remove this text from the manual
template if you want it completely blank.

Installation

2 Installation

2.1 Hardware installation

Please refer to SAIA document and the user's manual of the peripheral devices.

Particular points to respect
The length of a RS232 line should as short as possible and never exceed 15 m. Use twisted and shielded cables. The cable should be kept as far away as possible from the power line.

RTS-CTS and DTR-DSR control lines are not required for the PCD. However RTS and DTR outputs are set to High level and can be used to supply the partner device if necessary.

For longer cables use a RS422 interface. The length of a RS422 line can be up to 1200 meters.

A bus installation (RS485) must comply to the SAIA recommendations reported in the document for RS485 Networks. It is recommended to use connection boxes and repeaters supplied by SAIA.

For a multi drop installation, the SAIA converters type PCD7.T120 and PCD7.T140 cannot be used for PCD with the Modbus Master or Slave driver. It is recommended to use only serial line equipped for RS 485. However these converters are very useful to connect a serial line analyzer listening on the bus.

2.2 Software installation

Please refer to the SAIA documents for the installation of SAIA PG5 programming tools.

The Modbus 2 library is delivered with as self-extract file with its own installation program. Start the program and follow the instructions.

Start PG5 after having installed the library.

If the library is correctly installed, the available Fbox family appears automatically in the 2 families named Modbus 2 Master and Modbus 2 Slave.

More information about Library installation is available in a FAQ document on the Engiby site on Internet. Go to www.engiby.ch/modbus/tcpfaq.htm

General information

3 General information

3.1 Function supported by the Master

This table shows the the Modbus codes generated by the master driver of this library. The implementation of the codes in the slave equipment is the scope of the manufacturer and can vary from one device to another one. Please consult the corresponding manual.

Function	Definition	Fbox
Function 1	Read Coil Status	RCV Bits
Function 2	Read Input Status	RCV Bits
Function 3	Read Holding Registers (16 bits)	RCV Integer
Function 3	Read Holding Registers (32 bits)	RCV Integer
Function 3:	Read Holding Registers (IEEE, 32 bits)	RCV Float
Function 4	Read Input Registers (16 bits)	RCV Integer
Function 4	Read Input Registers (32 bits)	RCV Integer
Function 4:	Read Input Registers (IEEE, 32 bits)	RCV Float
Function 7	Read Exception Status	RCV Bits
Function 20	Read General Reference (16 bits)	RCV Integer
Function 20	Read General Reference (32 bits)	RCV Integer
Function 20	Read General Reference (IEEE, 32 bits)	RCV Float
Function 5	Force Single Coil	SEND Bits
Function 6	Preset Single Register (16 bits)	SEND Integer
Function 15	Force Multiple Coils	SEND Bits
Function 16	Preset Multiple Registers (16 bits)	SEND Integer
Function 16	Preset Multiple Registers (32 bits)	SEND Integer
Function 16:	Preset Multiple Registers (IEEE, 32 bits)	SEND Float
Function 21	Write General Reference (16 bits)	SEND Integer
Function 21	Write General Reference (32 bits)	SEND Integer
Function 21	Write General Reference (IEEE, 32 bits)	SEND Float
Function 23	Read/Write Registers (16 bits)	SEND/RCV Integer
Function 23	Read/Write Registers (32 bits)	SEND/RCV Integer

Maximum number of values per request, supported by the Master

Functions in Integer 16 bits format:	127 Registers
Functions in Integer 32 bits format:	63 Registers
Functions in Binary format:	2040 Flags
Functions in IEEE floating point:	63 Registers
Functions 20, 21, 23 in 16 bits format:	124 Registers
Functions 20, 21, 23 in 32 bits format:	62 Registers
Functions 20, 21, 23 in IEEE format:	62 Registers

Functions 20 and 21 are restricted to one sub-request per request.

Depending on the slave implementation, the maximum allowed values per request may be lower.

See also Functions supported by the Slave

3.2 Functions supported by the Slave

This table shows the utilization of the Modbus codes for the Slave driver of this library. It applies only to the behavior of a PCD as Slave station. Theses codes may be slightly different compared to the standard codes and their understanding used for other equipment (Master and Slave).

Particularities may also apply to some code when used with Gateway functions.

As to insure the compatibility of the function codes, only standard telegrams and address ranges, within the given limit, must be used.

Function	Definition	Address range	Note
Function 1	Read flags	0..16383	(5)
Function 2	Read inputs/outputs	0..1023/8191	(4)
Function 3	Read registers (16 bits)	0..16383	(6)
Function 3	Read registers (32 bits)	0..16383	(1)
Function 3:	Read registers (IEEE, 32 bits)	0..16383	(2)
Function 4	Read timers/counters (16 bits)	0..1599	
Function 4	Read timers/counters (32 bits)	0..1599	(1)
Function 7	Read Status Flag	0..7	
Function 20	Read data blocs (16 bits)	0..7999	(3)
Function 20	Read data blocs (32 bits)	0..7999	(1) (3)
Function 20	Read data blocs (IEEE, 32 bits)	0..7999	(2) (3)
Function 5	Write one flag	0..16383	(5)
Function 6	Write one register (16 bits)	0..16383	(6)
Function 15	Write flags	0..16383	(5)
Function 16	Write registers (16 bits)	0..16383	(6)
Function 16	Write registers (32 bits)	0..16383	(1)
Function 16:	Write registers (IEEE, 32 bits)	0..16383	(2)
Function 21	Write data blocs (16 bits)	0..7999	(3)
Function 21	Write data blocs (32 bits)	0..7999	(1) (3)
Function 21	Write data blocs (IEEE, 32 bits)	0..7999	(2) (3)
Function 23	Write/Read registers (16 bits)	0..16383	(6)
Function 23	Write/Read registers (32 bits)	0..16383	(1)
Function 23:	Write/Read registers (IEEE, 32 bits)	0..16383	(2)
Function 22:	Mask Write register	0..16383	(7)

(1) By default, the Modbus protocol is designed to exchange 16 bits values. Integer in 32 bits are accessed by applying an offset to the register address. The offset is configurable in the PCD.

(2) Integer and floating point register are mixed up in the PCD. Register in floating point format are accessed by applying an offset to the register address. The offset is configurable in the PCD.

(3) Reading and writing DB with functions 20 and 21:

The file number corresponds to the DB address (data bloc).

The register address corresponds to the element in the DB.

The DB range may vary depending on the PCD type and according to its memory equipment.

On old system, the DB in the range 0 to 3999 contain maximum 383 memory elements.
Contact Saia for more info.

The DB in the range 4000 to 7999 can have up to 16'384 elements.

The floating point offset is applied to the register address (element) for using the 32 bits and IEEE format.

(4) Input range:
NT-systems have a maximum input range of 0..1023.
Non-NT systems have an input range of 0..8191.
E-Line systems does not allow the direct access to Inputs. The function 2 is not supported.

(5) Flag range:
FW version 1.14.02 and up on NT systems have an extended flags range of 0..14335.
FW version 1.20.01 and up on NT systems have an extended flags range of 0..16383, if the option 16 bits address is configured in PG5.
Non-NT systems have a flags range of 0..8191.
E-Line systems have a reduced register range of 0..3999.

(6) Register range:
NT-Systems have a register range of 0..16383.
For Non-NT systems the register range is limited to 0..4096.
E-Line systems have a register range of 0..3999, or 0..1999.

(7) Function 22 applies an AND and OR masks to a single register. Only the lower 16 bits of the register can be written with this function. The higher 16 bits remains unchanged.
The applied function is the following:

$$New\_Value = (Curent\_Value\ AND\ And\_Mask)\ OR\ (Or\_Mask\ AND\ \overline{And\_Mask})$$

General remark:
Accessing non existing elements can be rejected with an exception response but may also cause a CPU error.
Warning ! Some address ranges are reserved for dynamic allocation and should not be accessed by a Modbus master.
As to protect the slave against unwanted write access to dynamic elements, set the option '**Reject not mapped request**' to **'Write dynamic'** in the Slave Application Fbox,

Maximum amount of values per request, supported by the Slave

Functions in Integer 16 bits format:	127 Registers
Functions in Integer 32 bits format:	63 Registers
Functions in Binary format:	2040 Flags
Functions in IEEE floating point	63 Registers
Functions 20 and 21:	124 Registers, One sub-request per request only
Functions 20 and 21 in 32 bits format:	62 Registers, One sub-request per request only
Functions 20 and 21 in IEEE format:	62 Registers, One sub-request per request only

Remarks:
In case of overloading of the Slave station, the number of values per request must be reduced.

When used with a gateway function the maximum amount of values per request can be lower.

See also Function supported by the Master

3.3 Modbus Exception Codes

For Slave driver:
In case of rejected telegram, the following codes are returned to the Master:

Code	Name	Comment
1	Function not supported	For function 7 and 8

2	Illegal address	Overrun of a PCD address range.
3	Illegal data	Illegal data for function code 5.
4	Slave device failure	For S-Bus gateway. The S-Bus port cannot establish the communication.

For Master Driver

The following codes are defined for Modbus and can be sent by the slave and shown in the master Fbox (but not applicable to PCD system):

Note that any slave can implement its own error code list. In this case, refer to the documentation of the slave device.

Code	Name	Comment
1	Function not supported	The sent function is not supported.
2	Illegal address	The sent register of coil address is illegal for the slave.
3	Illegal data	Illegal data. E.g. for function code 5 and 15.
4	Slave device failure	A failure occurs when processing the Modbus request.
5	Acknowledge	The request is acknowledged but not yet completed.
6	Slave device busy	The slave device is currently bus and cannot process the request.
7	Negative acknowledge	For function 13 and 14.
8	Memory parity error	The slave detected a parity error in its memory.

3.4 Address offset

The option 'Address offset' allows you to adapt addressing concept of different systems.

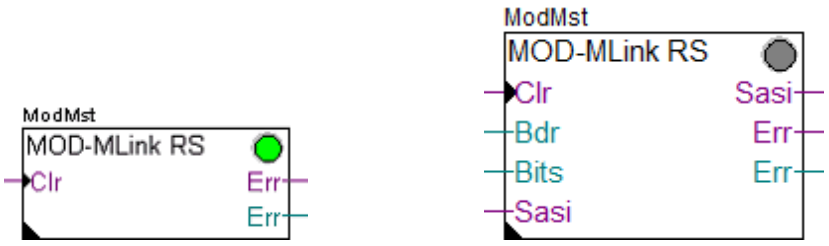
- 0 (SAIA)	It means no offset between specified address and telegram address. This is the default value.
- 1 (Modicon)	It means that telegram addresses are 1 unit lower than specified addresses. The Master driver reduces the address by 1 before sending the telegram. The Slave driver increases the address by 1 before reading or writing the elements. Modicon PLCs and other slaves use this coding and some supervisors work the same way. In a Master PCD, if address 0 is specified in a SEND or RVC function, the error 33, (Address) will occur and the function is aborted. Note that for File functions (Data block), only the register address is affected by the offset.
- 1+2*i	Means that the offset 1 is applied and in multiple read/write, each successive address is incremented by 2. E.g. Writing 3 values at address 12 (11 in telegram) will write into R 12, R 14 and R 16. This match the addressing principle of some modbus drivers.
- 0+2*i	Means that no offset is applied and in multiple read/write, each successive address is incremented by 2. E.g. Writing 3 values at address 12 (12 in telegram) will write into R 12, R 14 and R 16. This match the addressing principle of some modbus drivers.

Master and Slave systems should use the same offset. Otherwise, the specified address and the effectively accessed element are shifted by 1 (even more with 1+2*i).

Master Functions

4 Master Functions

4.1 Master Link RS



The Master Link RSxxx function is used to support the Modbus protocol on RS232, RS422 and RS485 lines. The Master Link is the kernel of the Modbus 2 Master driver. It must be placed once at the beginning of the program. This Fbox supports the functions of the lower layers of the Modbus protocol like:

- RTU or ASCII coding and decoding
- Checking and building the telegram headers
- Building of the telegram structure
- Checksum computing
- Timeout supervision

Two versions of this Fbox exist:

- Master Link RS xxx
- Master Link RS Adj

In the first Fbox, the Baudrate and the bits setting is a fix parameter selected in the Fbox. In the second Fbox the baudrate and the bit settings are given on Inputs and can be adjusted in runtime. The line can also be assigned and de-assigned in runtime.

After the Master Fbox, you must place Slave Station Fboxes to define the Slave stations the Master will access to. These Slave Station Fboxes will make reference to the Master Link Fbox. Finally, SEND and RCV Fboxes must be placed to define the request to send to the Slaves. SEND and RCV Fboxes will make reference to the corresponding Slave Station Fbox.

Input / Output / LED

Clr	Clear	Allows to clear the error diagnostic.
Bdr	Baudrate	With Master Link RS Adj Fbox only. Define the baudrate of the serial line. See below.
Bits	Bits settings	With Master Link RS Adj Fbox only. Define the bits setting of the serial line. See below.
Sasi (input)	Assign	When the input is High, the line is assigned and the driver runs. When the input is Low, the line is de-assigned and the driver stops. This allows to assign the line in another mode or to activate another Master on the bus.
Sasi (output)	Assigned	Indicates that the line is assigned (High) or not (Low). Check that this signal is Low before to assign the line with another driver.
Err	Error detected	The binary Err output indicates that an error has been detected.
Err	Error code	The numeric Err output indicate the code of the last detected error

LED	LED	The LED is red if an error has been detected. It turns back to green when the error is cleared.

Parameters

Serial channel	Selection of the serial channel used. See remark below for channel 0.
Hardware type	Selection of the Hardware type of the serial channel.
Transmission speed	Selection of the speed of the serial channel.
Bits-Parity-Stop	Selection of the bits settings. Parity : N=None, O=Odd, E=Even
Protocol	Selection of the RTU (binary) or ASCII protocol. For RTU Fast see note below.
Timeout [s]	Maximum response time for the slave replay. The value 0.0 is replaced by 50ms.
Number of repetitions	Number of repetitions of the same request if no valid response is received from the slave. The first request is included.
Min request delay	Minimum delay between requests. This parameter can be important when broadcast is used on slow slave devices. The value 0 will be replaced by the minimum value specified by Modbus. In the Link RS Adj Fbox, the default delay is computed for 9600 bauds, 8-E-1. For other settings (especially longer time), the delay must be adjusted manually.
Address offset	Offset between telegram addresses and PCD addresses.
- 0 (SAIA)	Addressing acc. to SAIA.
- 1 (Modicon)	Addressing acc. to Modicon.
Default Integer 32 bits	Default option for the support of 32 bits integer format. This option can be changed by the Station Fbox for a particular slave station.
- No 32 bits	The 32 bits integer is not used. In fact, is equivalent to Little Endian.
- Little Endian	The least significant word is transmitted first. Note that the byte order is always MSB first.
- Big Endian	The most significant word is transmitted first. Format used by Modicon for instance.
Default Floating-point	Default option for the support of the floating-point format. This option can be changed by the Station Fbox for a particular slave station.
- No Fp	The Floating point format is not used. In fact, is equivalent to Little Endian.
- Little Endian	The least significant word is transmitted first. Note that the byte order is always MSB first.
- Big Endian	The most significant word is transmitted first. Format used by Modicon for instance.
Application timeout [ms]	Maximum time given to the higher application level. Short time (100 ms) can be specified for a standard application.
Load on the CPU	Load of the CPU allowed for the driver.

	-----[Display of sent telegrams]-----
Station number	Last sent Station number.
Function	Last sent Function. For F23 see below.
Base address	Last sent Base address.
File address	Last sent File address.
Number of elements	Last sent Number of elements.
Requests sent	Number of sent Requests.
Link error	Last error detected by the link layer.
Link error argument	Argument of the last error detected by the link layer.
Modbus exception code	Last Modbus exception code returned by the slave. See topic : Modbus Exception Codes
Error counter	Number of detected errors since last clearing.

Use of channel 0

The channel 0 has a PGU function in many PCD systems. When a PGU protocol is started, the port is forced in PGU mode by a control signal. If you only use the port with the Modbus protocol, ensure that the control signals inputs CTS and DSR are always at a low level (e.g. grounded).
If you want to use the port alternatively in PGU and Modbus, select the option Channel 0 PGU. The port will automatically be restored in Modbus after it has been used in PGU. Note that the Link Fbox and the Station Fboxes may show errors after the port has been used in PGU and you may need to wait the long reconnect time until all stations are reconnected.
On PCD3.M5 systems,if you have select the option 'Full RS-232 handshaking on Port 0' you don't need to use the option Channel 0 PGU anymore.

Remark for F23

The function 23 execute a Write and a Read access in the same transaction. The base address and the number of elements show the parameter of the Write access. The base address of the Read access is shown as File address. The number of element is not displayed.

RTU Fast option

This option has been introduced in version 2.4.300. If you do not have it in the Fbox, you may need to replace the Fbox with a new one. The RTU Fast option can be used to speed up the CRC calculation of the RTU mode. It will use a system function to compute the CRC. Therefore, you must first ensure that your system supports the system functions.
It can spare up to 120 ms on a PCD2.M120 for a package of 100 registers (time difference measured on the maximum CPU cycle time).

Error codes

Code	**Message**	**Description**	**Argument**
0	OK	No error	0
1	SASI	SASI Error. The serial line could not be assigned. With adjustable bauds and bits, wrong parameters at he Fbox input.	- Value at the Bits input.
2	Diag	A low level diagnose have been reported by the firmware.	Value of the diag register
3	Overflow	Too big package received.	-

7	Tx locked	Transmission is locked by FW. The driver is not anymore able to transmit any telegrams.	Internal flags
8	Token locked	The transmission token have been locked. Can be due to uncalled program block of flag corruption.	Internal flags
11	CRC Slv	CRC error in a Slave telegram.	0
21	Byte	Invalid Byte count in the telegram.	Number of bytes specified in the telegram.
22	Receive	Unexpected reception.	Internal code
23	Timeout	No response in the given time or invalid/incomplete response.	Internal code
26	Length	More char received than expected length	0
28	Rx Func	Wrong function code received in the slave response.	Received function code.
29	Rx Stat	Received station address is not the same as the sent station. Another station respond to the request.	Received station address
30	Function	Function not supported	Function code
31	Message Slv	Exception message returned by the slave The message type is displayed in the adjust window.	Modbus message code
32	Nb of Data	Wrong number of data returned by the slave.	
33	Address	Invalid address or address range in a request. The request is not sent.	
36	F Invalid	Function invalid. Occurs with Indirect Send/Rcv Fboxes and Read function in Multicast.	Used function
40	Application	General application error replay. See the error displayed in corresponding application Fbox.	-
48	App replay	The application did not replay to link layer. E.g. No application Fbox exist for the concerned slave address.	-
49	Qwave	Qwave application error replay	Internal code
88	Trial ended	For demo package. Trial period ended.	
90..99	<90>..<99>	Internal error.	-

Runtime Adjustable Bits settings

This feature can only be used on FW supporting the indirect baudrate and bits settings in the SAIA text. See SAIA document for minimum FW.

By using the Master Link RS Adj Fbox, the baudrate and the bits settings can be given on inputs and can be changed in runtime according to the table below.

When one of the input value changes, the line is immediately re-assigned with the new setting. If the provided parameters are not valid (not accepted by the PCD), the error code 1 (SASI) is issued and the driver will stop working until valid parameters are set back.

A typical use is to define the baudrate and the bits settings over binary inputs. In this case, the Fbox Input Baud and Bits of the Modbus Slave family can be used.

Baudrate	Input value
110	110
300	300
600 bds	600
1200 bds	1200
2400 bds	2400
4800 bds	4800
9600 bds	9600
19.2 kbds	19200
38.4 kbds	38400
57,6 kbds	57600
115,2 kbds	115200

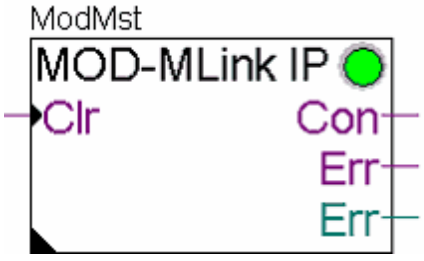
The bits settings values is a 3 digits number made of :

- Number of bits (x100)
- Parity (x10)
- Number of stop bits (x1)

Number of bits	Input value	Remark
7	700	Not for RTU Mode
8	800	Usually for RTU
Parity	Input value	
None	00	Usually for RTU
Odd	10	
Even	20	
Number of stop	Input value	
1	1	Usually for RTU
2	2	

Examples : 801 = 8 Bits, No Parity, 1 Stop
712 = 7 Bits, Parity Odd, 2 Stop
821 = 8 Bits, Parity Even, 1 Stop

4.2 Master Link IP



The Master Link IP function is used to support the Modbus/TCP protocol on the IP-Module (Ethernet). The Master Link is the kernel of the Modbus 2 Master driver. It must be placed once at the beginning of the program. This Fbox supports the functions of the lower layers of the Modbus/TCP protocol like:

- Opening and closing TCP/IP ports
- Checking and building the telegram headers
- Building of the telegram structure
- Timeout supervision

After the Master Fbox, you must place Slave Station Fboxes to define the Slave stations the Master will access to. These Slave Station Fboxes will make reference to the Master Link Fbox. Finally, SEND and RCV Fboxes must be placed to define the request to send to the Slaves. SEND and RCV Fboxes will make reference to the corresponding Slave Station Fbox.

Input / Output / LED

Clr	Clear	Allows you to clear the error diagnostic.
Con	Connected	1 = The driver is connected to a Slave over the TCP/IP port. 0 = The driver is not yet or not anymore connected. When accessing several Slaves, this signal blinks.
Err	Error detected	The binary Err output indicates that an error has been detected.
Err	Error code	The numeric Err output indicate the code of the last detected error
LED	LED	The LED is red if an error has been detected. It turns back to green when the error is cleared.

Parameters

Ethernet module	Available since version 2.5.023. In the most cases, the option 'Default' is working correctly. If the PCD has more than 1 Ethernet module, or if you need to specify the slot to use, select the suitable option.
Channel	Logical Channel used. A channel can only be used once. Take care if you used several Modbus Master and/or Slave functions. Each of them must use another channel. Note that this channel number has nothing to do with the Channel 8 and 9 of the hardware configuration which concerns S-Bus only.
Destination port	TCP or UDP destination port used. The port 502 is the Modbus port. Other ports up to 1023 are reserved. Ports from 1024 on are free for private use.
Source port	TCP or UDP source port used. Dynamic : A free port is assigned dynamically. Same as destination : The same port as the defined port for destination is used. In Fbox without this option, TCP uses a dynamic port, UDP uses the same as destination port. If you want to use several Driver, connected to different Slaves on the same destination port (e.g. 502), you need to use Dynamic source ports.
Protocol	Modbus/TCP or Modbus/UDP. See below.
Timeout [s]	Maximum response time for the slave replay. The value 0.0 is replaced by 50ms. See remark below for TCP.

Number of repetitions	Number of repetitions of the same request if no valid response is received from the slave. The first request is included. See remark below for TCP.
Idle disconnect time	Time to disconnect the TCP connection if no more activity is detected. A disconnect is however executed immediately if communication to a station with another IP address is started (i.e. only one TCP connection is open at the same time). In addition a security mechanism handled by the FW will force a disconnect if no activity is detected on the channel during 2 times the idle disconnect. Take care to keep this time higher than the timeout. Else, it may cause unwanted TCP disconnect. With value 0, the FW security is disabled (not recommended).
Min request delay	Minimum delay between requests. This parameter can be important when broadcast is used on slow slave devices.
Address offset	Offset between telegram addresses and PCD addresses.
- 0 (SAIA)	Addressing acc. to SAIA.
- 1 (Modicon)	Addressing acc. to Modicon.
Default Integer 32 bits	Default option for the support of 32 bits integer format. This option can be changed by the Station Fbox for a particular slave station.
- No 32 bits	32 bits integer not used. In fact, is equivalent to Little Endian.
- Little Endian	The least significant word is transmitted first. Note that the byte order is always MSB first.
- Big Endian	The most significant word is transmitted first. Format used by Modicon.
Default Floating-point	Default option for the support of the floating-point format. This option can be changed by the Station Fbox for a particular slave station.
- No Fp	Floating point not used. In fact, is equivalent to Little Endian.
- Little Endian	The least significant word is transmitted first. Note that the byte order is always MSB first.
- Big Endian	The most significant word is transmitted first. Format used by Modicon.
Application timeout [ms]	Maximum time given to the higher application level. Short time (100 ms) can be specified for a standard application.
Load on the CPU	Load of the CPU allowed for the driver.
	-----[Display of sent telegrams]-----
IP-Node	Last sent IP-Node
Station number	Last sent Station number.
Function	Last sent Function. For F23 see below.
Base address	Last sent Base address.
File address	Last sent File address.
Number of elements	Last sent Number of elements.
Requests sent	Number of sent Requests.

Link error	Last error detected by the link layer.
Link error argument	Argument of the last error detected by the link layer.
Modbus exception code	Last Modbus exception code returned by the slave. See topic : Modbus Exception Codes
Error counter	Number of detected errors since last clearing.

Modbus/TCP or UDP: The Modbus protocol over IP specified by the Modbus organization uses the TCP protocol. Almost all implementations of Modbus over IP use actually TCP. Although, small data exchange as used by Modbus are faster with UDP packages. Some manufacturers have chosen to implement an UDP/IP version instead of TCP/IP or as alternative to it. If available, it is recommended to use UDP rather than TCP.
PCD3 firmware prior to version 1.08.10 have problems with TCP and should only use UDP for Modbus Master.
In TCP, repetition (number and interval) is handled by the socket and not by the repetition mechanism of this Fbox. The total timeout is set to: Timeout * Number of repetitions.

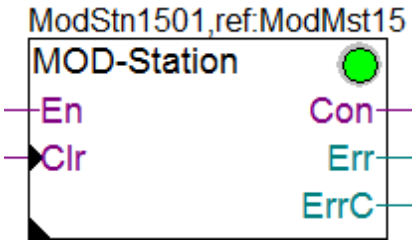
Modbus Function 23
The function 23 executes a Write and a Read access in the same transaction. The base address and the number of elements show the parameter of the Write access. The base address of the Read access is shown as File address. The number of elements of the Read access is not displayed.

Error codes

Code	Message	Description	Argument
0	OK	No error	-
1	Data Mode	In old versions, was displayed after clearing in place of error 4.	-
2	Diag	A low level diagnose have been reported from the firmware.	-
3	Overflow	Too big package received.	-
4	Data Mode	Error opening data mode.	-
5	TCP Client	Error opening TCP Client port.	Port number.
6	TCP Connect	Error when connecting to (or disconnecting from) a server	1 = Connect 2 = Disconnect
7	Tx locked	Transmission is locked by FW. The driver is not anymore able to transmit any telegrams.	Internal flags
8	Token locked	The transmission token have been locked. Can be due to uncalled program block of flag corruption.	Internal flags
15	Rx IP	Error when an IP package is received	
16	IP Length	A too big IP package has been received	Package length
17	Frame ID	A wrong frame ID has been returned by the slave	Received ID
20	Connect Tout	TCP connection timeout.	Internal code
21	Byte	Invalid Byte count in the telegram.	Number of bytes specified in the telegram.
22	Receive	Unexpected reception.	Internal code

23	Timeout	No valid response in the given time.	Internal code
26	Len	Wrong telegram length.	-
28	Rx Func	Wrong function code received in the slave response.	Received function code.
29	Rx Stat	Received station address is not the same as the sent station. Another station respond to the request.	Received station address
30	Function	Function not supported	Function code
31	Message Slv	Exception message returned by the slave The message type is displayed in the adjust window. When communicating with a TCP->RTU Gateway Message Slv can be returned by the gateway when a slave device is not responding (instead of a Timeout error).	Modbus message code
32	Nb of Data	Wrong number of data returned by the slave.	
33	Address	Invalid address or address range in a request. The request is not sent.	
35	Fnc File	Illegal reference on a Read or Write Function File.	-
36	F Invalid	Function invalid. Occurs with Indirect Send/Rcv Fboxes and Read function in Multicast.	Used function
40	Application	General application error replay. See the error displayed in corresponding application Fbox.	-
48	App replay	The application did not replay to link layer. E.g. No application Fbox exist for the concerned slave address.	-
88	Trial ended	For demo package. Trial period ended.	-
90..99	<90>..<99>	Internal error.	-

4.3 Slave Station



The Slave Station Fbox is used in a Modbus Master application to define the Slave stations the Master will access to. The Fbox define also the IP-Node (in case of Modbus/TCP) and the slave station address. Error related to the concerned station (same as displayed in the Master Link) are also displayed by this Fbox.

The Fbox reference must refer to the corresponding Modbus Master Link Fbox. You must place SEND and RCV Fboxes to define the request to be sent the concerned slave. The SEND and RCV Fboxes will make reference to the corresponding Slave Station Fbox.

The good functioning of the slave is monitored by this Fbox. In case of problem (timeout) the station is put offline for a while and a reconnection attempt is start at regular interval. When the station is offline, due to an error or when the Enable input is Low, all SEND and RCV Fbox related to this station are disabled.

Input / Output / LED

En	Enable	Enables / Disables the requests to the concerned station.
Clr	Clear	Allows you to clear the error diagnostic.
Con	Connected	Shows (or assumes) that the station is physically connected. It is set High or Low according to option at startup. Then it remains high as long as valid responses are received. It drops to low if an error occurs. The state remains unchanged when the Fbox is disabled or no Rcv/Send Fbox is enabled.
Err	Error code	The numeric Err output indicates the code of the last detected error.
ErrC	Error Counter	Counts the number of errors since startup or last clearing.
LED	LED	The LED is red if an error has been detected. It turns back to green when the error is cleared.

Parameters

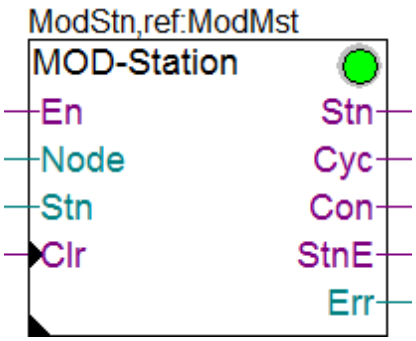
IP-Node	IP address of the concerned slave station in IP address notation (e.g. 192.168.2.41). It can also be a Node ID defined in TCP/IP configuration if only the last byte is non zero (e.g. 0.0.0.41 is the IP-Node 41).
Station address	Modbus address of the concerned slave station.
Short reconnect time	Reconnect time applies after a first communication error. This short time allow a fast reconnection is case of occasional errors.
Integer 32 bits format	Option for the support of 32 bits integer format.
- Default	Use the default settings from the Driver Fbox.
- Little Endian	The least significant word is transmitted first. This option overwrites the default settings in the Driver Fbox. Note that the byte order is not changed by this option.
- Big Endian	The most significant word is transmitted first. This option overwrites the default settings in the Driver Fbox. Format used by Modicon for instance.
Floating-point format	Option for the support of floating-point format. This option overwrites the default settings in the Driver Fbox.
- Default	Use the default settings from the Driver Fbox.
- Little Endian	The least significant word is transmitted first. This option overwrites the default settings in the Driver Fbox. Note that the byte order is not changed by this option.
- Big Endian	The most significant word is transmitted first. This option overwrites the default settings in the Driver Fbox. Format used by Modicon for instance.
Byte order	Option to define the byte order used by the slave device. Because the byte order is well defined by Modbus, it should not be necessary to change this option for a Modbus compliant device.

- Default	Use the default byte order as defined by Modbus which is 'Big Endian'.
- Little Endian	Change the byte order to Little Endian (LSB is transmitted first)
- Big Endian	Use byte order Big Endian (MSB is transmitted first)
Long reconnect time	The long reconnect time applies when the short reconnection fails. Reconnection attempts are then started at regular interval with this time.
Default connect state	Default connect state at startup until a first connect attempt is executed (= a first request has been sent).
Disconnect on Exception message	Defines if the station must be considered as disconnected (Con output set Low) if an exception message is received. This option is useful if an exception message is received when a station is not reachable (for instance with a TCP to RS485 gateway).
Reconnect now	Button to manually start a reconnection attempt.
Error	Display of the last detected error with this station. See the list of errors of the Master Link RS or Master Link IP. The button allows you to clear the error diagnostic.

The connect status is only updated if at least one SEND or RCV Fbox is enabled. A reconnection attempt can also only be started if a SEND or a RCV Fbox is enabled.

The careful use of the Enable and the reconnect time allows to drastically reduce the amount of communication breaks in case of physical disconnection or shut down of slave stations.

4.4 Slave Station Indirect



This is an advanced Fbox allowing to change the accessed slave station by the Master in runtime.
Please read first the description of the 'standard' Slave Station Fbox to understand the working principle of the Slave Station Fboxes.
Because of the difficulties to perfectly handle the node and station changes in runtime and due to the restrictions described below, it is recommended to use the 'standard' Slave Station Fbox where possible.
This Fbox is however useful in the following cases:

- The Slave stations to be accessed is not known in advanced and is set in runtime. In this case, the Station is only adjusted once, for instance over a display.

- The Stations to accessed is handled by a supervisor. In this case, the disconnection of stations must also be handled by the supervisor.
- A large amount of slave stations must be accessed and a short program is whished. In this case, particular care must be taken to ensure a correct functioning. Graftec and IL coding is recommended for the control sequence.

Restrictions:

- Because the accessed station will change in runtime, the Fbox cannot handle a connection state of all accessed slave stations.
- No disconnect-Reconnect mechanism is supported.
- The output error is the last detected error (it may also be caused by another standard Station Fboxes).
- The Node and Stn inputs cannot change during a communications cycle. New values are only used after the end of a communication cycle.
- The Enable input concerns all Send/Rcv Fboxes with reference to this Station Fbox.

Inputs

En	Enable	Enables / Disables the requests to the concerned stations. The reference to this Fbox is relevant and not the effective station number.
Node	IP-Node	For Modbus/TCP only. Define the currently accessed IP-Node. Must be set to 0 for Modbus RSxxx. A direct IP address should be given in hex format (e.g. 192.168.2.41 is 0C0A80229H). It can also be a Node ID defined in TCP/IP configuration if only the last byte is non zero (e.g. 41 is the IP-Node 41).
Stn	Station	Define the currently accessed Station address.
Clr	Clear	Allows to clear the error diagnostic.

Outputs / LED

Stn	Station Active	Indicates that the station (IP-Node and Slave station) specified at the inputs is now active.
Cyc	Cycled	Indicates that the selected station has executed at least one complete communication cycle (maybe with error).
Con	Connect	Indicates that the currently accessed station is connected. The output is reset when the Fbox is disabled and each time the accessed station changes. It can only be updated if at least one Send/Rcv Fbox is activated.
StnE	Station Error	Indicates that the currently accessed station has caused an error. The Error code at the Err output concern this station (else it may concern another previously accessed station).
Err	Error code	The numeric Err output indicates the code of the last detected error.
LED	LED	The LED is red if an error has been detected. It turns back to green when the error is cleared.

Parameters

Integer 32 bits format	Option for the support of 32 bits integer format.
- Default	Use the default settings from the Driver Fbox.

- Little Endian	The least significant word is transmitted first. This option overwrites the default settings in the Driver Fbox. Note that the byte order is always MSB first.
- Big Endian	The most significant word is transmitted first. This option overwrites the default settings in the Driver Fbox. Format used by Modicon for instance.
Floating-point format	Option for the support of floating-point format. This option can overwrites the default settings in the Driver Fbox.
- Default	Use the default settings from the Driver Fbox.
- Little Endian	The least significant word is transmitted first. This option overwrites the default settings in the Driver Fbox. Note that the byte order is always MSB first.
- Big Endian	The most significant word is transmitted first. This option overwrites the default settings in the Driver Fbox. Format used by Modicon for instance.
Byte order	Option to define the byte order used by the slave device. Because the byte order is well defined by Modbus, it should not be necessary to change this option for a Modbus compliant device.
- Default	Use the default byte order as defined by Modbus which is 'Big Endian'.
- Little Endian	Change the byte order to Little Endian (LSB is transmitted first)
- Big Endian	Use byte order Big Endian (MSB is transmitted first)
Error	Display of the last detected error. See the list of errors of the Master Link RS or Master Link IP. The button allows you to clear the error diagnostic.

Station switching

Before version 2.4.200, the IP-Node and the Slave station was switched immediately when the inputs did change. This was difficult to synchronize with the Send/Rcv Fboxes over the user program.
Since version 2.4.200 the Fbox has some improvements.
When the IP-Node and/or the Slave station is changed, an internal signal abort any pending (but not started) transmissions in the Send/Rcv Fboxes with reference to this Station Fbox. This avoid to send data to the wrong station during switching. The output Stn, Cyc and StnE are reset to indicate that the transmission with the former station is stopped.
At the begin of a new communication cycle, the station is switched with the new input values and the transmission is enabled again. At this point, the Stn output is set to indicate that the transmission with the new station is started.
In some application the Rcv Fboxes may be permanently activated and must update some values from the slave before to activate further functions (typically with the Rcv/Send Auto Fboxes). This can be controlled by the Cyc output. This output is set to High after one complete communication cycle (comprising only the enabled Send/Rcv Fboxes).
The StnE output is set again if error occur with the new selected station. The error code is available at the Err output. In other words, the error code only concerns the selected station if the StnE output is also set.

4.5 Multicast

Some slave device are designed to react on a multicast address (in supplement to the broadcast address 0). The Multicast Fbox is designed to send data in multicast to a defined station number. In Multicast, it is expected that more than one station receive the data (e.g. a group of stations). Therefore the restriction are the same as in broadcast :

- No station will answer to the telegrams
- Only write functions are allowed

The Fbox allows also to define a request delay. A silent is inserted in the telegram sequence after each multicast telegram. This gives time to all concerned slaves to process the received data.

Use this Fbox instead of the Station Fbox. It means that the Send Fbox for the multicast telegrams will make reference to the Multicast Fbox. The Multicast Fbox makes always reference to the Modbus Master Link Fbox.

The Fbox can also be used in the following cases :

- A slave has a different broadcast address than the default defined by Modbus (default is 0)
- You need a longer request delay for broadcast telegrams. In this case, specify 0 as multicast address and give the needed delay.

Input / Output / LED

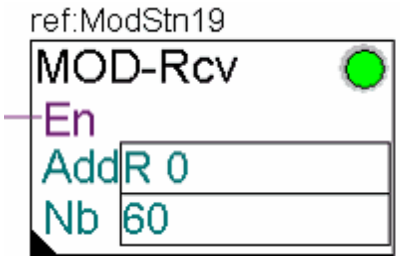
En	Enable	Enables / Disables the requests to the concerned stations. The reference to this Fbox is relevant and not the effective station number.
Clr	Clear	Allows to clear the error.
Err	Error code	The numeric Err output indicates the code of the last detected error.
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly treated.

Parameters

IP-Node	IP address of the concerned slave station in IP address notation (e.g. 192.168.2.41). It can also be a Node ID defined in TCP/IP configuration if only the last byte is non zero (e.g. 0.0.0.41 is the IP-Node 41).
Multicast address	Modbus address for the multicast telegrams.
Multicast request delay	Silent delay inserted after each multicast telegram.
Error	Display of the last detected error with this multicast address. See the list of errors of the Master Link RS or Master Link IP.

The most current error is the Invalid Function which occurs if a Read function is used in Multicast. Remember that only Write functions (with Send Fboxes) are allowed in multicast.

4.6 RCV or SEND Direct



The SEND and RCV Direct Fboxes define the request to be sent to the slave station. The Modbus function to use and the parameter of the function are adjusted in the Fbox. The Fbox makes reference to the corresponding Slave Station Fbox. The base address and the number of element in the PCD are specified in Fbox fields.

The requests to the slave are sent cyclically when the enable is high and the concerned station is enabled and in connect state.

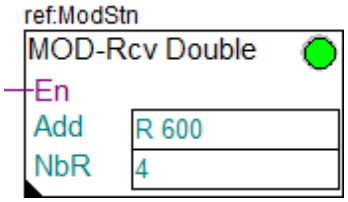
Input / Output / LED

En	Enable	Enables / Disables the transmission of the requests.
Add	Address	Base address of the PCD variables to be sent or to receive the data.
Nb	Number	Number of successive PCD variables to send or to receive.
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly treated.

Parameters

Function	Modbus function code to use. Functions 5 and 6 can send only one element per telegram. If number is bigger than 1, successive telegrams will be sent.
Auto-send on change	Only for SEND Bits direct. Define if changed bits must automatically be sent to the slave. With this option, changed bits are sent even if the enable input is low. With function 15, all bits are sent in one package. With function 5, only the changed bit is sent.
Format conversion	16->32 = Normal Modbus format for a RCV. 16 bits are received. 32->16 = Normal Modbus format for a SEND. 16 bits are sent. 32->32 = 32 bit values are sent/received from slave. Float 32 = Standard format for float values
Base address	Base address sent to the slave with the request.
File number	File number sent with the request for functions 20 and 21.
Manual command	Button to manually send a request to the slave (only executed if the slave is enabled and in connect state).

4.7 RCV Integer Double



This Fbox can be used to receive integer values with double resolution (64 bits or 2*9 digits).
When the En input is high, the defined data package is cyclically polled from the slave station and updated in the Master station.
Since a PCD register has only 32 bits, this Fbox uses 2 registers for each double value.
On the Fbox field NbR you must specify the number of **used PCD register** in range 2 to 20 (e.g. 4 registers for 2 double values).

Because a Modbus register has only 16 bits, the generated Modbus request (sent to the slave) will specify a number equal to 2 times the specified number of registers, or 4 times the number of double values.
E.g. : For 1 double value, 64 bits -> 2 PCD registers, 32 bits each -> 4 Modbus registers, 16 bits each.
For 2 double values -> 4 PCD registers, 32 bits each -> 8 Modbus registers, 16 bits each.

The register mapping in the PCD is always as follow:

Add+0	First value, higher part
Add+1	First value, lower part
Add+2	Second value, higher part
Add+3	Second value, lower part
	And so on...

Input / Output / LED

En	Enable	Enables / Disables the reception of the values.
Add	Address	Base address of the PCD variables to receive the values.
NbR	Number register	Number of successive PCD variables to receive the values. Range 2 to 20. Each double value uses 2 registers.
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly executed.

Parameters

Function	Modbus function code to use.
Base address	Base address sent to the slave with the request.
Slave Format	Format of the values in the slave station. The actual supported format are 64 bits integer and float and 2*9 digits. See details below.
Swap double word	This option will swap elements of each double word received from the slave. It must be used if the first 32 bits element holds the lower part (instead of the higher part) and the next 32 bits element holds the higher part.

Output format	Format of the output value. Use 2 * 32 bits for slave format 64 bits. Use 2 * 9 digits for slave format 2 * 9 digits. Mix up of formats is not yet supported. See details below.
Correction factor	Factor to increase or reduce the returned values. It is applied on both part of the value and the remaining digits of the higher part are restored as higher digits in the lower part. With this option you can make the double value more 'usable' for a PCD, for instance by removing non-significant lower digits. In case of factor 10 or bigger, you may have an overflow of the value (result has more than 18 digits or more than 64 bits). In case of overflow: Format 2*9 digits -> the extra digits are lost Format 2*32 bits -> value 0 is returned.
Manual command	Button to manually send the read request to the slave. (only executed if the slave is in connect state).

Slave Formats

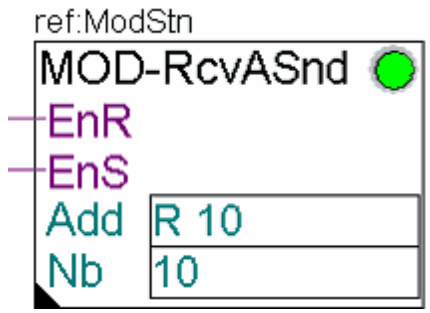
64 bits	The 64 bits are provided over 4 Modbus register (16 bits each). The 2 first Modbus registers are supposed to hold the 32 higher bits while the next 2 Modbus registers (16 bits each) holds the lower 32 bits. If it does not match the slave mapping, use the swap option. Note that if single words (16 bits) must be swapped, you must use the option Little/Big Endian for Integer of the Station Fbox.
2 * 9 digits	Each 32 bit package holds up to 9 decimal digits of the value. The first 32 bits element is supposed to hold the 9 higher digits while the next 32 bits element holds the 9 lower digits. This is very important if a conversion is applied. If it does not match the slave mapping, use the swap option. Note that if single words (16 bits) must be swapped, you must use the option Little/Big Endian for Integer of the Station Fbox.
64 bits float	The 64 bits are provided over 4 Modbus register (16 bits each). The format is the IEEE 64bits floating point. The 2 first Modbus registers are supposed to hold the 32 higher bits while the next 2 Modbus registers (16 bits each) holds the lower 32 bits. If it does not match the slave mapping, use the swap option. Note that if single words (16 bits) must be swapped, you must use the option Little/Big Endian for **Integer** of the Station Fbox (received values are not converted into PCD float by the driver). Only the output format 2*9 digits can be used with this slave format. The received values is converted into 2 parts in integer format. The value range of 2*9 digits is much smaller than 64 bits float values and might be not sufficient for big values. If the returned value has more than 18 digits, wrong result can be output. Take care to use a suitable correction factor according to the expected values. Due to the various operation to split the value in 2 parts, the precision of the result can be reduced down to 14 digits in worst cases.

Ouput Formats

2 * 32 bits	A 64 bits value is returned on 2 registers. The first holds always the higher part, while the 2nd hold the lower parts. You cannot handle this format in a PCD, but a supervisor with higher resolution can read both registers and build the value as follow:

	Value = (higher_part * 2^32) + lower_part
2 * 9 digits	The value is returned on 2 PCD registers. You cannot handle this format in a PCD, but a supervisor with higher resolution can read both registers and build the value as follow: Value = (higher_part * 1'000'000'000) + lower_part

4.8 RCV / Auto Send



This Fbox can be used to update values in both directions: Rcv and Send. It has been specially designed for cases where parameters are modified on both side (master and slave). Don't use it for values that automatically change on the master and/or on the slave.

The Rcv function is the same as in the simple RCV Direct Fbox When the EnR input is high, the defined data package is cyclically polled from the slave station and updated in the Master station as long as there is no change on values master side. Take care that the send function has always priority as to ensure that no change on master side are lost. In the worth case, if permanent changes are detected on master side, the read function may never be executed.

The Auto Send function does cyclically check if a value has been modified in the Master station and send any change to the Slave station. Only the changed value is sent at a time. The EnS input can be used to activate the auto Send function. If a value is re-written with the same value, it will no be sent because the comparison with the image will not detect any change. Note that a RAM data block is used to keep an image of integer values. The RAM DB range must be correctly configured in the software configuration.

Input / Output / LED

EnR	Enable Receive	Enables / Disables the reception of the values.
EnS	Enable Send	Enables / Disables the Auto sending of changed values. If values changed while the EnS input is low, all changed values will be sent when the EnS input is set to high.
Add	Address	Base address of the PCD variables to be sent and to receive the data.
Nb	Number	Number of successive PCD variables to handle.
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly treated.

Parameters

Function	Modbus function code to use.
Format conversion (receive)	For Integer Fbox only.

	The selected conversion is valid for the Receive. The Send function use the opposite conversion. 16->32 = Normal Modbus format for a RCV. 16 bits are received. 32->32 = 32 bit values are sent to/received from slave. See below.
Address conversion	None = The specified address is sent and incremented for each register in the array. (Add + i) * 2 = The address and increment are multiplied by 2. Add + (i*2) = The array increment is multiplied by 2. See detail below.
Base address	Base address sent to the slave with the request.
File number	File number sent with the request for functions 20 and 21.
Manual command Receive	Button to manually send a read request to the slave. (only executed if the slave is in connect state).
Manual command Auto Send	Button to manually execute an auto-send. The function looks for a changed element and the first found is sent to the slave. Only one element is sent at each command. If several elements have changed, you must click several times to send all changed elements. (only executed if the slave is in connect state).

Notes

Such a combination cannot be correctly realized by using simple Send and Rcv Fboxes. A special prioritization has been implemented to ensure a correct update in both direction without lost of changed value. A small risk still exist when a value is changed by S-Bus protocol because S-Bus is handled by interrupt in the CPU. However this risk is kept as small as possible and should be less than 1% in the worth cases (the worth case is a small program, few data exchange and high baudrate). This risk doesn't exist if the value is changed by the user program (e.g. by the HMI).

After a program download, all images are initialized with zeros. This will cause all non zero values to be sent to the slave at startup.

Format 32->32

Since Modbus is based on 16 bits registers, this format will Receive and Send the double of elements as specified.
Therefore, the function **'6 Write 1R'** cannot be used with this format. Use always the function **'16 Write R'.**
Because the slave may have a different address mapping for register, you may also need to apply an Address conversion.

Address conversion

In the most cases, for 16 bits values you should not need any address conversion.
With 32 bits values, different slave mapping can be encountered.
Three different address mapping are supported with this Fbox:

No conversion:
The specified address is directly used for Send and Receive function.
Example for an array of 4 registers:

Master R 100 - 32 bits	<- Read <-	**Slave Add 100 - 32 bits**	Reading 4 registers, 32 bits each from Slave addresses 100, 101, 102 and 103.
Master R 101 - 32 bits	<- Read <-	Slave Add 101 - 32 bits	
Master R 102 - 32 bits	<- Read <-	Slave Add 102 - 32 bits	
Master R 103 - 32 bits	<- Read <-	Slave Add 103 - 32 bits	

PCD - R 102 - 32 bits	**-> Write ->**	**Slave - R 102 - 32 bits**	As register 102 changes it is sent to R 102 of the slave.

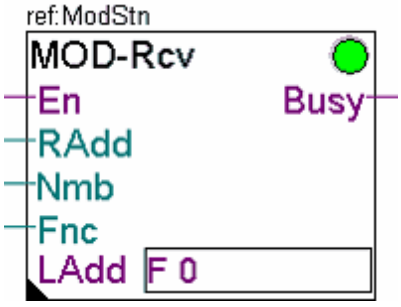
Conversion (Add + i) * 2
This option apply to a slave where the whole register range is mapped to one address range skipping each 2nd address.
Only address 0, 2, 4, 6,.. are valid over the whole address range.
Example for an array of 4 registers:

Master - R 100 - 32 bits	<- Read <-	Slave - R 200 - 32 bits	Reading 4 registers from Slave, addresses 200, 202, 204 and 206.
Master - R 101 - 32 bits	<- Read <-	Slave - R 202 - 32 bits	
Master - R 102 - 32 bits	<- Read <-	Slave - R 204 - 32 bits	
Master - R 103 - 32 bits	<- Read <-	Slave - R 206 - 32 bits	
Master - R 102 - 32 bits	**-> Write ->**	**Slave - R 204 - 32 bits**	**As register 102 changes it is sent to R 204 of the slave.**

Conversion Add + (i * 2)
This option apply to a slave where each register range is mapped to its base address and each 2nd addresses is skipping inside this range.
Only address Base+0, Base+2, Base+4, Base+6 are valid inside the register range. The base address is applied as specified in the Modbus telegram.
Example for an array of 4 registers:

Master - R 100 - 32 bits	<- Read <-	Slave - R 100 - 32 bits	Reading 4 registers from Slave, addresses 100, 102, 104 and 106.
Master - R 101 - 32 bits	<- Read <-	Slave - R 102 - 32 bits	
Master - R 102 - 32 bits	<- Read <-	Slave - R 104 - 32 bits	
Master - R 103 - 32 bits	<- Read <-	Slave - R 106 - 32 bits	
Master - R 102 - 32 bits	**-> Write ->**	**Slave - R 104 - 32 bits**	**As register 102 changes it is sent to R 104 of the slave.**

4.9 RCV or SEND Indirect



The SEND and RCV **Indirect** Fboxes define the request to be sent to the slave station. The remote variables address and the number of element are given as Fbox input. The Modbus function to use can be set in the Fbox or can be given on an Fbox input. The Fbox makes reference to the corresponding Slave Station Fbox. The base address of local variables (in the PCD Master) are specified in an Fbox field.

The requests to the slave are sent cyclically when the enable is high and the concerned station is enabled and in connect state.

Take care
Particular care must be taken to create a correct application using Indirect Fboxes. The Inputs must remain unchanged until the request is ended (the Busy input is low).
The comments about indirect station addressing in the Slave Station Indirect Fbox are also valid for these Fboxes.

The function code must also be a valid code for the variable type. In the either case, the request is rejected by the Master Fbox (no request is sent) and an Error is shown.
It is however allowed to use a Write function code in a RCV Fbox as well as a Read function code in a SEND Fbox.

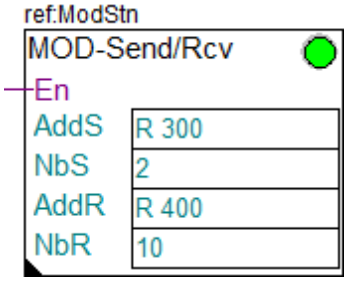
Input / Output / LED

En	Enable	Enables / Disables the transmission of the requests.
RAdd	Remote Address	Base address of the PCD variables to be sent or to receive the data.
Nmb	Number	Number of successive PCD variables to send or to receive. Function 5 and 6 can only send 1 element. Value at input Nmb is ignored.
Fnc	Function	Used if the option 'Function = Indirect' is selected. Define the Modbus function to use. See details below.
LAdd	Local Address	Base address of the PCD variables to be sent or to receive the data.
Busy	Busy	Indicate that a transmission is currently pending. The input parameters must not be changed while the Fbox is busy.
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly treated.

Parameters

Function	Modbus function code to use. The option 'Indirect' allows to pass the function code by the Function input.
Format conversion	->32 = Normal Modbus format for a RCV. 16 bits are received. 32->16 = Normal Modbus format for a SEND. 16 bits are sent. 32->32 = 32 bit values are sent/received from slave. Float 32 = Standard format for float values
Local address	Only for RCV Integer Indirect Fbox Defines if the local address (register as LAdd label) is direct or indirect. With indirect addressing, the specified register must point to the base address of the target register array.
Manual command	Button to manually send a request to the slave (only executed if the slave is enabled and in connect state).

4.10 SEND / RCV Direct with F23



These SEND / RCV Direct Fboxes uses the Modbus function 23 which executes a Send and a Read operation in a single transaction. Ensure the slave support the function 23 before to use it.
The base address and the number of element in the PCD are specified in Fbox fields.

The Fbox makes reference to the corresponding Slave Station Fbox.
The requests to the slave are sent cyclically when the enable is high and the concerned station is enabled and in connect state.

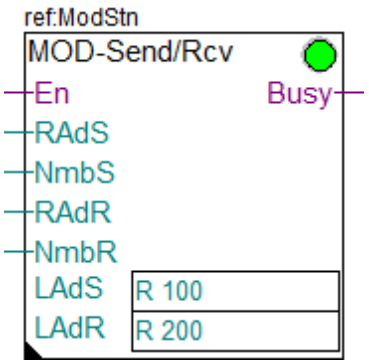
Input / Output / LED

En	Enable	Enables / Disables the transmission of the requests.
AddS	Address SEND	Base address of the PCD variables to be sent to the slave.
NbS	Number SEND	Number of successive PCD variables to send.
AddR	Address RCV	Base address of the PCD variables to receive the data.
NbR	Number RCV	Number of successive PCD variables to receive the data.
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly treated.

Parameters

Function	Modbus function code to use.
Format conversion SEND	32 -> 16 = Normal Modbus format for SEND and RCV. 16 bits are sent. 32 -> 16US = Unsigned 16 bits values are SEND and RCV. 32 -> 32 = 32 bit values are sent and received. Int 32 -> Fp*10 = Send Integer values as float values with 1/10 resolution The RCV function uses a symmetrical format conversion. E.g.: If 16 bits are sent, only 16 bits are received. If integer values are sent as float, float values are also received and converted into integer.
Base address SEND	Base address in the slave for the sent data.
Base address RCV	Base address in the slave for the data to receive.
Manual command	Button to manually send a request to the slave (only executed if the slave is enabled and in connect state).

4.11 SEND / RCV Indirect with F23



These SEND / RCV Indirect Fboxes uses the Modbus function 23 which executes a Send and a Read operation in a single transaction. Ensure the slave support the function 23 before to use it.
The remote variables addresses and the number of elements are given as Fbox inputs. The base address of local variables (in the PCD Master) are specified in Fbox fields.

The Fbox makes reference to the corresponding Slave Station Fbox.
The requests to the slave are sent cyclically when the enable is high and the concerned station is enabled and in connect state.

Take care
Particular care must be taken to create a correct application using Indirect Fboxes. The Inputs must remain unchanged until the request is ended (the Busy input is low).
The comments about indirect station addressing in the Slave Station Indirect Fbox are also valid for these Fboxes.

Input / Output / LED

En	Enable	Enables / Disables the transmission of the requests.
RAdS	Remote Address SEND	Base address in the slave for the sent data.
NmbS	Number SEND	Number of successive variables to send (PCD and Slave).
RAdR	Remote Address RCV	Base address in the slave for the variables to receive.
NmbR	Number RCV	Number of successive variables to receive (PCD and Slave).
LAdS	Local Address SEND	Base address of the PCD variables to be sent.
LAdR	Local Address RCV	Base address of the PCD variables to receive the data.
Busy	Busy	Indicate that a transmission is currently pending. The input parameters must not be changed while the Fbox is busy.
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly treated.

Parameters

Function	Modbus function code to use. The option 'Indirect' allows to pass the function code by the Function input.
Format conversion SEND	32 -> 16 = Normal Modbus format for SEND and RCV. 16 bits are sent. 32 -> 16US = Unsigned 16 bits values are SEND and RCV. 32 -> 32 = 32 bit values are sent and received.

	Int 32 -> Fp*10 = Send Integer values as float values with 1/10 resolution The RCV function uses a symmetrical format conversion. E.g.: If 16 bits are sent, only 16 bits are received. If integer values are sent as float, float values are also received and converted into integer.
Local address	Defines if the local address (register as LAdS and LadR label) are direct or indirect. With indirect addressing, the specified registers must point to the base address of the target register arrays.
Manual command	Button to manually send a request to the slave (only executed if the slave is enabled and in connect state).

This page is intentionally left blank.
Remove this text from the manual
template if you want it completely blank.

Specific Devices

5 Specific Devices

Under this topic you will find Fbox that have been specially created to match particular devices.

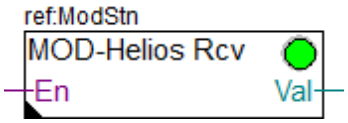
It might be to support a particular data format, to support particular communication sequences or to provide a compact Fbox ready to use for specific devices.

5.1 Helios Devices

Under this topic you will find Fbox specifically created to support a particular data format used by Helios devices.
You need a particular license which allows the use of these specific Fboxes.

You must use the standard Driver Fbox and the standard Station Fbox before to use the the particular RCV/SEND Helios Fboxes.

5.1.1 RCV Integer Helios



When communicating over TCP/IP with Helios devices, particular ASCII messages are used. This Fbox can be used to build the ASCII request and decode the ASCII response.
A 'Master Link IP' and a 'Slave Station' Fbox must be used as usual.
In the 'Master Link IP', the following settings are needed:
- Destination port = 502 (default)
- Protocol = Modbus/TCP (default)
- Address offset = 1 (Modicon)
- Default Integer 32 bits = 'Little Endian'.

In the 'Slave Station', the following settings are needed:
- Station address = 180
- Integer 32 bits format = 'Little Endian'.
- Byte order = 'Default'

Other parameters can be adjusted as desired.
The Modbus function to use, the Modbus register reference and the number of element to send/read are fix defined and must not be adjusted.
The Fbox makes reference to the corresponding Slave Station Fbox.

The requests to the device are sent cyclically when the enable is high and if the concerned station is enabled and in connect state.

Input / Output / LED

En	Enable	Enables / Disables the transmission of the requests.
Val	Value	Received value.
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly executed.

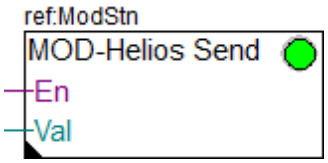
Parameters

Value address	Address of the value to read. Refer to the Helios document.
Manual command	Button to manually send a read request to the device (only executed if the slave is enabled and in connect state).
Error	Display of the last detected error. See list below. Button to manually clear the error. When a request is correctly executed the error is automatically cleared

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
11	IV address	The provided address is not valid. See address list of Helios document.
20	IV response	The 'V' or the '=' sign was not found in the response.
21	Rsp too short	The received response was too short.
22	IV digit address	An invalid digit was found in the returned address.
23	IV address	The returned address is not valid (not identical as request)
31	End not found	The end mark <NUL> was not found in the response.
32	IV digit value	An invalid digit was found in the returned value.

5.1.2 SEND Integer Helios



When communicating over TCP/IP with Helios devices, particular ASCII messages are used. This Fbox can be used to build the ASCII request and decode the ASCII response.
A 'Master Link IP' and a 'Slave Station' Fbox must be used as usual.
In the 'Master Link IP', the following settings are needed:
- Destination port = 502 (default)
- Protocol = Modbus/TCP (default)
- Address offset = 1 (Modicon)
- Default Integer 32 bits = 'Little Endian'.

In the 'Slave Station', the following settings are needed:
- Station address = 180
- Integer 32 bits format = 'Little Endian'.
- Byte order = 'Default'

Other parameters can be adjusted as desired.
The Modbus function to use, the Modbus register reference and the number of element to send are fix defined and must not be adjusted.
The Fbox makes reference to the corresponding Slave Station Fbox.

The requests to the device are sent cyclically when the enable is high and if the concerned station is enabled and in connect state.

Input / Output / LED

En	Enable	Enables / Disables the transmission of the requests.
Val	Value	Value to send. Refer to the Helios manual for the valid values on each address.
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly executed.

Parameters

Value address	Address of the value to write. Refer to the Helios document.
Manual command	Button to manually send a read request to the device (only executed if the slave is enabled and in connect state).
Error	Display of the last detected error. See list below. Button to manually clear the error. When a request is correctly executed the error is automatically cleared

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
11	IV address	The provided address is not valid. See address list of Helios document.

5.2 Belimo Devices

Under this topic, you will find compact Fboxes created to support specific Belimo devices.
You need a particular license which allows the use of these specific Fboxes.

Use the standard Driver Fbox before to use the Belimo Fboxes.
The Belimo Fboxes already include the connection mechanism of the Station Fbox.
Therefore, the Belimo Fboxes must directly make reference to the Modbus Driver Fbox.

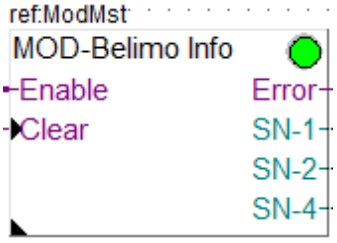
The Fboxes are made for a use over serial lines RS485 because most Belimo devices support only Modbus RTU (over RS485).
You can however, connect your device over a Modbus TCP to Modbus RTU gateway and use a Modbus IP driver on the PCD.
To define the IP address of the converter, place the Fbox Belimo Define IP Connection before the Belimo Fboxes. Add a new Fbox to change the IP-Address of further devices connected to another Gateway. In the same way you can communicate with Belimo device supporting Modbus TCP directly (e.g. Belimo Energy Valve V4).

A typical modbus TCP - Modbus RTU gateway is the iSMA device which also includes inputs and outputs.

Beside the Device specific Fboxes, you can use the Generic Belimo Device Info Fbox to get general info about each device.
You can place this Fbox once in a Fupla program and change the connection in runtime to check the info of all your Belimo devices.

Belimo devices return a malfunction code with bit per bit info. The device Fboxes return this code in numeric form (integer output) and you should display it in binary format.
As to help you to check each relevant bit, auxiliary Fboxes are available. You can connect the Malfunction output to the input of the Malfunction Fbox.
Not all device use the same set of malfunction bits. Take care to use the matching malfunction Fbox which is indicated in the help topic of the corresponding device Fbox.

5.2.1 Belimo Device Info



This generic Fbox can be used with any Belimo device to read the serial number (part 1, 2 and 4), the actuator type and the firmware version.
Note that the part 3 of the serial number cannot be read over Modbus.
The Fbox must make reference to the Modbus driver.
Please consult also the Belimo documentation about the Modbus communication with this device.
See also general comments about Belimo Devices

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error code and the error outputs
Error	Error	Indicates that an error has been detected. A more detailed code is shown in the Fbox.
SN-1	Serial number part 1	Part 1 of the serial number.
SN-2	Serial number part 2	Part 2 of the serial number.
SN-4	Serial number part 4	Part 4 of the serial number. The part 3 of the serial number cannot be read.
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly executed.

Parameters

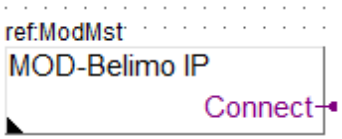
Slave address	Modbus slave address of the device to read.
Read interval	Time interval to regularly read the actuator info. The reading is executed as long as the Enable input is high. Since these values are constants in the device it is not worth to read them too fast.
Read device info	Button to manually execute a readout.
SN part 1, 2, 4	Serial number, parts 1, 2 and 4
Actuator type	Show the actuator type returned by the device. The actuator can also be 'Not connected' or 'No value' can be returned.

Firmware version	Value of the Firmware version returned by the device.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.

5.2.2 Belimo Define IP Connection



This generic Fbox can be used with any Belimo device to define an IP connection.
The Fbox must make reference to the Modbus IP Driver.
The Belimo Fboxes placed after this Fbox will automatically use the defined IP address.
IP Connection can be used with devices with an Ethernet connection and Modbus TCP.
It can also be used with other devices using a Modbus/TCP to Modbsu/RTU converter.
In the later case, several devices will use the same IP Address with different station addresses.
See also general comments about Belimo Devices

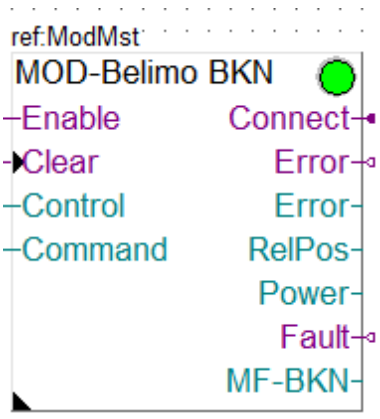
Input / Output

Connect	Connect	Shows that the referenced driver is currently connected with specified IP address.

Parameters

IP address	IP Address to be used for all Belimo Fboxes placed after this one.

5.2.3 Belimo BKN230-24



This specific Fbox can be used to read, control and configure the Belimo Fire actuator BKN230-24.
The Fbox must make reference to the Modbus driver.
Unless otherwise specified, the values are adapted to a resolution of 1/10th.
Note that the device with firmware version 1.x does not support all registers. You should select the applicable FW in the Fbox and some values are not supported. See notes below.
Please consult also the Belimo documentation about the Modbus communication with this device.
See also general comments about Belimo Devices

Actor types:
BKN230-24-MOD with FW V 1.xx
BKN230-24-MOD with FW V 2.xx

Important: Devices with FW version <1.09 cause many communication errors and should not be used with this Modbus library.

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
Control	Control code	Override control code sent cyclically to the device: 0 = None 1 = Open 2 = Close
Command	Command code	Command code sent cyclically to the device: 0 = None 2 = Test 4 = Reset fault bits
Connect	Connect	Indicate that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected. It remains high until it has been cleared even thought communication is running correctly again.
Error	Error (num)	Code of the last detected error.
RelPos	Relative position	Value of the relative position of the device in range 0 to 1000 for 0.0% to 100.0%. Some devices returns only the values: - 0 = 0.0% -> Closed position - 500 = 50.0% -> Intermediate position - 1000 = 100.0%. -> Open position
Power	Power	Shows the power consumption of the actuator in mW. With FW version 1.x the power is not returned by the device.
Fault	Fault	Collective Fault
MF-BKN	Malfunction	Binary code of the malfunction returned by the device. You can use the Belimo Malfunction BKN230-24 Fbox to have a bit per bit decoding of the value.
LED	LED	The LED has the same status as the error output. Error shown -> red / Error cleared -> green.

Parameters

Slave address	Modbus slave address of the device
-----[Commands]-----	
Open	Button to send a Open command. See details below.
Close	Button to send a Close command See details below.
Test	Button to send a Test command See details below.
Reset	Button to send a Reset command. See details below.
-----[Configuration]-----	
Read configuration	Button to read all configuration parameters. You should always first read the parameters before to change and write a new configuration.
Close on bus timeout	**Bus fall position** Activation of the bus supervision. The device will automatically close in case of a bus timeout.
Bus supervision timeout [s]	**Bus Watchdog (>= FW 2.01)** Timeout in seconds for the bus supervision. With FW version < 1.10 this parameter is fix to 120 sec. With FW version >= 1.10 this parameter is fix to 300 sec.
Write configuration	Button to write the configuration parameters. Always all parameters are written with the write command.
Bus countdown [s]	Shows the internal timer in seconds of the 'Bus Watchdog countdown'. With FW version 1.x this register is not supported.
-----[Errors]-----	
Error	Display of the last detected error. See list below. Button to manually clear the error.

Open/Close/Test/Reset buttons

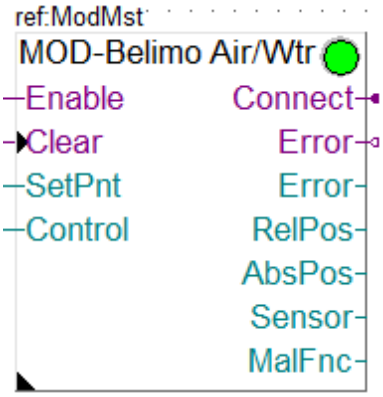
When one of these button is pressed, the corresponding command is sent once to the device. After that, the transmission of values at the Control and Command inputs is paused during 30 sec.
After 30 sec, if the Enable is high, the transmission of the values at the input is automatically re-activated. If you want, for instance, extend the duration of the Test, press the Test button repetitively, at least once each 30 sec.
You can also click one of these buttons while the Enable is low. The command is sent to the device. But, after 30 sec, no transmission is activated and the device will react according to its bus timeout configuration.
Consult also the Belimo documentation for more details about the process executed for each commands.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error

10	Internal sequence error 10	DB reading error
20	Tx/Rx error	One of the Tx or Rx failed. The communication is paused for 10 sec.
50	Internal Fbox error	Fbox sequence error.
other		Other internal errors

5.2.4 Belimo Air/Water



This specific Fbox can be used to read, control and configure the Belimo devices for Air and Water actuators.
The Fbox must make reference to the Modbus driver.
Unless otherwise specified, the values are adapted to a resolution of 1/10th.
Please consult also the Belimo documentation about the Modbus communication with this device.
See also general comments about Belimo Devices

Actor types:
..M(C)24A-MOD
..R24A-MOD
..V(K)24A-MOD

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
SetPnt	Set point	Position set point in range 0 to 1000 for 0.0% to 100.0%
Control	Control code	0 = None 1 = Open 2 = Close 3 = Min 4 = Mid 5 = Max
Connect	Connect	Indicate that the device is connected and communication works.Initialized to 1 at start up. Status is updated if

		Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected. It remains high until it has been cleared even thought communication is running correctly again.
Error	Error (num)	Code of the last detected error.
RelPos	Relative position	Value of the relative position of the device in range 0 to 1000 for 0.0% to 100.0%.
AbsPos	Absolute position	Value of the absolute position of the device with a resolution of 1° or 1mm. [°] for actuator with rotary movement [mm] for actuator with linear movement
Sensor	Sensor value	Measured value of the additional sensor depending on the configured sensor type.
MalFnc	Malfunction	Binary code of the malfunction returned by the device. You can use the Belimo Malfunction Fbox to have a bit per bit decoding of the value.
LED	LED	The LED has the same status as the error output. Error shown -> red / Error cleared -> green.

Parameters

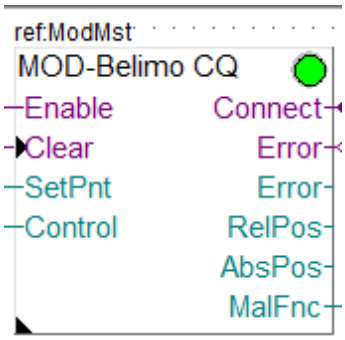
Slave address	Modbus slave address of the device
Read configuration	Button to read all configuration parameters. You should always first read the parameters before to change and write a new configuration.
Min Setpoint [%]	Configuration of the minimum setpoint in %.
Max Setpoint [%]	Configuration of the maximum setpoint in %.
Sensor type	Selection of the sensor type to be supported.
Write configuration	Button to write the configuration parameters. Always all parameters are written with the write command.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Tx/Rx error	One of the Tx or Rx failed. The communication is paused for 10 sec.

50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.2.5 Belimo CQ Rotary Actuator



This specific Fbox can be used to read, control and configure the Belimo CQ Rotary Actuator.
The Fbox must make reference to the Modbus driver.
Unless otherwise specified, the values are adapted to a resolution of 1/10th.
Please consult also the Belimo documentation about the Modbus communication with this device.
See also general comments about Belimo Devices

Actor types:
CQ24A-MOD
CQ24A-BAC

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
SetPnt	Set point	Position set point in range 0 to 1000 for 0.0% to 100.0%
Control	Control code	0 = None 1 = Open 2 = Close 5 = Max
Connect	Connect	Indicate that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected. It remains high until it has been cleared even thought communication is running correctly again.
Error	Error (num)	Code of the last detected error.
RelPos	Relative position	Value of the relative position of the device in range 0 to 1000 for 0.0% to 100.0%.
AbsPos	Absolute position	Value of the absolute position of the device with a resolution of 1° or 1mm.

		[°] for actuator with rotary movement [mm] for actuator with linear movement
MalFnc	Malfunction	Binary code of the malfunction returned by the device. You can use the Belimo Malfunction Fbox to have a bit per bit decoding of the value.
LED	LED	The LED has the same status as the error output. Error shown -> red / Error cleared -> green.

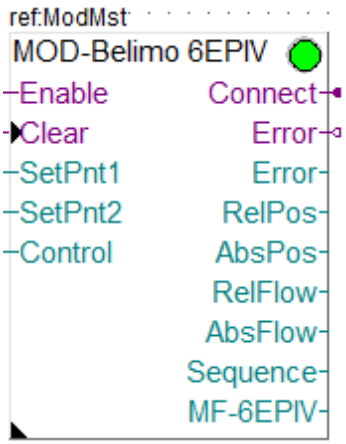
Parameters

Slave address	Modbus slave address of the device
Read configuration	Button to read all configuration parameters. You should always first read the parameters before to change and write a new configuration.
Max Setpoint [%]	Configuration of the maximum setpoint in %.
Write configuration	Button to write the configuration parameters. Always all parameters are written with the write command.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Tx/Rx error	One of the Tx or Rx failed. The communication is paused for 10 sec.
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.2.6 Belimo 6-Way EPIV



This specific Fbox can be used to read, control and configure the Belimo 6-way EPIV valve.
The Fbox must make reference to the Modbus driver.
Unless otherwise specified, the values are adapted to a resolution of 1/10th.
Please consult also the Belimo documentation about the Modbus communication with this device.
See also general comments about Belimo Devices

Actuator type:
EP..R-R6+BAC

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
SetPnt1	Set point 1	Position set point full control or for sequence 1 depending on option below.
SetPnt2	Set point 2	Position set point for sequence 2 depending on option below.
Control	Control code	0 = None 1 = Open Sequence 1 (0%) 2 = Open Sequence 2 (100%) 3 = Close 4 = Vmax Sequence 1 5 = Vmax Sequence 2
Connect	Connect	Indicate that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected. It remains high until it has been cleared even thought communication is running correctly again.

Error	Error (num)	Code of the last detected error.
RelPos	Relative position	Value of the relative position of the device in range 0 to 1000 for 0.0% to 100.0%.
AbsPos	Absolute position	Value of the absolute position of the device with a resolution of 1° or 1mm. [°] for actuator with rotary movement [mm] for actuator with linear movement
RelFlow	Relative Flow	Value of the relative flow of the device in range 0 to 1000 for 0.0% to 100.0%.
AbsFlow	Absolute Flow	Value of the absolute flow of the device.
Sequence	Active sequence	Value of the active sequence: -1 = Unknown 0 = Sequence 1 (0…33% of valve position) 1 = Sequence 2 (67…100% of valve position) 2 = Dead Band (34…66% of valve position)
MF-6EPIV	Malfunction for 6-way EPIV	Binary code of the malfunction returned by the device. You can use the Belimo Malfunction EV V4 Fbox to have a bit per bit decoding of the value.
LED	LED	The LED has the same status as the error output. Error shown -> red / Error cleared -> green.

Parameters

Slave address	Modbus slave address of the device
Setpoint mode	Selection of the way Setpoint 1 and 2 are used. - Setpoint 1 = Only input Setpoint 1 is used. - Setpoint 1 invert = Only input Setpoint 1 is used but inverted. - Setpoint 1+2 = Inputs Setpoint 1 and 2 are used. - Sp 1 invert + 2 direct = Inputs Setpoint 1 and 2 are used. Setpoint 1 is inverted = valve position 50.0% to 0.0% See more details below.
Dead range	The EPIV valve has a mechanical dead range of 33% between sequence 1 and 2. With this parameter you can reduce the effective dead range to 20% or 10%. See details below.
Read configuration	Button to read all configuration parameters. You should always first read the parameters before to change and write a new configuration.
Absolute Vnom [l/h]	Absolute Vnom in l/h. This parameter is set in the device and cannot be changed.
Vmax Sequence 1 [%]	Configuration of Vmax Sequence 1 in %.
Vmax Sequence 2 [%]	Configuration of Vmax Sequence 2 in %.
Control mode	Configuration of the control made. See the Belimo documentation for more details. Before a first read, the mode cannot be displayed.
Write configuration	Button to write the configuration parameters. Always all parameters are written with the write command. You should always first read the parameters before to change and write a new configuration.
Actual setpoint	Display of the actual setpoint value sent to the valve.

	It is the computed value according to the selected dead range and the use of setpoint1 or setpoint 2.
Active sequence	Display of the active sequence reported by the valve. Same as the Sequence output, but with a clear text.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Setpoint mode

The Setpoint mode define if only 1 or both inputs Setpoint 1 and Setpoint 2 are used and if the signal is inverted.
The computed setpoint value is shown in the Fbox.

Option Setpoint 1

If only Setpoint 1 is used, the input range 0 to 1000 controls the valves from 0.0% to 100.0% (over sequences 1 and 2).

<- Valve pos 0%	Valve pos 100.0% ->
<- Setpoint1 = 0	Setpoint1 = 1000 ->

Option Setpoint 1 inverted

If only Setpoint 1 is used, and inverted the input range 0 to 1000 controls the valves over both sequences 1 and 2 but in an inverted direction.
Value 0 -> valve position 100.0%.
Value 1000 -> valve position 0.0%.

<- Valve pos 0%	Valve pos 100.0% ->
<- Setpoint1 = 1000	Setpoint1 = 0 ->

Option Setpoint 1+2

If Setpoint1 and 2 are used,
- as long as Setpoint 2 is 0, Setpoint 1 is used.
- if Setpoint 2 is bigger than 0, Setpoint 2 is used and Setpoint 1 is ignored.
- for Setpoint 1: the range 0 to 1000 controls the valves from 0.0% to 50.0% (in the sequence 1) *.
- for Setpoint 2: the range 0 to 1000 controls the valves from 50.0% to 100.0% (in the sequence 2) *.

* See also the effect of the reduced dead range option 20% or 10% below.

<- Valve pos 0%	Valve pos 50% ->	<- Valve pos 50.0%	Valve pos 100.0% ->
<- Setpoint1 = 0	Setpoint1 = 1000 ->	<- Setpoint2 = 0	Setpoint2 = 1000 ->

Option Setpoint 1 invert + Setpoint 2 direct

Setpoint1 and 2 are used, but Setpoint 1 is inverted.
- as long as Setpoint 2 is 0, Setpoint 1 is used.
- if Setpoint 2 is bigger than 0, Setpoint 2 is used and Setpoint 1 is ignored.
- for Setpoint 1: the range 0 to 1000 controls the valves from **50.0% to 0.0%** (in the sequence 1) *.
- for Setpoint 2: the range 0 to 1000 controls the valves from 50.0% to 100.0% (in the sequence 2) *.

* See also the effect of the reduced dead range option 20% or 10% below.

<- Valve pos 0%	Valve pos 50% ->	<- Valve pos 50.0%	Valve pos 100.0% ->
<- Setpoint1 = 1000	Setpoint1 = 0 ->	<- Setpoint2 = 0	Setpoint2 = 1000 ->

Dead range

The EPIV valve has a mechanical dead range of 33% between sequence 1 and 2.
Per default, the control signal from 0.0 to 100.0% controls the valve linearly over sequence 1 (0% to 33%), dead range (33% to 66%) and sequence 2 (66% to 100%). This large dead range of 33% may disturb a PI or PID controller when working inside the dead range. In the other hand, a minimum dead range is necessary to avoid a regular balancing between heating and cooling.
You may also want to keep the valve in the middle position when it is inside the dead range.

With the dead range option you can reduce the dead range to 20% or even 10% and ensure the middle position.
With option Dead range = 20%, the control signal is adapted to control the valve:
- in sequence 1 with a setpoint from 0.0% to 40.0%
- in **middle position** with a setpoint from >40.0% to <60.0% (total 20%)
- in sequence 2 with a setpoint from 60.0% to 100.0%

With option Dead range = 10%, the control signal is adapted to control the valve:
- in sequence 1 with a setpoint from 0.0% to 45.0%
- in **middle position** with a setpoint from >45.0% to <55.0% (total 10%)
- in sequence 2 with a setpoint from 55.0% to 100.0%

When working with 2 setpoints, the same adaptation is made. The 20% or 10% is applied on both setpoints (20% each or 10% each).

As a result, the valve is automatically moved to the middle position when the setpoint reaches the dead range.
This control is not realized by the Fbox if you choose the option '33% linear'. You are supposed to adapt the control signal yourself.

Example with reduced dead range 10% when using Setpoint 1 only.

Setpoint 1	Valve setpoint	Sequence
0	0%	1
200	14.8%	1
450	33.3%	1
451	50%	Dead range
500	50%	Dead range
549	50%	Dead range
550	66.7%	2
800	85.2%	2
1000	50%	2

Example with reduced dead range 20% when using Setpoint 1 + 2.

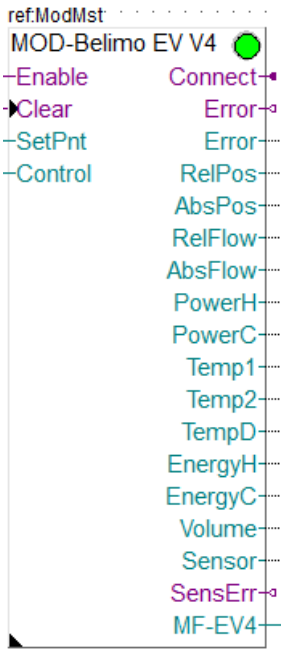
Setpoint 1	Setpoint 2	Valve setpoint	Sequence
0	0	0%	1
200	0	8.3%	1
400	0	16.6%	1
800	0	33.3%	1
801	0	50%	Dead range

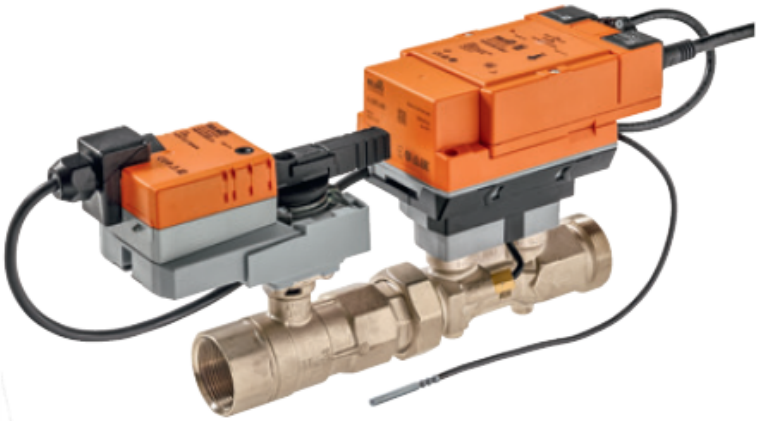
1000	0	50%	Dead range
any	1	50%	Dead range
any	199	50%	Dead range
any	200	66.7%	2
any	400	75.0%	2
any	800	91.6%	2
any	1000	100.0%	2

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Tx/Rx error	One of the Tx or Rx failed. The communication is paused for 10 sec.
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.2.7 Belimo Energy Valve V4





This specific Fbox can be used to read, control and configure the Belimo Energy Valve Version 4.
The Fbox must make reference to the Modbus driver.
Unless otherwise specified, the values are adapted to a resolution of 1/10th.
Please consult also the Belimo documentation about the Modbus communication with this device.
See also general comments about Belimo Devices

Model numbers:
EV..R2+(K)BAC (Version 4, DIN 15,,50)
EV..R2+MID (Version 4, DIN 15,,50)

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
SetPnt	Set point	Position set point in range 0 to 1000 for 0.0% to 100.0%
Control	Control code	0 = None 1 = Open 2 = Close 3 = Min 4 = Mid 5 = Max
Connect	Connect	Indicate that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.

Error	Error (bin)	Indicates that an error has been detected. It remains high until it has been cleared even thought communication is running correctly again.
Error	Error (num)	Code of the last detected error.
RelPos	Relative position	Value of the relative position of the device in range 0 to 1000 for 0.0% to 100.0%.
AbsPos	Absolute position	Value of the absolute position of the device with a resolution of 1° or 1mm. [°] for actuator with rotary movement [mm] for actuator with linear movement
RelFlow	Relative Flow	Value of the relative flow of the device in range 0 to 1000 for 0.0% to 100.0%.
AbsFlow	Absolute Flow	Value of the absolute flow of the device.
PowerH	Heating power	Value of the actual heating power.
PowerC	Cooling power	Value of the actual cooling power.
Temp1	Temperature 1	Value of the temperature measured by the temperature sensor 1.
Temp2	Temperature 2	Value of the temperature measured by the temperature sensor 2.
TempD	Temperature difference	Value of the temperature difference between sensor 1 and 2.
EnergyH	Heating energy	Value of heating energy counter.
EnergyC	Cooling energy	Value of cooling energy counter.
Volume	Volume	Value of volume counter.
Sensor	Sensor value	Measured value of the additional sensor depending on the configured sensor type.
SensErr	Sensor error	Indicates that an error has been detected with the sensor.
MF-EV4	Malfunction	Binary code of the malfunction returned by the device. You can use the Belimo Malfunction EV4 Fbox to have a bit per bit decoding of the value.
LED	LED	The LED has the same status as the error output. Error shown -> red / Error cleared -> green.

Parameters

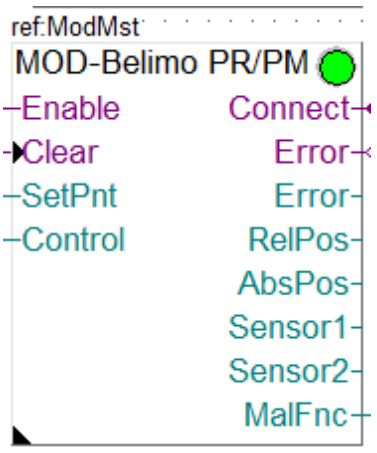
Slave address	Modbus slave address of the device
Read configuration	Button to read all configuration parameters. You should always first read the parameters before to change and write a new configuration.
Min flow limit [%]	Configuration of the minimum flow in %.
Max flow limit [%]	Configuration of the maximum flow in %.
Max power limit [%]	Configuration of the maximum power in %.
Setpoint Delta T [K]	Configuration of the 'Setpoint Delta T' in K
Setpoint flow at Delta T [l/sec]	Configuration of the 'Flow at Delta T' in l/sec
Control mode	Configuration of the 'Control mode'. See the Belimo documentation for more details.

Delta T limitation	Configuration of the 'Delta T limitation'. See the Belimo documentation for more details.
Sensor type	Selection of the sensor type to be supported.
Passive sensor type	Additional selection for passive sensor types.
Write configuration	Button to write the configuration parameters. Always all parameters are written with the write command.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Tx/Rx error	One of the Tx or Rx failed. The communication is paused for 10 sec.
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.2.8 Belimo PR/PM



This specific Fbox can be used to read, control and configure the Belimo PR/PM devices (Butterfly Valve Actuator).

The Fbox must make reference to the Modbus driver.
Unless otherwise specified, the values are adapted to a resolution of 1/10th.
Please consult also the Belimo documentation about the Modbus communication with this device.
See also general comments about Belimo Devices

Actor types:
PR..-BAC-,,
PM..-BAC-,,

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
SetPnt	Set point	Position set point in range 0 to 1000 for 0.0% to 100.0%
Control	Control code	0 = None 1 = Open 2 = Close 3 = Min 4 = Mid 5 = Max
Connect	Connect	Indicate that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected. It remains high until it has been cleared even thought communication is running correctly again.
Error	Error (num)	Code of the last detected error.
RelPos	Relative position	Value of the relative position of the device in range 0 to 1000 for 0.0% to 100.0%.
AbsPos	Absolute position	Value of the absolute position of the device with a resolution of 1° or 1mm. [°] for actuator with rotary movement [mm] for actuator with linear movement
Sensor1	Sensor 1 value	Measured value of the additional sensor 1 depending on the configured sensor type.
Sensor2	Sensor 2 value	Measured value of the additional sensor 2 depending on the configured sensor type.
MalFnc	Malfunction	Binary code of the malfunction returned by the device. You can use the Belimo Malfunction Fbox to have a bit per bit decoding of the value.
LED	LED	The LED has the same status as the error output. Error shown -> red / Error cleared -> green.

Parameters

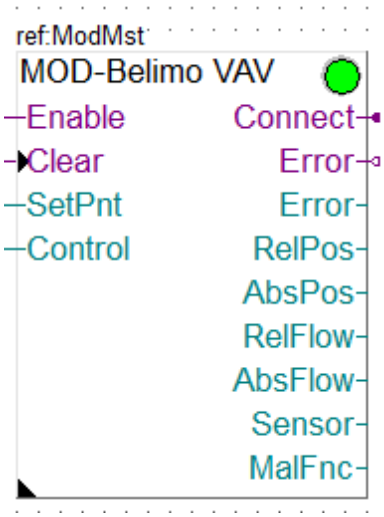
Slave address	Modbus slave address of the device
Read configuration	Button to read all configuration parameters. You should always first read the parameters before to change and write a new configuration.
Min Setpoint [%]	Configuration of the minimum setpoint in %.

Max Setpoint [%]	Configuration of the maximum setpoint in %.
Sensor type	Selection of the sensor type to be supported.
Write configuration	Button to write the configuration parameters. Always all parameters are written with the write command.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Tx/Rx error	One of the Tx or Rx failed. The communication is paused for 10 sec.
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.2.9 Belimo VAV



This specific Fbox can be used to read, control and configure the Belimo VAV devices.
The Fbox must make reference to the Modbus driver.
Unless otherwise specified, the values are adapted to a resolution of 1/10th.
Please consult also the Belimo documentation about the Modbus communication with this device.
See also general comments about Belimo Devices

Actor types VAV-Compact:
LMV-D3-MOD
NMV-D3-MOD
LHV24A-D3-MOD

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
SetPnt	Set point	Position set point in range 0 to 1000 for 0.0% to 100.0%
Control	Control code	0 = None 1 = Open 2 = Close 3 = Min 4 = Mid 5 = Max
Connect	Connect	Indicate that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected. It remains high until it has been cleared even thought communication is running correctly again.
Error	Error (num)	Code of the last detected error.
RelPos	Relative position	Value of the relative position of the device in range 0 to 1000 for 0.0% to 100.0%.
AbsPos	Absolute position	Value of the absolute position of the device with 1/10 resolution.
RelFlow	Relative flow	Value of the relative flow of the device in range 0 to 1000 for 0.0% to 100.0%.
AbsFlow	Absolute flow	Value of the absolute flow of the device with 1/10 resolution.
Sensor	Sensor value	Measured value of the additional sensor depending on the configured sensor type.
MalFnc	Malfunction	Binary code of the malfunction returned by the device. You can use the Belimo Malfunction Fbox to have a bit per bit decoding of the value.
LED	LED	The LED has the same status as the error output. Error shown -> red / Error cleared -> green.

Parameters

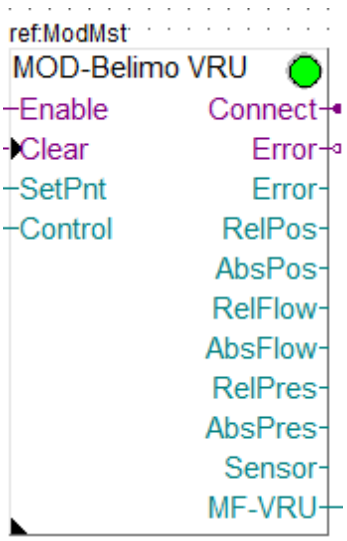
Slave address	Modbus slave address of the device
Read configuration	Button to read all configuration parameters. You should always first read the parameters before to change and write a new configuration.
Min Setpoint [%]	Configuration of the minimum setpoint in %.
Max Setpoint [%]	Configuration of the maximum setpoint in %.
Sensor type	Selection of the sensor type to be supported.

Write configuration	Button to write the configuration parameters. Always all parameters are written with the write command.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Tx/Rx error	One of the Tx or Rx failed. The communication is paused for 10 sec.
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.2.10 Belimo VRU



This specific Fbox can be used to read, control and configure the Belimo VRU devices.
The Fbox must make reference to the Modbus driver.
Unless otherwise specified, the values are adapted to a resolution of 1/10th.
Please consult also the Belimo documentation about the Modbus communication with this device.
See also general comments about Belimo Devices

Actor types VRU

VAV-Universal
VRU-D3-BAC
VRU-M1-BAC
VRU-M1R-BAC

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
SetPnt	Set point	Position set point in range 0 to 1000 for 0.0% to 100.0%
Control	Control code	0 = None 1 = Open 2 = Close 3 = Min 4 = - 5 = Max 6 = - 7 = - 8 = Motor stop
Connect	Connect	Indicate that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected. It remains high until it has been cleared even thought communication is running correctly again.
Error	Error (num)	Code of the last detected error.
RelPos	Relative position	Value of the relative position of the device in range 0 to 1000 for 0.0% to 100.0%.
AbsPos	Absolute position	Value of the absolute position of the device with 1/10 resolution.
RelFlow	Relative flow	Value of the relative flow of the device in range 0 to 1000 for 0.0% to 100.0%.
AbsFlow	Absolute flow	Value of the absolute flow of the device with 1/10 resolution.
RelPres	Relative pressure	Value of the relative pressure of the device in range 0 to 1000 for 0.0% to 100.0%.
AbsPres	Absolute pressure	Value of the absolute pressure of the device with 1/10 resolution.
Sensor	Sensor value	Measured value of the additional sensor depending on the configured sensor type.
MF-VRU	Malfunction	Binary code of the malfunction returned by the device. You can use the Belimo Malfunction VRU Fbox to have a bit per bit decoding of the value.
LED	LED	The LED has the same status as the error output. Error shown -> red / Error cleared -> green.

Parameters

Slave address	Modbus slave address of the device

Read configuration	Button to read all configuration parameters. You should always first read the parameters before to change and write a new configuration.
Min Setpoint [%]	Configuration of the minimum setpoint in %.
Max Setpoint [%]	Configuration of the maximum setpoint in %.
Sensor type	Selection of the sensor type to be supported.
Write configuration	Button to write the configuration parameters. Always all parameters are written with the write command.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Tx/Rx error	One of the Tx or Rx failed. The communication is paused for 10 sec.
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.2.11 Belimo Malfunction

This generic Fbox can be used to decode the malfunction numeric output of several device types. The MalFnc output of the Belimo device Fbox must be connected to the MalFnc input of this Fbox. Please consult also the Belimo documentation for more details about malfunctions and service information.
See also general comments about Belimo Devices

This Fbox can be used with the following device Fbox:
- Belimo Air/Water
- Belimo VAV
- Belimo PR/PM

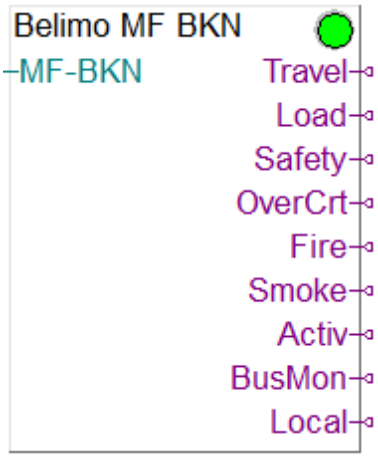
- Belimo CQ Rotary Actuator

Note that not all bits are used by each device type.
The LED is red if at least one of the bit is set.

Outputs

Label	Bit no	Belimo name	Belimo description
Mech	1	Mech travel increased	The actuator has been moved outside the adapted working range
Move	2	Actuator cannot move	Mechanical overload e.g. blocked actuator, etc.
Activity	8	Internal activity	Actuator performs a test run, adaption, etc.
Gear	9	Gear disengaged	The gear disengaged button is pressed
BusWD	10	Bus Watchdog triggered	Timeout for the Bus Watchdog expired

5.2.12 Belimo Malfunction BKN230-24



This Fbox can be used to decode the malfunction numeric output of the BKN230-24 device.
The MF-BKN output of the Belimo BKN230-24 Fbox must be connected to the MF-BKN input of this Fbox.
Please consult also the Belimo documentation for more details about malfunctions and service information.
See also general comments about Belimo Devices

The LED is red if at least one of the bit is set.

Outputs english description

Label	Bit no	Belimo name	Belimo description
Travel	1	Actuation path increased	– End position not reached within time – Actuator leaves end position (e.g. open) with no reason

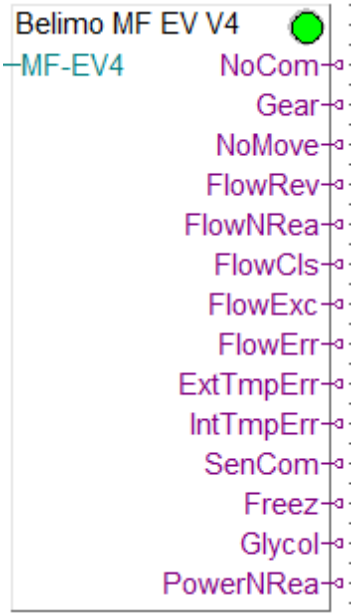
			– Actuator / end switches not connected As consequence actuator runs into safety position Close – BAE / BAT on actuator triggered with FW V1.x
Load	2	Mechanical overload	Same as bit 1
Safety	4	Safety-relevant malfunction	Internal device error – Contact Belimo
OverCrt	5	Actuator too much current	– Actuator broken – Short circuit Only with FW 2.x
Fire	6	BAT triggered	– Local connected BAE / BAT triggered. With FW 1.x – Temperature sensor (BAT) on actuator triggered. With FW 2.x – Actuator / end switches not connected. With FW 2.x
Smoke	7	Smoke detector triggered	Local connected smoke detector triggered
Activ	8	Internal activity	Shows if there is a Test run via BACnet / Modbus active
BusMon	10	Bus monitoring triggered	Bus time is up without receiving a command within the set Watchdog time
Local	11	Local override control active	Local control active Bridge connected between terminal 1 and 4

Outputs german description

Label	Bit no	Belimo name	Belimo description
Travel	1	Stellweg vergrössert	– Endposition wurde innerhalb der Zeitlimite nicht erreicht – Antrieb verlässt ohne ersichtlichen Grund die Endposition (z.B. «Open») – Endschalter sind nicht angeschlossen Der Antrieb geht in der Folge in die Sicherheitsposition «Close». – Temperatur Sensor (BAT) ausgelöst mit FW V1.x
Load	2	Mechanische Überlast	Wie bit 1
Security	4	Sicherheitsrelevante Störung	Interner Gerätefehler – Belimo kontaktieren
OverCrt	5	Stromaufnahme des Antriebs zu hoch	– Antrieb defekt – Kurzschluss Nur mit FW 2.x
Fire	6	BAT ausgelöst	– Lokal angeschlossenes BAE / BAT ausgelöst. Mit FW 1.x. – Temperatur Sensor (BAT) des Antriebs ausgelöst. Mit FW 2.x. – Antrieb / Endschalter sind nicht angeschlossen. Mit FW 2.x.
Smoke	7	Rauchmelder ausgelöst	Lokal angeschlossener Rauchmelder ausgelöst

Activ	8	Interne Aktivität	Interner Test aktiv, aktiviert über BACnet / Modbus
Superv	10	Busüberwachung ausgelöst	Es wurden innerhalb des Timer-Werts der Busüberwachung keine Befehle auf dem überwachten Register festgestellt.
Local	11	Lokale Zwangssteuerung aktiv	Lokale Zwangssteuerung aktiviert. Brücke zwischen Anschlussklemme 1 und 4.

5.2.13 Belimo Malfunction EV V4



This Fbox can be used to decode the malfunction numeric output of the Energy Valve V4.
The MF-EV4 output of the Energy Valve V4 Fbox must be connected to the MF-EV4 input of this Fbox.
Please consult also the Belimo documentation for more details about malfunctions and service information.
See also general comments about Belimo Devices

The LED is red if at least one of the bit is set.

Outputs

Label	Bit no	Belimo name	Belimo description
NoCom	0	No communication to actuator	Communication with actuator not possible.
Gear	1	Gear disengaged	Gear disengaged button is pressed.
NoMove	2	Actuator cannot move	Mechanical overload due to blocked valve, etc. (only available for EV..R+KBAC)
FlowRev	3	Reverse flow	Reverse flow is detected.
FlowNRea	4	Flow setpoint not reached	Setpoint cannot be reached within 15 min during flow control.

FlowCls	5	Flow with closed valve	Flow with closed valve detected.
FlowExc	6	Actual flow exceeds nominal flow	Actual flow exceeds the designed nominal flow.
FlowErr	7	Flow measurement error	Air in the system, error occurred during flow measurement.
ExtTmpErr	8	External temperature error	No connection to the external temperature sensor.
IntTmpErr	9	Integrated temperature error	Error with embedded temperature sensor.
SenCom	10	Communication to sensor interrupted	Internal communication to flow sensor interrupted.
Freez	11	Freeze warning	Measured temperature & glycol concentration indicate that grease ice can build up.
Glycol	12	Glycol detected	Glycol was detected in a MID application.
PowerNRea	13	Power setpoint not reached	Setpoint cannot be reached within 15 min during power control.

5.2.14 Belimo Malfunction VRU

This Fbox can be used to decode the malfunction numeric output of the VRU devices.
The MF-VRU output of the VRU device Fbox must be connected to the MF-VRU input of this Fbox.
Please consult also the Belimo documentation for more details about malfunctions and service information.
See also general comments about Belimo Devices

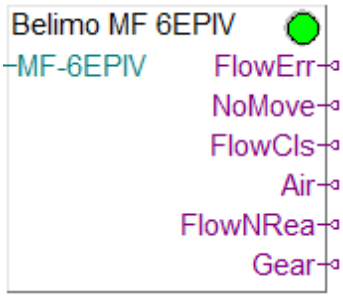
The LED is red if at least one of the bit is set.

Outputs

Label	Bit no	Belimo name	Belimo description

SenErr	4	Error dP Sensor	
Reverse	5	Reverse Airflow detected	
AirFlow	6	Airflow not reached	
Flow	7	Flow in closed position	
Activity	8	Internal activity	Internal activity (Adaptation, Synchronization in progress)
Gear	9	Gear disengaged	The gear disengaged button is pressed
BusWD	10	Bus Watchdog triggered	Timeout for the Bus Watchdog expired
Applicati on	11	Actuator doesn't fit to application	
SenCon	12	Pressure Sensor wrong connected	
Reached	13	Pressure Sensor not reached	
SenOut	14	Error dP Sensor out of Range	

5.2.15 Belimo Malfunction 6-way EPIV



This Fbox can be used to decode the malfunction numeric output of the 6-way EPIV devices.
The MF-6EPIV output of the 6-way EPIV device Fbox must be connected to the MF-6EPIV input of this Fbox.
Please consult also the Belimo documentation for more details about malfunctions and service information.
See also general comments about Belimo Devices

The LED is red if at least one of the bit is set.

Outputs

Label	Bit no	Belimo name	Belimo description
FlowErr	2	Error flow sensor	Error with the flow sensor
NoMove	3	Actuator cannot move	Mechanical overload due to blocked valve, etc.

FlowCls	4	Flow with closed valve	Flow is measured but position of valve is closed (Dead Band)
Airbubbles	5	Airbubbles	Airbubbles in the hydronic system. As long as there are airbubbles in the system, position control mode is active, regardless of control mode setting
FlowNRea	6	Flow not reached	Setpoint cannot be reached within 3min during flow control
Gear	9	Gear disengaged	The gear disengaged button is pressed

5.3 GFAE / KN3 Kopplernetz

Under this topic, you will find compact Fboxes created to support specific GFAE devices with the KN3 Kopplernetz communication protocol which is compatible with Modbus.
You need a particular license which allows the use of these specific Fboxes.

Note that you get the best performances of GFAE Devices only by using the KN2 Protocol which cannot be combined with other Modbus devices.
This is specially important to reach short reaction time when Push buttons are used.
A library for Saia-PCD also exist for the KN2 Protocol. Please contact Engiby.

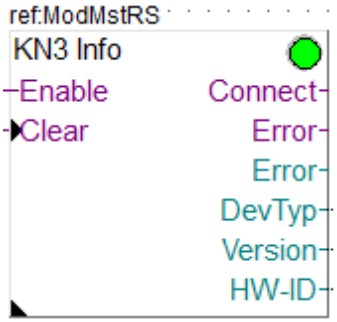
The Fboxes of this library support only KN3 and can be combined with other Modbus devices.
The only particularity is that the **station addresses 245, 246 and 247** are reserved for KN1, KN2 and KN3 devices. All addresses from 1 to 244 are free for other devices.
You don't have to care about this address in the Fboxes. You only need to specify the Module ID.

Use the standard Driver Fbox before to use the GFEA / KN3 Fboxes.
The KN3 Fboxes already include the connection mechanism of the Station Fbox.
Therefore, the KN3 Fboxes must directly make reference to the Modbus Driver Fbox.

The Fboxes are made for a use over serial lines RS485 because KN3 devices support only Modbus RTU (over RS485).
You can however, connect your device over a Modbus TCP to Modbus RTU gateway and use a Modbus IP driver on the PCD.

Beside the Device specific Fboxes, you can use the Generic KN3 Module Info Fbox to get general info about each device.
You can place this Fbox once in a Fupla program and change the connection in runtime to check the info of all your KN3 devices.

5.3.1 KN3 / Modul Info



This generic Fbox can be used with any GFAE module to read the device type, the version and hardware ID.
The Fbox must make reference to the Modbus driver.
Please consult also the GFAE / KN3 documentation about the KN3 Modbus communication with this device.
See also general comments about GFAE / KN3 Kopplernetz.

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error code and the error outputs
Error	Error	Indicates that an error has been detected. A more detailed code is shown in the Fbox.
DevTyp	Device Type	Code of the device type. You can see the device type in readable text in the Fbox.
Version	Version	Version (SW version) of the device
HW-ID	Hardware ID	Hardware ID
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly executed.

Parameters

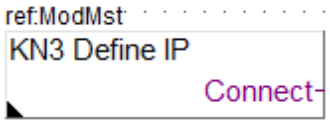
IP address	IP Address if the Gateway.
Module ID	Module ID.
Read interval	Time interval to regularly read the module info. The reading is executed as long as the Enable input is high. Since these values are constants in the device it is not worth to read them too fast.
Read device info	Button to manually execute a readout.
Device type	Device Type in readable text.
Version [hex]	Device version shown in hex format.
Module ID	Module ID returned by the module. It should match the specified Module ID above.
Hardware ID [hex]	Hardware ID.
Error	Display of the last detected error. See list below.

	Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.

5.3.2 KN3 / Define IP Connection



This generic Fbox can be used with any GFAE / KN3 Fbox to define an IP connection.
The Fbox must make reference to the Modbus IP Driver.
The Belimo Fboxes placed after this Fbox will automatically use the defined IP address.
IP Connection can be used when an Modbus/TCP to Modbsu/RTU converter is used.
Several modules will use the same IP Address with different Module ID.
See also general comments about GFAE / KN3 Kopplernetz

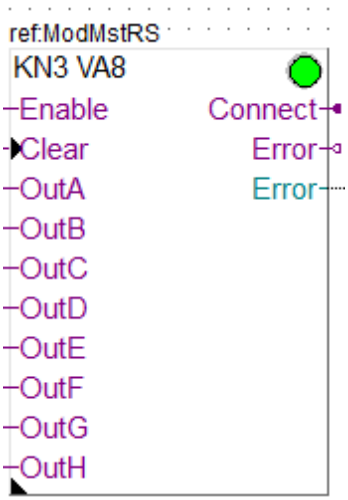
Input / Output

Connect	Connect	Shows that the referenced driver is currently connected with specified IP address.

Parameters

IP address	IP Address to be used for all KN3 Fboxes placed after this one.

5.3.3 KN3 / 8-Aktoren VA8



This specific Fbox can be used to read, control and configure the GFAE KN3 / 8-Aktoren VA8 Module.
The Fbox must make reference to the Modbus driver.

Please consult also the GFEA / KN3 documentation about the KN3 Modbus communication with this device.
See also general comments about GFAE / KN3 Kopplernetz.

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
OutA..H	Output A..H	status for the outputs A to H
Connect	Connect	Indicate that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected. It remains high until it has been cleared even thought communication is running correctly again.
Error	Error (num)	Code of the last detected error.
LED	LED	The LED has the same status as the error output. Error shown -> red / Error cleared -> green.

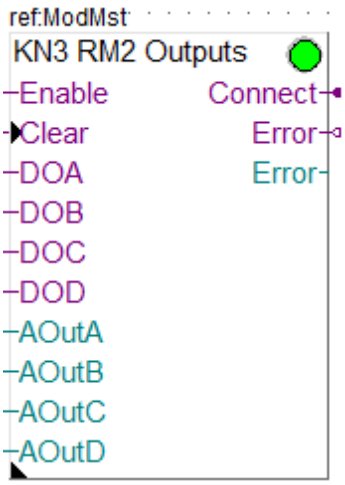
Parameters

IP address	IP address in case of connection over a Modbus TCP to Modbus RTU gateway.
Module ID	Module ID
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Tx/Rx error	One of the Tx or Rx failed. The communication is paused for 10 sec.
50	Internal Fbox error	Fbox sequence error.
other		Other internal errors

5.3.4 KN3 / Raummodul RM2 Outputs



This specific Fbox can be used to control the outputs of the KN3 / Raummodul RM2.
The Fbox must make reference to the Modbus driver.
Please consult also the GFAE / KN3 documentation about the Modbus communication with this device.
See also general comments about GFAE / KN3 Kopplernetz.

Use the Fbox KN3 / Raummodul RM2 Inputs Analog or KN3 / Raummodul RM2 Inputs Binary (or both) to read the inputs of the RM2 Module.

Optionally, you can also use the Fbox KN3 / Raummodul RM2 Configuration to check the configuration (DIL switch) of the Module.

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
DOA..D	Output DOA..D	Status for the digital outputs DOA to DOD
AOutA..D	Output AOutA..D	Values in mV for the analog outputs AOutA to AOutD
Connect	Connect	Indicate that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected. It remains high until it has been cleared even thought communication is running correctly again.
Error	Error (num)	Code of the last detected error.
LED	LED	The LED has the same status as the error output. Error shown -> red / Error cleared -> green.

Parameters

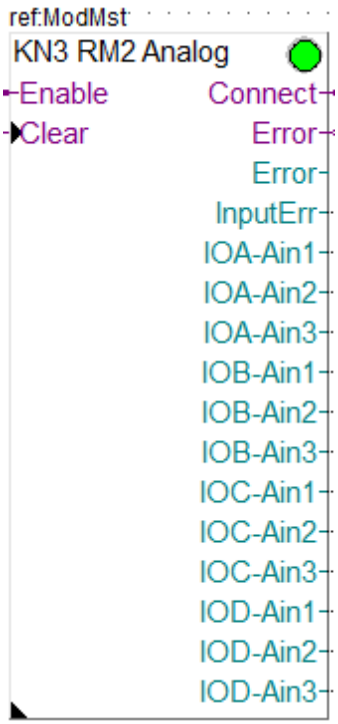
IP address	IP address in case of connection over a Modbus TCP to Modbus RTU gateway.
Modul ID	Modul ID

Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Tx/Rx error	One of the Tx or Rx failed. The communication is paused for 10 sec.
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.3.5 KN3 / Raummodul RM2 Inputs Analog



This specific Fbox can be used to read the analog inputs of the KN3 / Raummodul RM2.
The Fbox must make reference to the Modbus driver.
Please consult also the GFAE / KN3 documentation about the Modbus communication with this device.
See also general comments about GFAE / KN3 Kopplernetz.

The RM2 module allows all inputs to be used as binary inputs with a signal 0 / 24V.
You can use the Fbox KN3 / Raummodul RM2 Inputs Binary to read the binary status of the inputs.

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
Connect	Connect	Indicate that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected. It remains high until it has been cleared even thought communication is running correctly again.
Error	Error (num)	Code of the last detected error.
InputErr	Input error	A value #0 indicates an error at one of the inputs. For instance over-voltage protection activated.
IOA-Ain1... IOD-Ain3	IOA-Ain1...IOD-Ain3	Value (0-10V in mV) of the analog inputs IOA-Ain1 to IOD-Ain3.
LED	LED	The LED has the same status as the error output. Error shown -> red / Error cleared -> green.

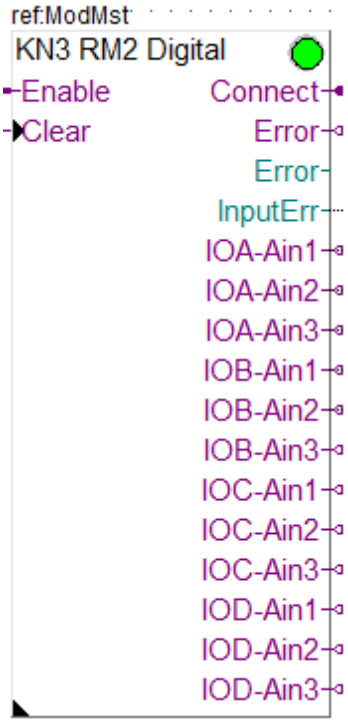
Parameters

IP address	IP address in case of connection over a Modbus TCP to Modbus RTU gateway.
Modul ID	Modul ID
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Tx/Rx error	One of the Tx or Rx failed. The communication is paused for 10 sec.
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.3.6 KN3 / Raummodul RM2 Inputs Digital



This specific Fbox can be used to read the status of inputs of the KN3 / Raummodul RM2 when used as Digital inputs (0-24V).
The Fbox must make reference to the Modbus driver.
Please consult also the GFAE / KN3 documentation about the Modbus communication with this device.
See also general comments about GFAE / KN3 Kopplernetz.

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
Connect	Connect	Indicate that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected. It remains high until it has been cleared even thought communication is running correctly again.
Error	Error (num)	Code of the last detected error.
InputErr	Input error	A value #0 indicates an error at one of the inputs. For instance over-voltage protection activated.
IOA-Ain1... IOD-Ain3	IOA-Ain1...IOD-Ain3	Status of the inputs IOA-Ain1 to IOD-Ain3 when used as Digital inputs.
LED	LED	The LED has the same status as the error output. Error shown -> red / Error cleared -> green.

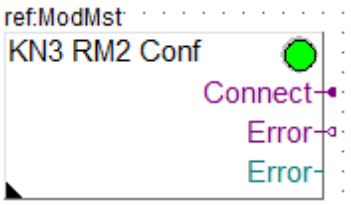
Parameters

IP address	IP address in case of connection over a Modbus TCP to Modbus RTU gateway.
Modul ID	Modul ID
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Tx/Rx error	One of the Tx or Rx failed. The communication is paused for 10 sec.
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.3.7 KN3 / Raummodul RM2 Configuration



This specific Fbox can be used to read the configuration of KN3 / Raummodul RM2.
You can only read the actual configuration. Changes can only be made by mean of the DIL-Switches in the module.
The Fbox must make reference to the Modbus driver.
Please consult also the GFAE / KN3 documentation about the Modbus communication with this device and possible configurations.
See also general comments about GFAE / KN3 Kopplernetz.

Input / Output / LED

Connect	Connect	Indicate that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected. It remains high until it has been cleared even thought communication is running correctly again.

Error	Error (num)	Code of the last detected error.
LED	LED	The LED has the same status as the error output. Error shown -> red / Error cleared -> green.

Parameters

Modul ID	Modul ID
Read configuration	Button to read the device configuration.
Device type	Show the device type returned by the device.
-----[Digital Output A..D]-----	
Ausgangstype	See GFAE manual for more details
Ausgangsmodus	See GFAE manual for more details
Forciert/Auschaltung	See GFAE manual for more details
Ansteuerung nach Timeout	See GFAE manual for more details
Umschalzeit	See GFAE manual for more details
Kanalpaar	See GFAE manual for more details
----- ----- ----- -----	
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

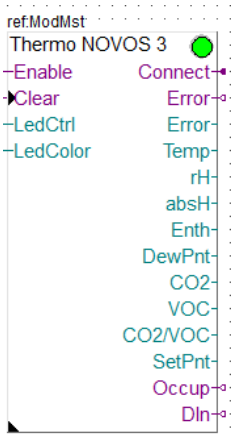
0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Tx/Rx error	One of the Tx or Rx failed. The communication is paused for 10 sec.
30	Driver disabled	Shown if you click read or change the Module ID while the driver is disabled.
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.4 Thermokon

Under this topic, you will find compact Fboxes created to support specific Thermokon devices.
You need a particular license which allows the use of these specific Fboxes.

Use the standard Driver Fbox before to use the Thermokon Fboxes.
The Thermokon Fboxes already include the connection mechanism of the Station Fbox.
Therefore, the Thermokon Fboxes must directly make reference to the Modbus Driver Fbox.

5.4.1 NOVOS 3 PTD



This specific Fbox can be used to read, control and configure the Thermokon devices NOVOS 3 PTD.
The Fbox must make reference to the Modbus driver.
Some values are only valid if the measurement is supported by the device.
The returned values from the device have different resolutions. You can chose to convert all returned to a resolution of 1/10.
Please consult also the Thermokon documentation about the Modbus communication with this device.

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
LEDCtrl	LED Control	LED Control code: 0 = LED Inactive 1 = LED Active 2 = LED shows occupancy status
LedColor	LED Color	You can control the LED color with the following code: 1 = White 2 = Black / LED Off 3 = Red 4 = Green 5 = Blue 6 = Yellow 7 = Magenta 8 = Turquoise
Connect	Connect	Indicate that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected.

Error	Error (num)	Code of the last detected error.
Temp	Temperature	Value of the temperature measurement [°C].
rH	Relative humidity	Value of the relative humidity measurement [%]
absH	Absolute humidity	Value of the absolute humidity measurement [g/m^3]. Default resolution 00.1 g/m^3
Enth	Enthalpie	Value of the enthalpie measurement [kJ/kg]
DewPnt	Dew point	Value of the dew point measurement [°C]
CO2	CO2	Value of the CO2 measurement [ppm]. Default resolution 1.0 ppm
VOC	VOC	Value of the VO2 measurement [%]
CO2/VOC	CO2/VOC	Value of the CO2/VOC measurement [%]
SetPnt	Set point	Value of actual setpoint [°C]
Occup	Occupancy	Occupancy status
DIn	Digital input	Sow the state of the digital input
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly executed.

Parameters

IP address	IP address of the device. Useful if the device is connected over a Modbus-TCP to Modbus-RTU converter. If the device is connected over RS485, this value is ignored.
Slave address	Modbus slave address of the device.
Output resolution	Default = values are output with the resolution of the NOVOS device. All 1/10 = All values are adapted to a resolution of 1/10.
Read configuration	Button to read all configuration parameters. You should always first read the parameters before to change and write a new configuration.
Default occupancy	Default state of the occupancy at power up of the device.
Setpoint display	Chose if the absolute or the relative setpoint is displayed.
Setpoint basis	Basis reference for setpoint.
Setpoint range	Range +/- for the setpoint adjustment.
Setpoint steps	Value of a step for the setpoint adjustment.
LED Control	This parameter has been removed in the actual version. The LED control is made over the Fbox input. Chose if the LED is activated or not, or controlled by the occupancy status.
Write configuration	Button to write the configuration parameters. Always all parameters are written with the write command.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error

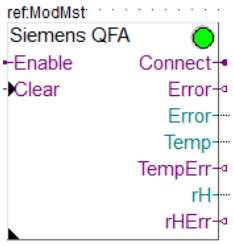
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Internal sequence error 20	Tx/Rx error
30	Driver disabled	Shown if you click Read or Write while the driver is disabled.
31	Exception message	An exception message has been returned to the request. It has been noticed that connected to a iSMA Gateway, some requests can be answered with an exception message generated by the gateway.
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.5 Siemens

Under this topic, you will find compact Fboxes created to support specific Siemens devices.
You need a particular license which allows the use of these specific Fboxes.

Use the standard Driver Fbox before to use the Siemens Fboxes.
The Siemens Fboxes already include the connection mechanism of the Station Fbox.
Therefore, the Siemens Fboxes must directly make reference to the Modbus Driver Fbox.

5.5.1 Siemens QFA2050/MO



This specific Fbox can be used to read, control and configure the Siemens device QFA2050/MO.

The Fbox must make reference to the Modbus driver.
The returned values from the device have different resolutions. You can chose to convert all returned values to a resolution of 1/10.
Please consult also the Siemens QFA2050/MO documentation about the Modbus communication with this device.

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
Connect	Connect	Indicate that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected.
Error	Error (num)	Code of the last detected error.
Temp	Temperature	Value of the temperature measurement [°C].
TempErr	Temperature error	Error on the temperature sensor
rH	Relative humidity	Value of the relative humidity measurement [%]
rHErr	Relative humidity error	Error on the humidity sensor
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly executed.

Parameters

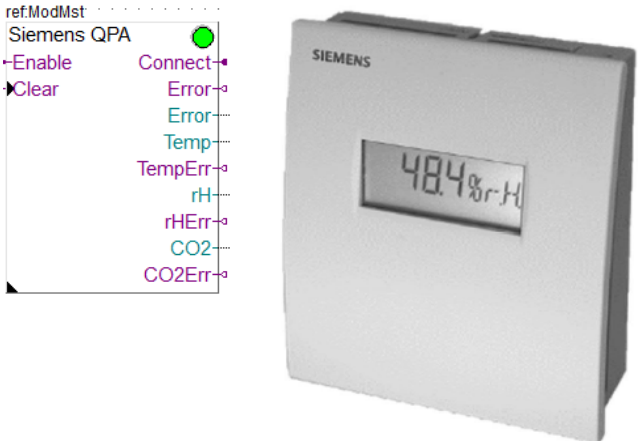
IP address	IP address of the device. Useful if the device is connected over a Modbus-TCP to Modbus-RTU converter. If the device is connected over RS485, this value is ignored.
Slave address	Modbus slave address of the device.
Output resolution	Default = values are output with the resolution of the device. All 1/10 = All values are adapted to a resolution of 1/10.
Read configuration	Button to read all configuration parameters. You should always first read the parameters before to change and write a new configuration.
System units	Select the unit of the device - °Celsius - Fahrenhait
Temperature offset	Offset for the temperature sensor in range -100.0..+100.0 °
Relativ humidity offset	Offset for the relative humidity sensor in range -10.0..+10.0 %
Write configuration	Button to write the configuration parameters. Always all parameters are written with the write command.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.

2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Internal sequence error 20	Tx/Rx error
30	Driver disabled	Shown if you click Read or Write while the driver is disabled.
31	Exception message	An exception message has been returned to the request. It has been noticed that connected to a iSMA Gateway, some requests can be answered with an exception message generated by the gateway.
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.5.2 Siemens QPA2052/MO



This specific Fbox can be used to read, control and configure the Siemens device QPA2052/MO.
The Fbox must make reference to the Modbus driver.
The returned values from the device have different resolutions. You can chose to convert all returned values to a resolution of 1/10.
Please consult also the Siemens QPA2052/MO documentation about the Modbus communication with this device.

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
Connect	Connect	Indicate that the device is connected and communication works.Initialized to 1 at start up. Status is updated if

		Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected.
Error	Error (num)	Code of the last detected error.
Temp	Temperature	Value of the temperature measurement [°C].
TempErr	Temperature error	Error on the temperature sensor
rH	Relative humidity	Value of the relative humidity measurement [%]
rHErr	Relative humidity error	Error on the humidity sensor
CO2	CO2	Value of the CO2 measurement [ppm]. Default resolution 1.0 ppm
CO2Err	CO2 Error	Error on the CO2 sensor
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly executed.

Parameters

IP address	IP address of the device. Useful if the device is connected over a Modbus-TCP to Modbus-RTU converter. If the device is connected over RS485, this value is ignored.
Slave address	Modbus slave address of the device.
Output resolution	Default = values are output with the resolution of the device. All 1/10 = All values are adapted to a resolution of 1/10.
Read configuration	Button to read all configuration parameters. You should always first read the parameters before to change and write a new configuration.
System units	Select the unit of the device - °Celsius - Fahrenhait
Temperature offset	Offset for the temperature sensor in range -100.0..+100.0 °
Relativ humidity offset	Offset for the relative humidity sensor in range -10.0..+10.0 %
CO2 offset	Offset for the CO2 sensor in range -2000..+2000 ppm
Write configuration	Button to write the configuration parameters. Always all parameters are written with the write command.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error

10	Internal sequence error 10	DB reading error
20	Internal sequence error 20	Tx/Rx error
30	Driver disabled	Shown if you click Read or Write while the driver is disabled.
31	Exception message	An exception message has been returned to the request. It has been noticed that connected to a iSMA Gateway, some requests can be answered with an exception message generated by the gateway.
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.6 iSMA RIOs

Under this topic, you will find compact Fboxes created to support specific iSMA devices.
You need a particular license which allows the use of these specific Fboxes.

The Fboxes are made for a use over serial lines RS485 with Modbus RTU or Ethernet with Modbus TCP.

Use the standard Driver Fbox, Link RS or Link IP to use the iSMA Fboxes. The iSMA Fboxes already include the connection mechanism of the Station Fbox.
Therefore, the iSMA Fboxes must directly make reference to the Modbus Driver Fbox. You don't need to place a station Fbox in between.

Beside the Device specific Fboxes, you can use the Generic Fbox to get general info about each device. You can place this Fbox once in a Fupla program and change the connection in runtime to check the info of all your iSMA devices.

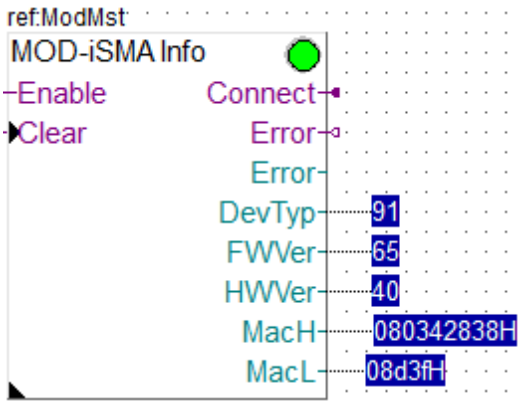
You can also place one Fbox to configure Universal inputs, Analog outputs and Digital outputs. You can change the IP address and station address in runtime and configure all your devices.

Remarks for the iSMA Modbus TCP - RTU Gateway.
To make the necessary settings of the Gateway, open the cover of the module.
The IP settings are made with the iSMA configuration tool over the USB connector placed under the cover.
The settings of the serial line, the station address and protocol selection are made by the DIP switches under the cover.
The termination resistors should be activated at least at one end of the bus. You can activate this termination over the Configuration tool.

Ensure that the parameter **'RS485 Timeout'** (Default 1000 ms -> set it to 500) of the gateway is shorter than the timeout in the Driver Fbox (Default 1.0 sec).

The option **'Send Modbus Error'** will cause the module to send back an error message (as response to the TCP request) each time a Modbus request is not answered within the selected timeout (the timeout in the iSMA module!). This will result by a Modbus error **'31 = Message Slv - 11 GW target failed'** shown in the Modbus Driver Fbox. Also the concerned device Fbox shows an error.
If you disable this option. the request will be repeated up to the specified repetitions number in the Driver Fbox. No error is issued unless all repetitions are used (e.g. if the device is not on the bus). The disadvantage is that the repetitive timeout cause a dead time and extend the global communication cycle.

5.6.1 iSMA Device Info



This generic Fbox can be used with any iSMA device to read the device type, hardware + firmware version and the MAC address.
The Fbox must make reference to the Modbus driver.
Please consult also the iSMA documentation about the Modbus communication with these devices.
See also general comments and **important remarks** about iSMA RIOs.

Since the read values are constants in the device it is not worth to read them too fast.
You can also use the Fbox to read the info of different devices by changing the address over the adjust window. In this case, the info and the Connect state are cleared with each change of the IP or station address.
Note that the MAC address has 6 bytes in hex format and is shown on 2 Register (higher 4 bytes - lower 2 bytes).

Unfortunately, the serial number is not available over Modbus.

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error code and the error outputs
Connect	Connect	Indicates that the device is connected. The last read has been executed successfully. Initialized to 0 at start up and each time the address is changed.
Error	Error (bin)	Indicates that an error has been detected. A more detailed code is shown in the Fbox.
Error	Error (num)	Code of the last detected error.
DevTyp	Device type	The code of device type according to the table in the iSMA manual. In the Fbox, the device type is shown in clear text.
FWVer	Firmware version	Firmware version of the device. Only the major and middle version number are returned.
HWVer	Hardware version	Hardware version of the device
MacH	MAC Higher part	4 higher bytes of the MAC address
MacL	MAC Lowerer part	2 lower bytes of the MAC address
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as the error is cleared.

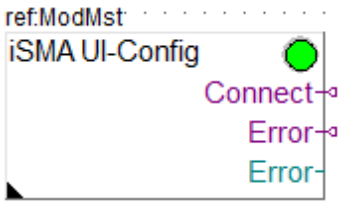
Parameters

IP address	IP-Address of the device. Ignored if Modbus RTU is used.
Slave address	Modbus slave address of the device to read.
Read interval	Time interval to regularly read the device info. The reading is executed as long as the Enable input is high. Since these values are constants in the device it is not worth to read them too fast.
Read device info	Button to manually execute a readout.
Device type	Show the device type returned by the device.
Firmware version	Value of the Firmware version returned by the device. Only the major and middle version number are returned.
Hardware version	Hardware version of the device.
MAC address, higher 4 bytes	MAC address, higher 4 bytes of the device
MAC address, lower 2 bytes	MAC address, lower 2 bytes of the device
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Internal sequence error 20	Tx/Rx error
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.6.2 iSMA Config Universal Inputs



This generic Fbox can be used to configure **Universal Analog** inputs of iSMA devices.

The Write button writes all configuration parameters. Therefore, you should always first read the parameters before to change and write a new configuration.
Please consult also the iSMA documentation about the Modbus communication for universal inputs.
See also general comments and **important remarks** about iSMA RIOs.

If you configure an input as 'Voltage/Current' the resistance measurement including the temperature calculation is disabled. Only voltage or current can be read in this case.

An option to disable voltage measurement is also available with the iSMA configuration tool (not available with this Fbox).
In all other cases, all measurements (Voltage, Current, Resistance, Temperature and Switch) are available.

Input / Output / LED

Connect	Connect	Updated after each read and Write command. Indicates that the device is connected and communication works.
Error	Error (bin)	Indicates that an error has been detected.
Error	Error (num)	Code of the last detected error.
LED	LED	The LED is red if the last read or Write caused an error. It turns to green when the Clear button is used to clear the error.

Parameters

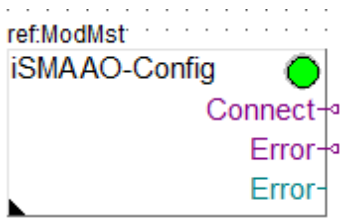
IP-address	IP-Address of the device. Ignored if Modbus RTU is used.
Slave address	Modbus slave address of the device to read.
Read configuration	Button to read the device configuration.
Device type	Return the type of the connected device. Check that the type match a device with 4 or 8 universal inputs.
----- Universal input 1..8 -----	
Sensor type	Select the type of sensor to be supported. Where not specified, the temperature unit is °C, with 0.1°C resolution.
Filter time[s]	Filter time in seconds. Range 0 to 60 sec. The default value is 2.
Resolution	Analogue signal resolution. WARNING! Setting 16-bit resolution increases the measurement time of one channel from 10ms to 140ms. The total time taken to measure all the channels increases from 50ms to 700ms.
----- ----- ----- -----	
Write configuration	Button to write the device configuration.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Internal sequence error 20	Tx/Rx error
30	Driver disabled	Shown if you click Read or Write while the driver is disabled.

50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.6.3 iSMA Config Analog Outputs



This generic Fbox can be used to configure **Analog Outputs** of iSMA devices.

It is important to configure each output with the used mode and select the corresponding mode in the iSMA Fbox writing the output.
- For an Analog output 0-10V -> Configure as 'Voltage/Digital' -> Use as 'Voltage/PWM'.
- For a PWM output -> Configure with one of the 'PWM' option -> Use as 'Voltage/PWM'.
- For a Digital output -> Configure as 'Voltage/Digital' -> Use as 'Digital'.

The Write button writes all configuration parameters. Therefore, you should always first read the parameters before to change and write a new configuration.
Please consult also the iSMA documentation about the Modbus communication for universal inputs.
See also general comments and **important remarks** about iSMA RIOs.

Input / Output / LED

Connect	Connect	Updated after each read and Write command. Indicates that the device is connected and communication works.
Error	Error (bin)	Indicates that an error has been detected.
Error	Error (num)	Code of the last detected error.
LED	LED	The LED is red if the last read or Write caused an error. It turns to green when the Clear button is used to clear the error.

Parameters

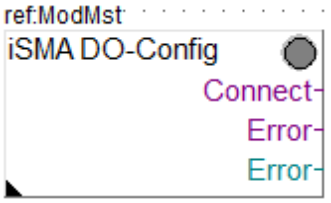
IP-address	IP-Address of the device. Ignored if Modbus RTU is used.
Slave address	Modbus slave address of the device to read.
Read configuration	Button to read the device configuration.
Device type	Return the type of the connected device. Check that the type match a device with 4 or 6 analog outputs.
Watchdog time [s]	Watchdog time in seconds in range 0 to 600. If no communication occurs with the device during the watchdog time, the outputs will be set to the default state. With value 0 the watchdog function is disabled.
----- Analog output 1..6 -----	
Default analog value	Default value for analog output. The default value applies at power on and in case of watchdog timeout.
Default state digital	Default state for outputs used as Digital. If set to 'On' the default state of the output is 10V and the default analog value is ignored.

	The default state applies at power on and in case of watchdog timeout.
Analog output mode	Select the mode of to be supported by the output.
----- ----- ----- -----	
Write configuration	Button to write the device configuration.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Internal sequence error 20	Tx/Rx error
30	Driver disabled	Shown if you click Read or Write while the driver is disabled.
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.6.4 iSMA Config Digital Outputs



This generic Fbox can be used to configure **Digital Outputs** of iSMA devices.
The Write button writes all configuration parameters. Therefore, you should always first read the parameters before to change and write a new configuration.
Please consult also the iSMA documentation about the Modbus communication for universal inputs.
See also general comments and **important remarks** about iSMA RIOs.

Input / Output / LED

Connect	Connect	Updated after each read and Write command. Indicates that the device is connected and communication works.
Error	Error (bin)	Indicates that an error has been detected.
Error	Error (num)	Code of the last detected error.
LED	LED	The LED is red if the last read or Write caused an error. It turns to green when the Clear button is used to clear the error.

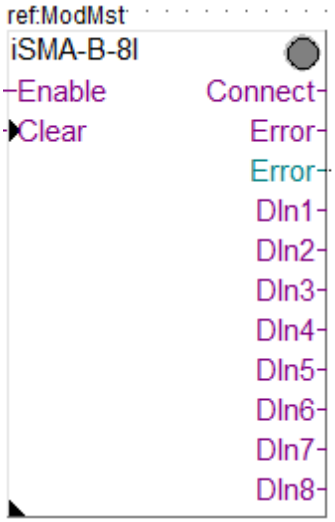
Parameters

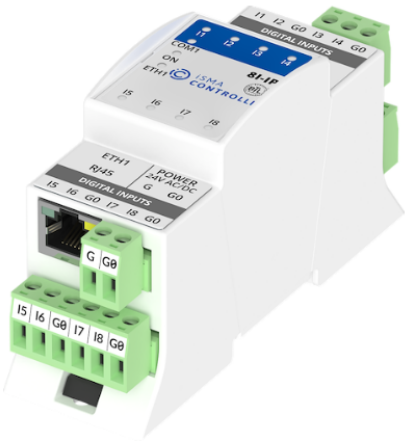
IP-address	IP-Address of the device. Ignored if Modbus RTU is used.
Slave address	Modbus slave address of the device to read.
Read configuration	Button to read the device configuration.
Device type	Return the type of the connected device. Check that the type match a device with 4 or 6 analog outputs.
Watchdog time [s]	Watchdog time in seconds in range 0 to 600. If no communication occurs with the device during the watchdog time, the outputs will be set to the default state. With value 0 the watchdog function is disabled.
----- [Default states] -----	
Default state DO1..6	Default state for the output. The default state applies at power on and in case of watchdog timeout.
----- ----- ----- -----	
Write configuration	Button to write the device configuration.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Internal sequence error 20	Tx/Rx error
30	Driver disabled	Shown if you click Read or Write while the driver is disabled.
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.6.5 iSMA-B-8I





This specific Fbox can be used to read, the iSMA devices type B-8I or B-8I-IP.
The Fbox must make reference to the Modbus driver.
Please consult also the iSMA documentation about the Modbus communication with this device.
See also general comments and **important remarks** about iSMA RIOs.

The device should be configured with the iSMA tool.

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
Connect	Connect	Indicates that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected.
Error	Error (num)	Code of the last detected error.
DIn1..8	Digital input 1..8	Status of the digital inputs 1 to 8.
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly executed.

Parameters

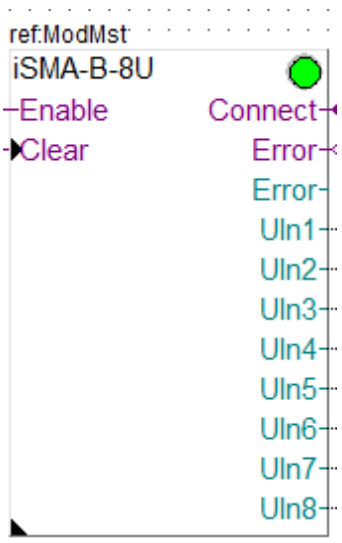
IP-address	IP-Address of the device. Ignored if Modbus RTU is used.
Slave address	Modbus slave address of the device.
Error	Display of the last detected error. See list below. Button to manually clear the error.

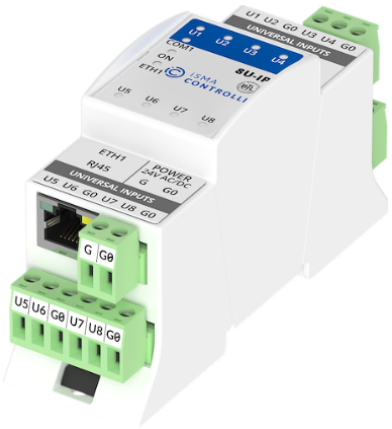
Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.

2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Internal sequence error 20	Tx/Rx error
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.6.6 iSMA-B-8U





This specific Fbox can be used to read, the iSMA devices type B-8U or B-8U-IP.
The Fbox must make reference to the Modbus driver.
You can use the generic Fbox iSMA Config Universal Inputs or the specific iSMA tool to make this configuration.
Please consult also the iSMA documentation about the Modbus communication with this device.
See also general comments and **important remarks** about iSMA RIOs.

If an input is configure as 'Voltage/Current' the resistance measurement including the temperature calculation is disabled. Only voltage or current can be read in this case.
An option to disable voltage measurement is also available with the iSMA configuration tool (not available with the configuration Fbox).
In all other cases, all measurements (Voltage, Current, Resistance, Temperature and Switch) are available.
For current measurement, you are supposed to place a 200ohms resistance on the input according to the diagram in the iSMA manual.
The resistance measurement is returned in Ω or in 0.1Ω units for PT1000 and NI1000 configuration.

The device should be configured with the iSMA tool. For some changes in the configuration, you can use the Fboxes iSMA Config Universal Inputs.

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
Connect	Connect	Indicates that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected.
Error	Error (num)	Code of the last detected error.
UIn1..8	Universal input 1..8	Value of the universal input 1 to 8 depending on the selected input type.
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly executed.

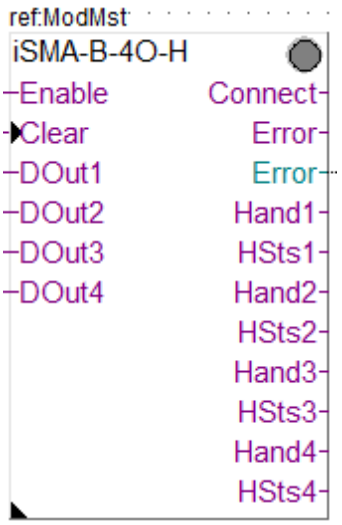
Parameters

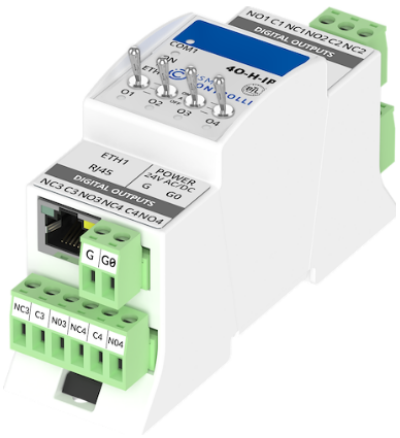
IP-address	IP-Address of the device. Ignored if Modbus RTU is used.
Slave address	Modbus slave address of the device.
-----[Input types]-----	
Input 1..8	Selection of the measurement type. Consider also the remarks above.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Internal sequence error 20	Tx/Rx error
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.6.7 iSMA-B-4O-H





This specific Fbox can be used to read, the iSMA devices type B-4O-H or B-4O-H-IP.
The Fbox must make reference to the Modbus driver.
Please consult also the iSMA documentation about the Modbus communication with this device.
See also general comments and **important remarks** about iSMA RIOs.

This device has a Hand control of the outputs. The status of the Hand control is also returned by the Hand and HSts outputs of the Fbox.

The device should be configured with the iSMA tool. For some changes in the configuration, you can use the Fbox iSMA Config Digital Outputs.

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
DOut1..4	Digital output 1..4	Signals for the digital outputs 1 to 4.
Connect	Connect	Indicates that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected.
Error	Error (num)	Code of the last detected error.
Hand1..4	Hand control 1..4	Indication that the Hand control is activated on the output.
HSts1..4	Hand status 1..4	Status of the output when Hand control is activated.
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly executed.

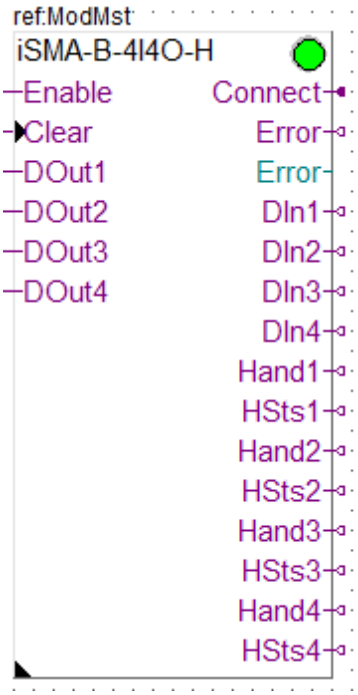
Parameters

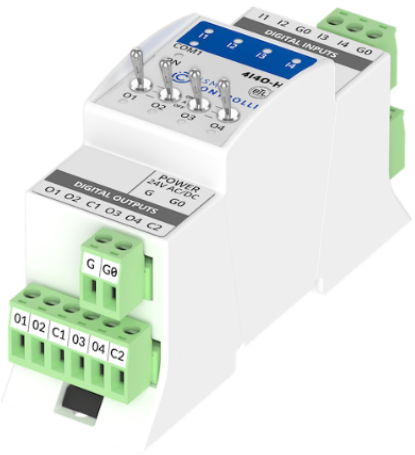
IP-address	IP-Address of the device. Ignored if Modbus RTU is used.
Slave address	Modbus slave address of the device.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Internal sequence error 20	Tx/Rx error
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.6.8 iSMA-B-4I4O-H





This specific Fbox can be used to read, the iSMA devices type B-4I4O-H or B-4I4O-H-IP.
The Fbox must make reference to the Modbus driver.
Please consult also the iSMA documentation about the Modbus communication with this device.
See also general comments and **important remarks** about iSMA RIOs.

This device has a Hand control of the outputs. The status of the Hand control is also returned by the Hand and HSts outputs of the Fbox.

The device should be configured with the iSMA tool. For some changes in the configuration, you can use the Fbox iSMA Config Digital Outputs.

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
DOut1..4	Digital output 1..4	Signals for the digital outputs 1 to 4.
DIn1..4	Digital input 1..4	Status of the digital inputs 1 to 4.
Connect	Connect	Indicates that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected.
Error	Error (num)	Code of the last detected error.
Hand1..4	Hand control 1..4	Indication that the Hand control is activated on the output.
HSts1..4	Hand status 1..4	Status of the output when Hand control is activated.
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly executed.

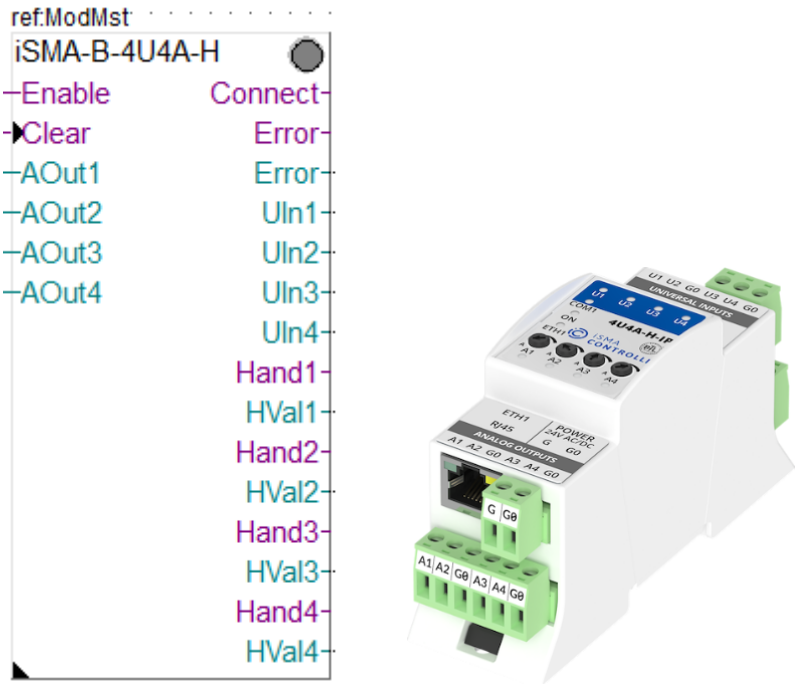
Parameters

IP-address	IP-Address of the device. Ignored if Modbus RTU is used.
Slave address	Modbus slave address of the device.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Internal sequence error 20	Tx/Rx error
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.6.9 iSMA-B-4U4A-H



This specific Fbox can be used to read, the iSMA devices type B-4U4A-H or B-4U4A-H-IP.
The Fbox must make reference to the Modbus driver.
You can use the generic Fbox iSMA Config Analog Output or the specific iSMA tool to make this configuration.
Please consult also the iSMA documentation about the Modbus communication with this device.
See also general comments and **important remarks** about iSMA RIOs.

If an input is configure as 'Voltage/Current' the resistance measurement including the temperature calculation is disabled. Only voltage or current can be read in this case.
An option to disable voltage measurement is also available with the iSMA configuration tool (not available with the configuration Fbox).
In all other cases, all measurements (Voltage, Current, Resistance, Temperature and Switch) are available.
For current measurement, you are supposed to place a 200ohms resistance on the input according to the diagram in the iSMA manual.
The resistance measurement is returned in Ω or in 0.1Ω units for PT1000 and NI1000 configuration.

This device has a Hand control of the outputs. The status of the Hand control is also returned by the Hand and HVal outputs of the Fbox.

The device should be configured with the iSMA tool. For some changes in the configuration, you can use the Fboxes iSMA Config Universal Inputs and iSMA Config Analog Outputs..

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
AOut1..4	Analogue output 1..4	Value in mV for the analogue outputs 1 to 4.

Connect	Connect	Indicates that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected.
Error	Error (num)	Code of the last detected error.
Uln1..4	Universal input 1..4	Value of the universal input 1 to 4 depending on the selected input type.
Hand1..4	Hand control 1..4	Indication that the Hand control is activated on the output.
HVal1..4	Hand value 1..4	Value in % of the outputs when Hand control is activated.
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly executed.

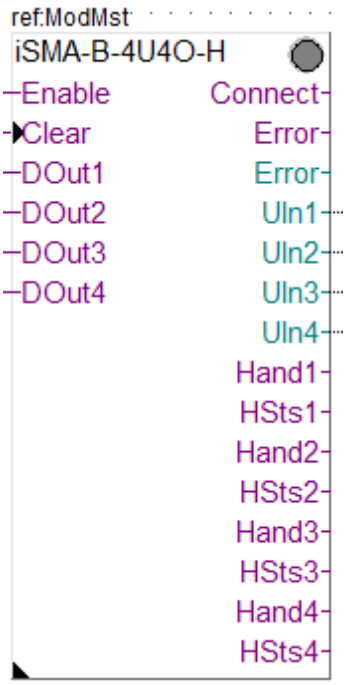
Parameters

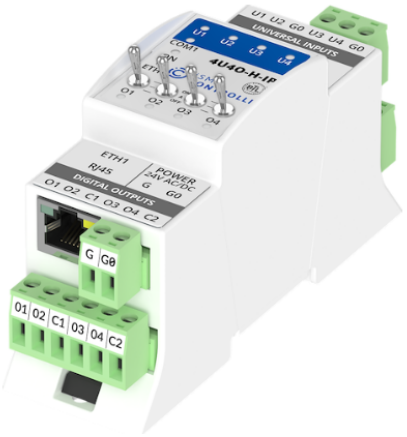
IP-address	IP-Address of the device. Ignored if Modbus RTU is used.
Slave address	Modbus slave address of the device.
-----[Input types]-----	
Input 1..4	Selection of the measurement type. Consider also the remarks above.
-----[Output modes]-----	
Output 1..4	For each output, the option must match the device configuration. The Modbus communication is adapted to the selected type. For outputs used as Digital, any value >=1 will set the output to 10V, while values <=0, set the output to 0V.
Output 1..4 range	Signal range provided at the Fbox inputs. Only used for mode = Voltage/PWM. The module output range is always 0-10V. **0-10'000mV** = The input is provided in mV in range 0-10'000. **0-100.0%** = The input is provided in %/10 in range 0-1'000 and converted by the Fbox.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Internal sequence error 20	Tx/Rx error
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.6.10 iSMA-B-4U4O-H





This specific Fbox can be used to read, the iSMA devices type B-4U4O-H or B-4U4O-H-IP.
The Fbox must make reference to the Modbus driver.
Please consult also the iSMA documentation about the Modbus communication with this device.
See also general comments and **important remarks** about iSMA RIOs.

If an input is configure as 'Voltage/Current' the resistance measurement including the temperature calculation is disabled. Only voltage or current can be read in this case.
An option to disable voltage measurement is also available with the iSMA configuration tool (not available with the configuration Fbox).
In all other cases, all measurements (Voltage, Current, Resistance, Temperature and Switch) are available.
For current measurement, you are supposed to place a 200ohms resistance on the input according to the diagram in the iSMA manual.
The resistance measurement is returned in Ω or in 0.1Ω units for PT1000 and NI1000 configuration.

This device has a Hand control of the outputs. The status of the Hand control is also returned by the Hand and HSts outputs of the Fbox.

The device should be configured with the iSMA tool. For some changes in the configuration, you can use the Fboxes iSMA Config Universal Inputs and.iSMA Config Digital Outputs.

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
DOut1..4	Digital output 1..4	Signals for the digital outputs 1 to 4.
Connect	Connect	Indicates that the device is connected and communication works.Initialized to 1 at start up. Status is updated if

		Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected.
Error	Error (num)	Code of the last detected error.
Uin1..4	Universal input 1..8	Value of the universal input 1 to 4 depending on the selected input type.
Hand1..4	Hand control 1..4	Indication that the Hand control is activated on the output.
HSts1..4	Hand status 1..4	Status of the output when Hand control is activated.
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly executed.

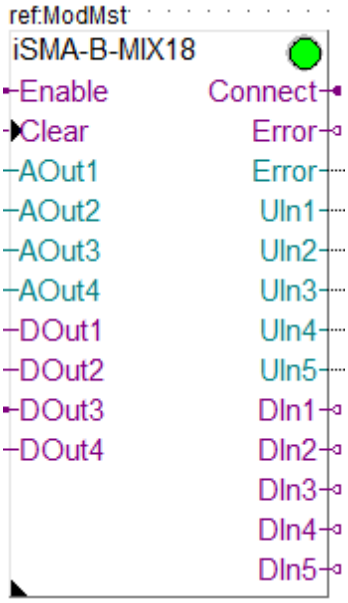
Parameters

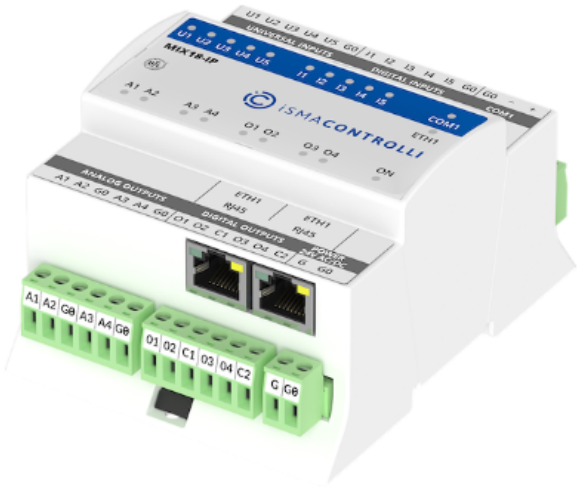
IP-address	IP-Address of the device. Ignored if Modbus RTU is used.
Slave address	Modbus slave address of the device.
-----[Input types]-----	
Input 1..4	Selection of the measurement type. Consider also the remarks above.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Internal sequence error 20	Tx/Rx error
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.6.11 iSMA-B-MIX18





This specific Fbox can be used to read, the iSMA devices type B-MIX18 or B-MIX18-IP.
The Fbox must make reference to the Modbus driver.
You can use the generic Fbox iSMA Config Universal Inputs and iSMA Config Analog Output or the specific iSMA tool to make this configuration.
Please consult also the iSMA documentation about the Modbus communication with this device.
See also general comments and **important remarks** about iSMA RIOs.

If an input is configure as 'Voltage/Current' the resistance measurement including the temperature calculation is disabled. Only voltage or current can be read in this case.
An option to disable voltage measurement is also available with the iSMA configuration tool (not available with the configuration Fbox).
In all other cases, all measurements (Voltage, Current, Resistance, Temperature and Switch) are available.
For current measurement, you are supposed to place a 200ohms resistance on the input according to the diagram in the iSMA manual.
The resistance measurement is returned in Ω or in 0.1Ω units for PT1000 and NI1000 configuration.

The device should be configured with the iSMA tool. For some changes in the configuration, you can use the Fboxes iSMA Config Universal Inputs and iSMA Config Analog Outputs..

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
AOut1..4	Analogue output 1..4	Value in mV or 0.1% for the analogue outputs 1 to 4.
DOut1..4	Digital output 1..4	Signals for the digital outputs 1 to 4.
Connect	Connect	Indicates that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected.

Error	Error (num)	Code of the last detected error.
Uln1..5	Universal input 1..5	Value of the universal input 1 to 5 depending on the selected input type.
Dln1..5	Digital inputs 1..5	Status of the digital inputs 1 to 5.
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly executed.

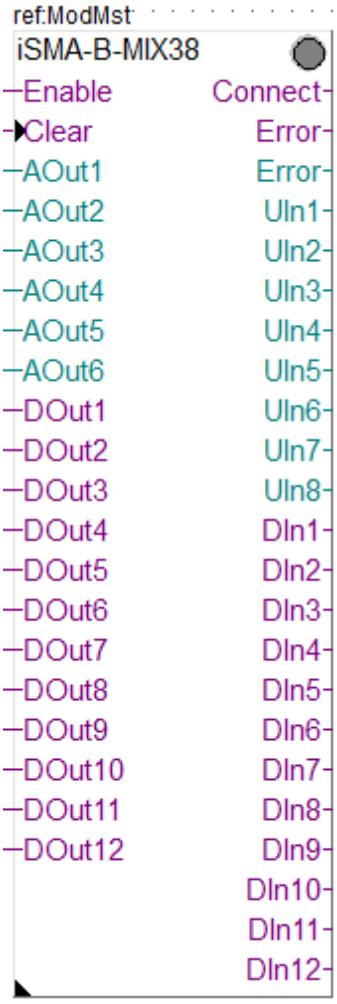
Parameters

IP-address	IP-Address of the device. Ignored if Modbus RTU is used.
Slave address	Modbus slave address of the device.
-----[Universal Input types]-----	
Universal Input 1..5	Selection of the measurement type. Consider also the remarks above.
-----[Output modes]-----	
Analog output 1..5	For each output, the option must match the device configuration. The Modbus communication is adapted to the selected type. For outputs used as Digital, any value >=1 will set the output to 10V, while values <=0, set the output to 0V.
Output 1..5 range	Signal range provided at the Fbox inputs. Only used for mode = Voltage/PWM. The module output range is always 0-10V. **0-10'000mV** = The input is provided in mV in range 0-10'000. **0-100.0%** = The input is provided in %/10 in range 0-1'000 and converted by the Fbox.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Internal sequence error 20	Tx/Rx error
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

5.6.12 iSMA-B-MIX38



This specific Fbox can be used to read, the iSMA devices type B-MIX38 or B-MIX38-IP.
The Fbox must make reference to the Modbus driver.
You can use the generic Fbox iSMA Config Universal Inputs and iSMA Config Analog Output or the specific iSMA tool to make this configuration.
Please consult also the iSMA documentation about the Modbus communication with this device.
See also general comments and **important remarks** about iSMA RIOs.

If an input is configure as 'Voltage/Current' the resistance measurement including the temperature calculation is disabled. Only voltage or current can be read in this case.
An option to disable voltage measurement is also available with the iSMA configuration tool (not available with the configuration Fbox).
In all other cases, all measurements (Voltage, Current, Resistance, Temperature and Switch) are available.
For current measurement, you are supposed to place a 200ohms resistance on the input according to the diagram in the iSMA manual.
The resistance measurement is returned in Ω or in 0.1Ω units for PT1000 and NI1000 configuration.

The device should be configured with the iSMA tool. For some changes in the configuration, you can use the Fboxes iSMA Config Universal Inputs and iSMA Config Analog Outputs..

Input / Output / LED

Enable	Enable	Enables / Disables the communication with the device.
Clear	Clear	Clears the error outputs
AOut1..6	Analogue output 1..6	Value in mV or 0.1% for the analogue outputs 1 to 6.
DOut1..12	Digital output 1..12	Signals for the digital outputs 1 to 12.
Connect	Connect	Indicates that the device is connected and communication works.Initialized to 1 at start up. Status is updated if Enable is 1. In case of communication error a reconnect attempt is executed each 10 sec.
Error	Error (bin)	Indicates that an error has been detected.
Error	Error (num)	Code of the last detected error.
UIn1..8	Universal input 1..8	Value of the universal input 1 to 8 depending on the selected input type.
DIn1..12	Digital inputs 1..12	Status of the digital inputs 1 to 12.
LED	LED	The LED is red if the last request caused an error. It turns automatically to green as son as a request is correctly executed.

Parameters

IP-address	IP-Address of the device. Ignored if Modbus RTU is used.
Slave address	Modbus slave address of the device.
-----[Universal Input types]-----	
Universal Input 1..8	Selection of the measurement type. Consider also the remarks above.
-----[Output modes]-----	
Analog output 1..6	For each output, the option must match the device configuration. The Modbus communication is adapted to the selected type. For outputs used as Digital, any value >=1 will set the output to 10V, while values <=0, set the output to 0V.
Output 1..6 range	Signal range provided at the Fbox inputs. Only used for mode = Voltage/PWM. The module output range is always 0-10V. **0-10'000mV** = The input is provided in mV in range 0-10'000. **0-100.0%** = The input is provided in %/10 in range 0-1'000 and converted by the Fbox.
Error	Display of the last detected error. See list below. Button to manually clear the error.

Error list

0	Ok	No error
1	Not executed	The request could not be executed by the Driver. See error in the Driver Fbox. Typically, it will be a timeout.
2	Internal sequence error 2	Invalid variable type
3	Internal sequence error 3	Invalid format code
4	Internal sequence error 4	Variable types not supported
5	Internal sequence error 5	Invalid function code
8	Internal sequence error 8	Indirect addressing not yet supported

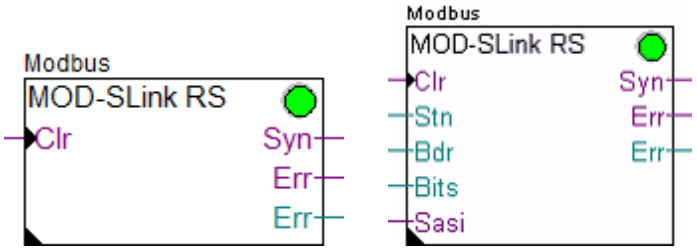
9	Internal sequence error 9	32 bit read/write error
10	Internal sequence error 10	DB reading error
20	Internal sequence error 20	Tx/Rx error
50	Internal Fbox error	Fbox sequence error
other		Other internal errors

This page is intentionally left blank.
Remove this text from the manual
template if you want it completely blank.

Slave Functions

6 Slave Functions

6.1 Slave Link RS



The Slave Link RS function is the kernel of the Modbus 2 Slave driver for RS232, 422 and 485 lines. It must be placed once at the beginning of the program. This Fbox supports the functions of the lower layers of the Modbus protocol like:

- Synchronization on the Bus
- Checksum control and calculation
- Building of the telegram structure
- Timeout supervision
- Address filtering

Two versions of this Fbox exist:

- Slave Link RS xxx
- Slave Link RS Adj

In the first Fbox, the Baudrate and the bits setting is a fix parameter selected in the Fbox. In the second Fbox the baudrate and the bit settings are given on Inputs and can be adjusted in runtime. The line can also be assigned and de-assigned in runtime.

The received request are not processed by this Fbox but only reported in an internal buffer. The functions of the higher level of the Modbus (the application layer) are then realized by one or several application Fboxes like:

- Standard application
- Gateway to S-Bus
- Virtual Slave
- Other Gateway from other Engiby libraries

To realize a simple Modbus slave station place one Slave Link Fbox and also one Slave Application Fbox.

Input / Output / LED

Clr	Clear	Allows you to clear the error diagnostic.
Stn	Station	Define the station number when the option 'External' is selected. Otherwise, the input value is ignored.
Syn	Synchronized	= The driver is synchronized on the Bus. 0 = The driver is not yet or not anymore synchronized.
Bdr	Baudrate	With Slave Link RS Adj Fbox only. Define the baudrate of the serial line. See below.
Bits	Bits settings	With Slave Link RS Adj Fbox only. Define the bits setting of the serial line. See below.

Sasi	Assign	When the input is High, the line is assigned and the driver runs. When the input is Low, the line is de-assigned and the driver stops. This allows you to assign the line in another mode.
Err (Bin)	Error detected	The binary Err output indicates that an error has been detected.
Err (Num)	Error code	The numeric Err output indicate the code of the last detected error

Parameters

Option station number	Option for the Slave station number
- Extern	The station number is defined by the Stn input Only one Modbus station is supported
- Range Intern	The range of the station supported is defined by the two specified addresses.
First station number	First slave address of the range.
Last station number	Last slave address of the range.
Serial channel	Serial channel used. See remark below for channel 0.
Hardware type	Hardware type of the serial line. RS 232 / PLM must be used for Modbus over Public Line Modem.
Transmission speed	Transmission speed of the serial line.
Bits-Parity-Stop	Bits-Parity-Stop of the serial line.
Protocol	Selection of the RTU (binary) or ASCII protocol. For RTU Fast see note below.
Timeout [s]	Timeout in second for the synchronization.
Min response delay [ms]	Minimum time before the driver send a response. The value 0 will be replaced by the minimum value specified by Modbus. In the Link RS Adj Fbox, the default delay is computed for 9600 bauds, 8-E-1. For other settings (especially longer time), the delay must be adjusted manually.
Application timeout [ms]	Maximum time given to the application to give a response. Short time (100 ms) can be specified for a standard application. A longer time (500 ms) must be used if a gateway function is used.
Max stations (synchro)	Specify the last station number present on the bus. A lower value helps the synchronization of the driver.
Load on the CPU	Load of the CPU allowed for the driver.
	-----[Display of received telegrams]-----
Station number	Last received Station number.
Function	Last received Function. For F23 see below.
Base address	Last received Base address.
File address	Last received File address.
Number of elements	Last received Number of elements.
Requests received	Number of received Requests.
Link error	Last error detected by the link layer.

Link error argument	Argument of the last error detected by the link layer.
Modbus exception code	Last Modbus error returned by the link layer. See topic : Modbus Exception Codes
Error counter	Number of detected errors since last clearing.

Use of channel 0

The channel 0 has a PGU function in many PCD systems. When a PGU protocol is started, the port is forced in PGU mode by a control signal. If you only use the port with the Modbus protocol, ensure that the control signals inputs CTS and DSR are always at a low level (e.g. grounded).
If you want to use the port alternatively in PGU and Modbus, select the option **Channel 0 PGU**. The port will automatically be restored in Modbus after it has been used in PGU. Note that the Link Fbox may show errors after the port has been used in PGU.

F23 : The function 23 execute a Write and a Read access in the same transaction. The base address and the number of elements show the parameter of the Write access. The base address of the Read access is shown as File address. The number of element is not displayed.

RTU Fast option

This option has been introduced in version 2.4.300. If you do not have it in the Fbox, you may need to replace the Fbox with a new one. The RTU Fast option can be used to speed up the CRC calculation of the RTU mode. It will use a system function to compute the CRC. Therefore, you must first ensure that your system supports the system functions.
It can spare up to 120 ms on a PCD2.M120 for a package of 100 registers (time difference measured on the maximum CPU cycle time).

Error codes

Code	Message	Description	Argument
0	OK	No error	-
1	SASI	SASI Error. The serial line could not be assigned. With adjustable bauds and bits, wrong parameters at he Fbox input.	- Value at the Bits input.
2	Diag	A low level diagnose have been reported by the firmware (Wrong baudrate or Parity, Framing error).	Value of the diag register
3	Overflow	Reception buffer overflow. The communication load is to high.	-
10	CRC Mst	CRC error in a Master telegram.	-
11	CRC Slv	CRC error in a Slave telegram.	-
20	Synchro	The Slave is waiting telegrams for synchronization. No telegram have been received since start up.	-
21	Byte	Invalid Byte count in the telegram.	Number of bytes specified in the telegram.
24	Modem	Timeout on RTS-CTS handshake with leased line modem.	-

25	Fnc File	Illegal reference on a Read or Write Function File.	-
26	Len	Wrong telegram length.	-
27	Fnc code	Error during decoding of function code.	Function code received.
40	Application	General application error replay.	-
41	Rejected	Requests rejected by a Map Slave function	-
48	App replay	The application did not replay to link layer.	-
90..99	<90>..<99>	Internal error.	-

Runtime Adjustable Bits settings

This feature can only be used on FW supporting the indirect baudrate and bits settings in the SAIA text. See SAIA document for minimum FW.

By using the Slave Link RS Adj Fbox, the baudrate and the bits settings can be given on inputs and can be changed in runtime according to the table below.

When one of the input value change, the line is immediately re-assigned with the new setting. If the provided parameters are not valid (not accepted by the PCD), the error code 1 (SASI) is issued and the driver will stop working until valid parameters are set back.

A typical use is to define the baudrate and the bits settings over binary inputs. In this case, the Fbox Input Baud and Bits can be used.

Baudrate	Input value
110	110
300	300
600 bds	600
1200 bds	1200
2400 bds	2400
4800 bds	4800
9600 bds	9600
19.2 kbds	19200
38.4 kbds	38400
57,6 kbds	57600
115,2 kbds	115200

The bits settings values is a 3 digits number made of :

- Number of bits (x100)
- Parity (x10)
- Number of stop bits (x1)

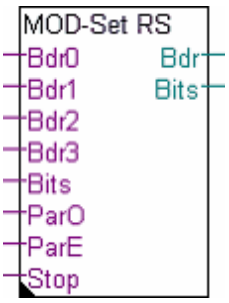
Number of bits	Input value	Remark
7	700	Not for RTU Mode
8	800	Usually for RTU
Parity	Input value	
None	00	Usually for RTU
Odd	10	

Even	20	
Number of stop	Input value	
1	1	Usually for RTU
2	2	

Examples :

801 = 8 Bits, No Parity, 1 Stop
712 = 7 Bits, Parity Odd, 2 Stop
821 = 8 Bits, Parity Even, 1 Stop

6.2 Input Baud and Bits



This Fbox is foreseen to define the baudrate and the bits settings over binary inputs. It is usefull for the Fboxes Master Link RS and Slave Link RS with adjustable baudrate and bits settings.

Inputs

Bdr0..3	Baudrate	Define the baudrate according the table below.
Bits	Number of bits	Low = 7 bits. High = 8 bits
ParO	Parity Odd	Define the Odd parity
ParE	Parity Even	Define the Even parity
Stop	Number of stop bits	Low = 1 bit. High = 2 bits

Outputs

Bdr	Baudrate	Baudrate value as required by the Master and Slave Link RS Fboxes.
Bits	Bits settings	Bits settings value as required by the Master and Slave Link RS Fboxes.

Parameters

Lowest baudrate	Define the lowest supported baudrate corresponding to all Bdr inputs set to Low.

Defining the baudrate

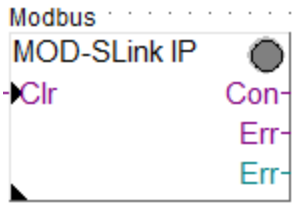
Each baudrate is associated to a numeric code from 0 to 8 (see table below). The input value defined by the 4 bits Bdr0 (LSB), Bdr1, Bdr2 and Bdr3 (LSB) is used to define the baudrate.

Code	Baudrate (bdr output)
0	110

1	300
2	600
3	1200
4	2400
5	4800
6	9600
7	19200
8	38400
9	57600
10	115200

If not all baudrates must be supported, you can reduce the number of inputs needed to the strict minimum with the adjustable lowest baudrate. The input value is then used to shift the lowest baudrate to a higher value. All bits set to low, define the selected lowest baudrate.
Example :
Lowest baudrate = 9600
Only 2 inputs are needed (Bdr0 and Bdr1) to support 9600, 19.2k and 38.4 kbds.
Bdr0=Low and Bdr1=Low = 9600 bds
Bdr0=High and Bdr1=Low = 19.2 bds
Bdr0=Low and Bdr1=High = 38.4 bds

6.3 Slave Link IP



The Slave Link IP function is used to support the Modbus/TCP protocol on the IP-Module (Ethernet). The Slave Link is the kernel of the Modbus 2 Slave driver. It must be placed once at the beginning of the program. This Fbox supports the functions of the lower layers of the Modbus/TCP protocol like:

- Opening and closing TCP/IP and UDP/IP ports
- Checking and building the telegram headers
- Building of the telegram structure
- Timeout supervision
- Address filtering

The received requests are not processed by this Fbox but only reported in an internal buffer. The functions of the higher level of the Modbus, the application layer, is realized by one or several application Fboxes like:

- Standard application
- Gateway to S-Bus
- Virtual Slave
- Other Gateway from other Engiby libraries

To realize a simple Modbus slave station place one Slave Link Fbox and also one Slave Application Fbox.

Input / Output / LED

Clr	Clear	Allows to clear the error diagnostic.
Con	Connected	= The driver is connected to a Master over the TCP/IP port. 0 = The driver is not yet or not anymore connected.
Err	Error detected	The binary Err output indicate that an error has been detected.
Err	Error code	The numeric Err output indicate the code of the last detected error

Parameters

Option station number	Option for the Slave station number
- Range Intern	The range of the station supported is defined by the two specified addresses.
- S-Bus config	The supported station is taken from the S-Bus configuration.
First station number	First slave address of the range. The station 0 is normally used as broadcast address and must not be specified in the range. If you specify the station 0 as first station it will be handled as a normal station (not anymore as broadcast). In this case, you must also place a Slave Application Fbox with Station 0.
Last station number	Last slave address of the range.
Ethernet module	Available since version 2.5.023. In the most cases, the option 'Default' is working correctly. If the PCD has more than 1 Ethernet module, or if you need to specify the slot to use, select the suitable option.
Channel	Logical Channel used. A channel can only be used once. Take care if you used several Modbus Master and/or Slave functions. Each of them must use another channel. If you select the protocol TCP+UDP, 2 channels will be used, the selected one and the following. E.g. Channel 1 selected -> Channels 1 and 2 used. Note that this channel number has nothing to do with the Channel 8 and 9 of the hardware configuration which concerns S-Bus only.
Port number	TCP/IP port used. The port 502 is the Modbus port. Other ports up to 1023 are reserved. Ports from 1024 on are free for private use. Note that on some device types (e.g. PCD3.T666) the port 502 cannot be used (locked by FW).
Protocol	Modbus/TCP and/or Modbus/UDP. See below.
Timeout [s]	Not yet used.
Idle disconnect time	Time, in sec, after which the TCP port is disconnected if no communication is detected. Then the master must re-connect the TCP port. The default value of 10 sec is recommended. This mechanism avoid an overflow of the dynamic allocation of TCP ports. The value 0 means : never disconnect (not recommended). The parameter is not used with UDP.
Min response delay [ms]	Minimum time before the driver send a response.
Application timeout [ms]	Maximum time given to the application to give a response. Short time (100 ms) can be specified for a standard application.

	A longer time (500 ms) must be used if a gateway function is used.
Load on the CPU	Load of the CPU allowed for the driver.
	-----[Display of received telegrams]-----
Station number	Last received Station number.
Function	Last received Function. For F23 see below.
Base address	Last received Base address.
File address	Last received File address.
Number of elements	Last received Number of elements.
Requests received	Number of received Requests.
Link error	Last error detected by the link layer.
Link error argument	Argument of the last error detected by the link layer.
Modbus exception code	Last Modbus error returned by the link layer. See topic : Modbus Exception Codes
Error counter	Number of detected errors since last clearing.

Modbus/TCP or UDP : The Modbus protocol over IP specified by Schneider use the TCP protocol. Almost all implementation of Modbus over IP use actually TCP. Although, small data exchange as used by Modbus are faster with UDP packages. Some manufacturers have choose to implement a UDP/IP version instead of TCP/IP or as alternative to it. In this Fbox you can choose to use TCP or UDP. You can even chose to support both TCP and UDP at the same time.

F23 : The function 23 execute a Write and a Read access in the same transaction. The base address and the number of elements show the parameter of the Write access. The base address of the Read access is shown as File address. The number of element is not displayed.

Error codes

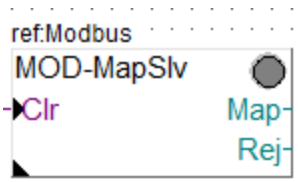
Code	Message	Description	Argument
0	OK	No error	-
2	Diag	A low level diagnose have been reported from the firmware.	Value of the diag register.
3	Overflow	Too big package received.	-
4	Open DM	Error opening data mode.	-
5	Open TCP	Error opening TCP Server port.	Port number.
6	Rx data	Error when receiving data on TCP/UDP channel.	-
7	Tx locked	Transmission is locked by the FW. The driver cannot send any response in this situation. This case should not occur in normal case.	1 = In TCP 2 = In UDP
20	Synchro	The Slave is waiting telegrams for synchronization. No telegram have been received since start up.	-
21	Byte	Invalid Byte count in the telegram.	Number of bytes specified in the telegram.
25	Fnc File	Illegal reference type or sub-request with function 20 or F21	-
26	Len	Wrong telegram length.	-
27	Fnc code	Error during decoding of function code.	Function code received.

28	TCP closed	The TCP connection has been closed by the master or a network error before the response has been sent back.	-
35	Fnc File	Illegal reference on a Read or Write Function File.	-
40	Application	General application error replay.	-
41	Rejected	Requests rejected by a Map Slave function	-
48	App replay	The application did not replay to link layer.	-
90..99	<90>..<99>	Internal error.	-

6.4 Map Slave

This Fbox allows you to tailor the action of the Modbus functions on the PCD variables like :

- Define the PCD media accessed by Modbus function
- Map Modbus address ranges to other PCD address ranges
- Lock the read and/or write access on specific PCD address ranges
- Define the data format in particular PCD address ranges



Input / Output / LED

Clr	Clear	Allows to clear the diagnostic.
Map	Mapped	Counter of the mapped packages
Rej	Rejected	Counter of the rejected packages
LED	LED	The LED is red when packages have been rejected. It turns back to green when the counters are cleared.

Parameters

Option station number	Option for the Slave station number. This defines the station number affected by the mapping of this Fbox. Package to other station numbers are passed without mapping.
- All	All station are accepted. This is useful if the station filter selected in the Slave Link Fbox is sufficient.
- Intern	The station number is defined by the address specified in the Fbox.
- S-Bus Config	The Modbus station address is taken from the configured S-Bus address
- S-Link first	The station address is taken from the first defined station in the S-Link Fbox.

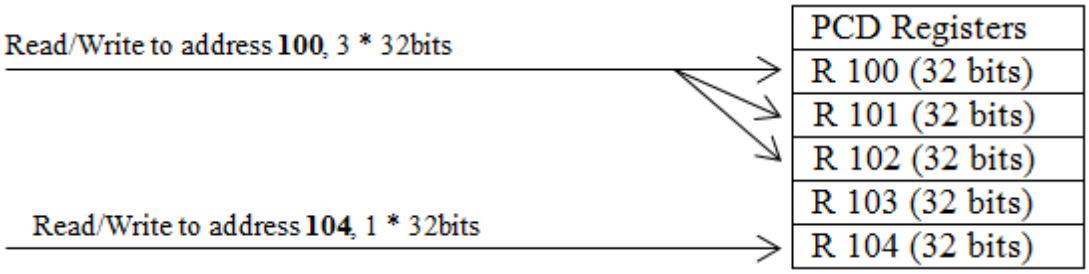
- S-Link last	The station address is taken from the last defined station in the S-Link Fbox.
Map station	Station number for the option 'Intern'.
-----[Mapping 1 and 2 Bin]-----	
Rcv function	Function(s) code of the received request
Rcv Base address	Base address of the range concerned by this mapping
Rcv Last address	Last address of the range concerned by this mapping
Map to Media	PCD Media where to map the requests
Map to Base address	Base address of the PCD media range accessed by the requests addressed in the defined Rcv range
-----[Mapping 3 and 4 Num]-----	
Rcv function	Function(s) code of the received request
Rcv Base address	Base address of the range concerned by this mapping
Rcv Last address	Last address of the range concerned by this mapping
Map to Media	PCD Media where to map the requests
Map to Base address	Base address of the PCD media range accessed by the requests addressed in the defined Rcv range
Format	Value format of the variables accessed by the requests addressed in the defined Rcv range.
Emulate 16 bits addressing	For 32 bit values, a 16 bits addressing schema is emulated inside the configured range. See below.
-----[Mapped requests]-----	
Function	Last mapped function
Base address	Base address of the last mapped function
Number of elements	Number of elements of the last mapped function
PCD Media type	PCD Media type of the last mapped function
PCD Media address	PCD Media address of the last mapped function
Requests mapped	Counter of the mapped packages
Requests rejected	Counter of the rejected packages Button to clear all diagnostics

The function includes 4 mapping definitions, 2 for binary and 2 for numeric functions. For more mapping, put several Map Slave Fboxes. The Fbox can be used with any Slave Link and Slave application Fboxes.
Important : This Fbox must be placed after the Slave Link Fbox and before any Slave application Fbox.
The Map Slave Fbox acts on a specific slave address and therefore allows also to control the access to PCD variables depending on the slave address used by the Master.
The option ‘All Write Bin’ and ‘All Write Num’ allows to reject or to re-map all write access. It applies only to the functions specified in the list (e.g. it does not apply to the function 23).
The option ‘All Bin’ and ‘All Num’ allows to reject or to re-map all access (read and write). It applies only to the functions specified in the list (e.g. it does not apply to the function 23).
If a request contains addresses which overlap a defined range (Base address to last address), it will be rejected. As a result, more than one address mapping cannot apply on values of the same request.
Ranges can specifically be defined to reject requests by using the option PCD Media=None.
When several Map Slave Fboxes are used, the priority is on the first Fbox where the package matches one of the defined mappings. This is also true for request rejection. Therefore, for security reason, package rejection should be defined before other mapping.

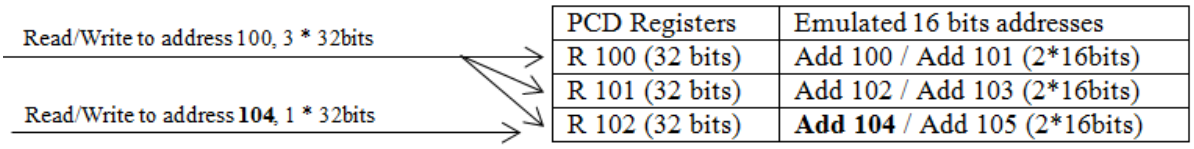
If a format is defined (for numeric function only) and is applied, it has priority to any format defined in the Slave application function. If no format is selected, 16 bit values are assumed and can still be applied by the Slave application function. When Map Slave Fbox are used, it is not anymore necessary and not recommended to use the offset address method of the Slave application functions (set it to No 32 Bits and No Fp).
If no mapping applies to a request, it is passed as it is to the next Map Slave or the Slave application Fbox. **Therefore ranges and functions that are not explicitly defined as locked (Map to Media=None) will be accepted.**

Emulate 16 bits addressing
Typically, when the master station sends requests inside the specified range (not only at the base address) it may be necessary to emulate a 16 bits address schema instead of the default PCD address for 32 bits registers.

Example with default PCD addressing:

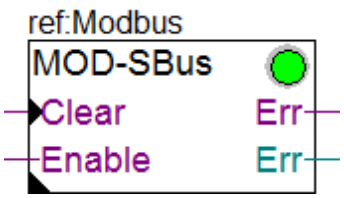


Example with emulated 16bits addressing:



Note that this addressing can again be modified by the option 'Address offset" in the Slave Application Fbox.
The option 'Emulate 16 bit addressing' is equivalent to the option '2*i' in the Slave Application Fbox Fbox. Don't use both at the same time.

6.5 Gateway S-Bus



This function allows you to convert the telegram received by the Modbus slave link and to send it on a S-Bus master port. The Gateway functions take the place of a Modbus application. It can be combined with a standard Modbus application. You can also place several S-Bus Gateway Fboxes for different

ranges and choose different options and activate them with different enable signals. Take care to not have overlapping in the station numbers.

The Slave Link Function must be programmed before the Gateway function. The address range of the gateway address must be in the range of the address supported by the Slave Link.

The S-Bus master port must be assigned in **S-Bus Master** using the SASI S-Bus Fbox of the Fupla Communication family before the gateway function.

Important ! The maximum number of elements per request is restricted to the maximum supported by the S-Bus protocol:
- 32 Registers
- 32 Timers/Counters
- 128 Flags
- 128 Inputs/Outputs

The S-Bus network will insert a supplementary delay for the response. This response time is supervised by the Slave Link function. Therefore, the application timeout of the Slave Link Fbox must be adapted consequently. The timeout of the Master must also consider the response time of the S-Bus network and of the Modbus network.

Input / Output / LED

Clear	Clear	Allows you to clear the error diagnostic.
Enable	Enable	Allows you to enable or disable the support of the specified station range. the behavior depends on the option "On disabled". See below for how to use the Enable input with the S-Bus Station Fbox.
Err	Error detected	The binary Err output indicates that an error has been detected.
Err	Error code	The numeric Err output indicate the code of the last detected error

Parameters

First station number	First slave address of the range.
Last station number	Last slave address of the range.
Address offset	Offset between telegram addresses and PCD addresses
- 0 (SAIA)	Addressing acc. to SAIA
- 1 (Modicon)	Addressing acc. to Modicon
Integer 32 bits format	Format option for the support of 32 bits integer format.
- No 32 bits	bits integer not supported.
- Little Endian	bits integer supported. Lower Significant Word transmitted first. Format used by Modicon.
- Big Endian	bits integer supported. Most Significant Word transmitted first.
Integer 32 bits offset	Offset applied to register, timer and counter for access in 32 bits integer format.
Floating-point format	Format option for the support of the floating point format
- No Fp	Floating point not supported
- Little Endian	Floating point supported. Lower Significant Word transmitted first. Format used by Modicon.
- Big Endian	Floating point supported. Most Significant Word transmitted first.
Floating-point offset	Offset applied to register for access in floating point format

On disabled	Defines the behaviors in case the Fbox is disabled. See details below.
On S-Bus timeout	Defines the behaviors in case of timeout from S-Bus. See details below.
	-----[Display of received telegrams]-----
Function	Last received Function.
Base address	Last received Base address.
File address	Last received File address.
Number of elements	Last received Number of elements.
Requests passed to S-Bus	Number of requests passed to the S-Bus port.
Error	Last error detected by the gateway.
Modbus error	Last Modbus error returned by the gateway. See list below.
Error counter	Number of detected errors since last clearing.

Modbus Error Codes

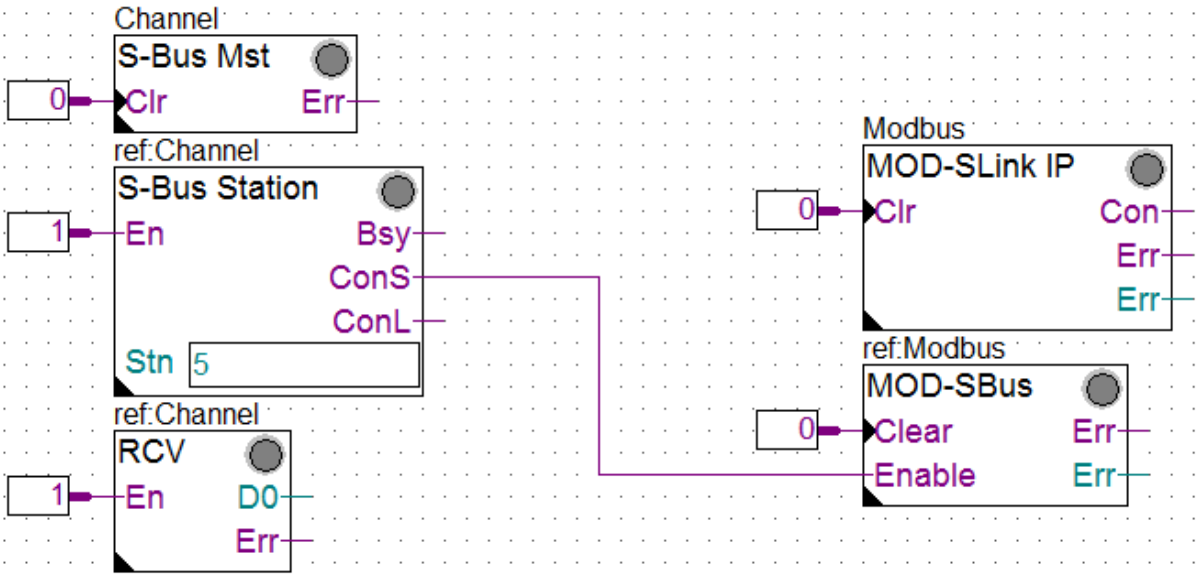
Modbus error are returned to the master using the modbus exception replay.

Code	Message	Description
0	OK	No error
1	Function	Function not supported
2	Address	Invalid address
3	Data	Invalid data (not used)
4	Slv Fail	S-Bus telegram did not succeed
5	Ack	not used
6	Busy	not used
7	Nack	Fbox is disabled.

How to use the Enable input with the S-Bus Station Fbox.

It can be more efficient to disable the Gateway Fbox when a S-Bus slave station is not connected to the bus.
To do this, place one Gateway Fbox for each slave station and adjust the corresponding range (E.g. for station 5 -> First=5, Last=5).
The Enable input must be connected to the ConS output of the S-Bus Station Fbox.
The ConS signal is only working if at least one RCV Fbox on the corresponding slave is active. Therefore you must place at least one RCV Fbox reading any element of the each slave.

Program example:

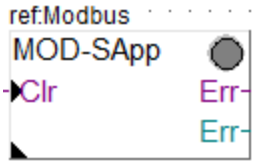


Options 'On disabled' and 'On S-Bus timeout'

These options define the response to the Modbus master in case the Fbox is disabled or timeout on S-Bus.

No response	With this option no response is returned to the Modbus master. This option correspond to the former Fbox without these options. Choose this option if the Modbus master is not able to correctly interpret the Exception message retuned with the other option.
Exception message	With this option an Exception message with **error code 7** is returned to the Modbus Master. This can speed up the communication because an answer is quickly returned to the Modbus master. The error code 7 is a NAK answer. The Modbus master should be able to correctly interpret this message. In the either case select the option 'No response'.

6.6 Slave Application



This Fbox define a standard Modbus slave application in the PCD. The standard Modbus application allows the Master to access all variables of the PCD using the standard Modbus telegrams.

To realize a simple Modbus slave station place also one Slave Link RS or one Slave Link IP Fbox before the Slave Application Fbox.

The slave address must be in the range of the address supported by the Slave Link.

Input / Output / LED

Clr	Clear	Allows to clear the error diagnostic.
Err	Error detected	The binary Err output indicate that an error has been detected.
Err	Error code	The numeric Err output indicate the code of the last detected error

Parameters

Option station number	Option for the Slave station number.
- All	All station are accepted. This is useful if the station filter selected in the Slave Link Fbox is sufficient.
- Intern	The station number is defined by the address specified in the Fbox.
- S-Bus Config	The Modbus station address is taken from the configured S-Bus address.
- S-Link first	The station address is taken from the first defined station in the S-Link Fbox.
- S-Link last	The station address is taken from the last defined station in the S-Link Fbox.
Station number	Station number for the standard application. The station 0 is normally used as broadcast address and is automatically supported by this Fbox. With Modbus/TCP, if you want to handle station 0 as a normal slave station, you must also place a Slave Application Fbox with address 0. See also Slave Link IP
Reject not mapped requests	Option to reject requests that have not been mapped. See details below.
Address offset	Offset between telegram addresses and PCD addresses.
- 0 (SAIA)	Addressing according to SAIA. See detail below.
- 1 (Modicon)	Addressing according to Modicon. See detail below.
- 1+2*i (Modicon)	Addressing according to Modicon skipping each second PCD register in case of 32 bits values (integer or float). Normal 16 bits Read/Write are not affected by the 2*i extension. See detail below.
- 0+2*i	Addressing without the Modicon offset but skipping each second PCD register in case of 32 bits values (integer or float). Normal 16 bits Read/Write are not affected by the 2*i extension. See detail below.
Integer 32 bits format	Format option for the support of 32 bits integer format.
- No 32 bits	bits integer not supported.
- Little Endian	bits integer supported. Lower Significant Word transmitted first. Format used by Modicon. Note that the byte order is always MSB first.
- Big Endian	bits integer supported. Most Significant Word transmitted first.
Integer 32 bits offset	Offset applied to register, timer and counter for access in 32 bits integer format. See also comment below.
Floating-point format	Format option for the support of the floating point format.
- No Fp	Floating point not supported.

- Little Endian	Floating point supported. Lower Significant Word transmitted first. Format used by Modicon. Note that the byte order is always MSB first.
- Big Endian	Floating point supported. Most Significant Word transmitted first.
Floating-point offset	Offset applied to register for access in floating point format. See also comment below.
	-----[Display of received telegrams]-----
Function	Last received Function. For F23 , see below.
Base address	Last received Base address.
File address	Last received File address.
Number of elements	Last received Number of elements.
Request received	Number of received Requests.
Application error	Last error detected by the application layer.
Modbus error	Last Modbus error returned to the master.
Error counter	Number of detected errors since last clearing.

Application Error Codes

Code	Message	Description	
0	OK	No error	
30	Function	Function not supported	
32	Nb of Data	Number of data to high	
33	Address	Addess out of range	
34	Data	Invalid data (with F5)	
35	Fnc File	Invalid reference type or sub-request (with F20 & F21)	
36	Rejected	Rejected by a map Fbox	
90..99	<90>..<99>	Internal error.	

Modbus Error Codes

Modbus error are returned to the master using the modbus exception replay.

Code	Message	Description	
0	OK	No error	
1	Function	Function not supported	
2	Address	Invalid address	
3	Data	Invalid data	
4	Slv Fail	not used	
5	Ack	not used	
6	Busy	not used	
7	Nack	not used	

Further comments

Reject not mapped requests : This option allows to reject requests that have not been mapped by an Map Slave Fbox placed before the Slave Application Fbox. It allows to protect some access in a simple way. Different options are available to support typical protection principles.
None = No requests are rejected by default. If no Map Fbox is used all requests to a valid media range are executed. Request already defined as rejected by a Map Fbox will still be rejected.
All = Any request that is not mapped will be rejected. In this case, the use of Map Slave Fbox is mandatory to allow each access needed for the master.
All Write = Any write request that is not mapped will be rejected. This option allows you to simply protect your application and reject any write access by the master. All read access are still accepted without the need to define each of them.
Write dynamics = All write access to dynamic ranges are rejected. This is a safe mode if you want to allows write access without the need to map each write request. Dynamic ranges are used for internal variables and should normally not be written by an external system.
Note that in any cases, requests to a sub range of a mapped range is also accepted. E.g. write to a single element in a mapped range of 100 registers.

F23 : The function 23 execute a Write and a Read access in the same transaction. The base address and the number of elements show the parameter of the Write access. The base address of the Read access is shown as File address. The number of element is not displayed.

Integer 32 bits format : By default, the Modbus telegrams transmit 16 bits packages. The received or requested values are mapped as 16 bits packages in PCD registers. To tell the driver to read and write 32 bits packages into PCD registers, the Master must extend the address by the specified offset. For instance, if offset is set to 10'000, to read and write 32 bits values in register 123, the master must read and write to address 10'123. For DB access using functions 20 and 21, the offset must be applied on the register address (DB element).
The floating point offset is checked first and win on the 32 bits offset. Therefore, the offset for the 32 bits integer must be lower than the offset for float format.

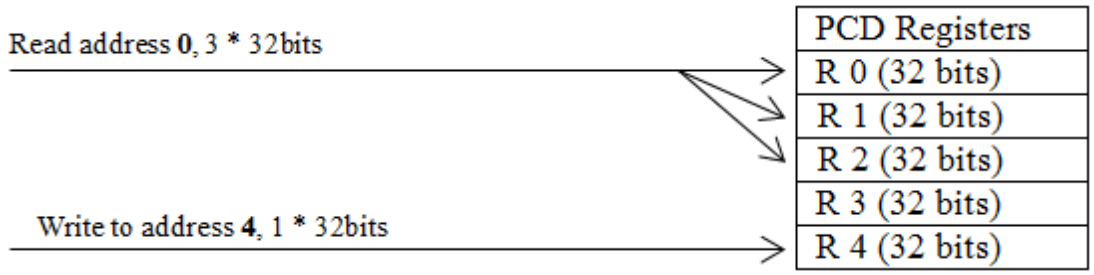
Floating point format : Usually Modbus Master transmit floating point values in IEEE format. The PCD registers use a Motorola floating format. Therefore, the values must be converted by the driver on reception and before transmission. To tell the driver to convert IEEE values to the PCD float format, the Master must extend the address by the specified offset. For instance, if offset is set to 20'000, to read and write floating point values in register 456, the master must read and write to address 20'456. For DB access using functions 20 and 21, the offset must be applied on the register address (DB element).
The floating point offset is checked first and win on the 32 bits integer offset. Therefore, the offset for the float format must be higher than the offset for 32 bits integer.

Note that Integer 32 bits format and Floating point registers can also be defined using the Map Slave Fbox. In this case, the address offset don't need to be added by the Master.

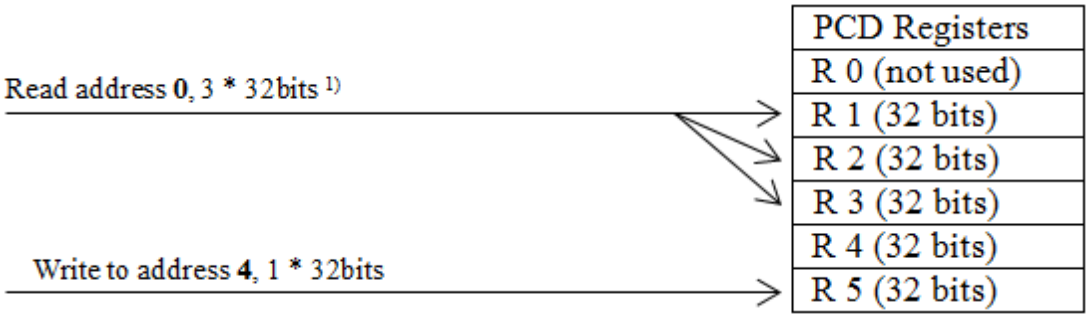
Address Offset
The PCD registers have 32 bits and the address range start at 0. but this is not the case of all PLCs and Modbus master may have a different register mapping. One common case is when the register range start with 1 the address in the Modbus request is shifted by 1. In this case, use the option Offset = 1.

For 32 bits integers and floats, some PLCs use a double register, thus occupying 2 addresses for one 32 bits values. Furthermore, when the master emulates its own address range according to a device using 2 addresses for a 32 bits value, a write function on a single register may not reach the expected PCD register. In this case, you can use the option Offset = 1+2*i. For more special cases, you must use the Map Slave Fbox.

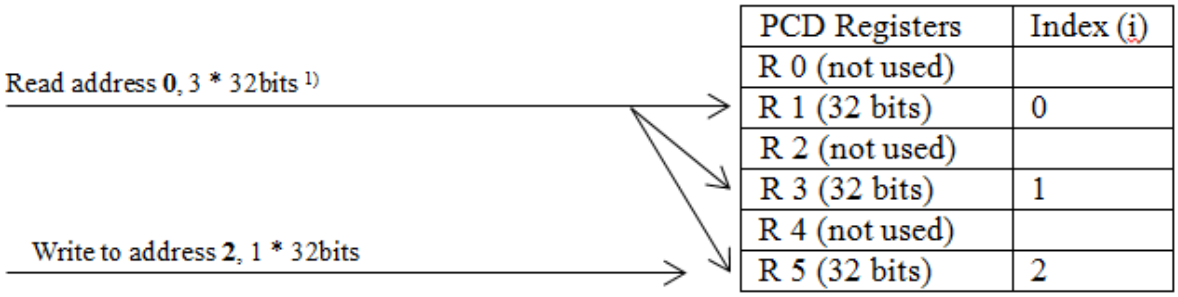
Example for Offset = 0 (Saia)



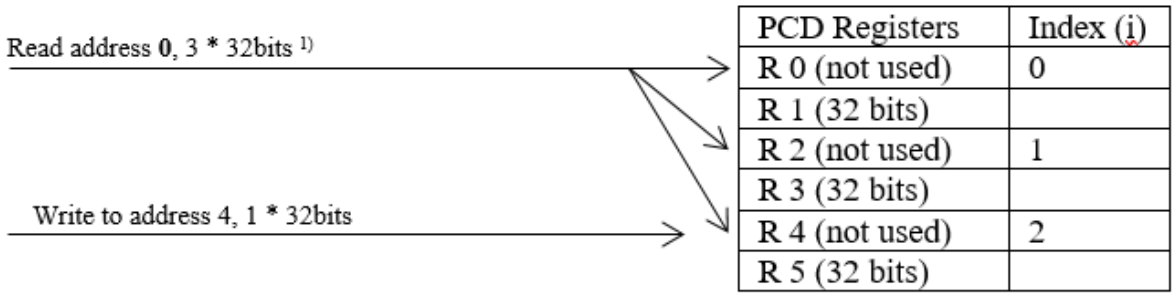
Example for Offset = 1 (Modicon)



Example for Offset = 1+2*i (Modicon) 2)



Example for Offset = 0+2*i (since V 2.7.679) 2)

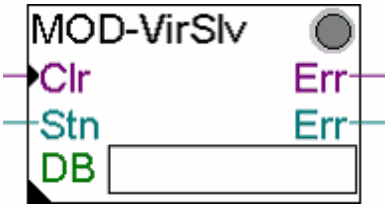


1) Depending on used notation in the master device, requests to address 0 may already be shown as address 1 (or even 40'001).

2) The 2*i address extension applies only for 32 bits Read/Write access.
For 16 bits access (without Integer 32 bits or Float 32 bits offset) the i*2 extension does not apply.

The option '2*i' is equivalent to the option 'Emulate 16 bit addressing' in the Map Slave Fbox. Don't use both at the same time.

6.7 Virtual Slave



This Fbox define a Modbus Slave application in the PCD supporting a definable array of virtual registers. The values are actually store in a DB in the PCD but are accessed like registers from the Master system with functions 3, 6 and 16. It allows to use the big DB memory of the PCD and to keep registers free for other tasks. Systems not able to read and write into DB can also read this DB like registers. The Fbox can be combined with a standard application but will get another slave address. Therefore it look like a virtual slave beside the standard PCD responding as Slave. Several such Fbox can even be used. Each of them must have its own DB and slave address.

Example: The PCD slave is defined as slave address 1 and support the standard slave application. A DB of 1000 elements is defined as virtual slave and has the slave address 2. The master can access the 4096 standard registers on slave 1 and 1000 other registers using the slave address 2.

The Slave Link Function must be programmed before the Slave Application. The slave address must be in the range of the address supported by the Slave Link.

Input / Output / LED

Clr	Clear	Allows to clear the error diagnostic.
Stn	Station	Define the station number when the option 'External' is selected. Otherwise, the input value is ignored.
Err	Error detected	The binary Err output indicates that an error has been detected.
Err	Error code	The numeric Err output indicate the code of the last detected error
DB	Data Block	Address of the DB used to store the virtual registers. See below.

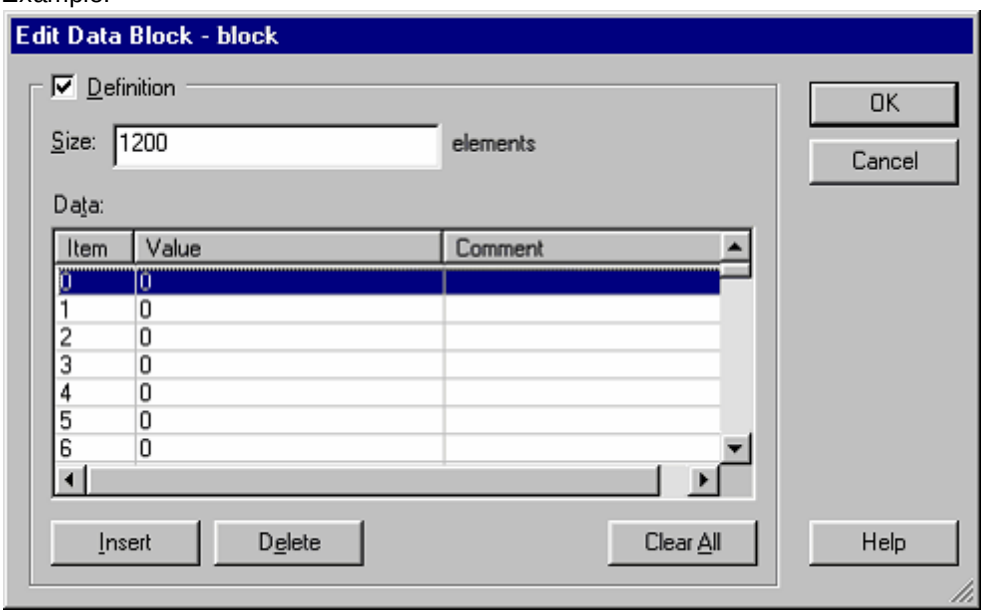
Parameters

Option station number	Option for the Slave station number.
- Extern	The station number is defined by the Stn input. Only one Modbus station is supported.
- Intern	The station number is defined by the address specified in the Fbox.
Station number	Station number for the standard application.
Address offset	Offset between telegram addresses and PCD addresses.
- 0 (SAIA)	Addressing acc. to SAIA.
- 1 (Modicon)	Addressing acc. to Modicon.
Integer 32 bits format	Format option for the support of 32 bits integer format.

- No 32 bits	bits integer not supported.
- Little Endian	bits integer supported. Lower Significant Word transmitted first. Format used by Modicon. Note that the byte order is always MSB first.
- Big Endian	bits integer supported. Most Significant Word transmitted first.
Integer 32 bits offset	Offset applied to register, timer and counter for access in 32 bits integer format.
Floating-point format	Format option for the support of the floating point format.
- No Fp	Floating point not supported.
- Little Endian	Floating point supported. Lower Significant Word transmitted first. Format used by Modicon. Note that the byte order is always MSB first.
- Big Endian	Floating point supported. Most Significant Word transmitted first.
Floating-point offset	Offset applied to register for access in floating point format.
	-----[Display of received telegrams]-----
Function	Last received Function.
Base address	Last received Base address.
File address	Last received File address.
Number of elements	Last received Number of elements.
Request received	Number of received Requests.
Application error	Last error detected by the application layer.
Modbus error	Last Modbus error returned by the link layer.
Error counter	Number of detected errors since last clearing.

The DB must be defined in RAM in order to write into it. Don't forget to check also the location of the RAM DB in the dynamic distribution of the project manager. The DB size will define the amount of virtual register available.

Example:



Application Error Codes

Code	Message	Description	
0	OK	No error	
30	Function	Function not supported	
32	Nb of Data	Number of data to high	
33	Address	Addess out of range	
34	Data	Invalid data (with F5)	
35	Fnc File	Invalid reference type or sub-request (with F20 & F21)	
36	Rejected	Rejected by a map Fbox	
90..99	<90>..<99>	Internal error.	

Modbus Error Codes

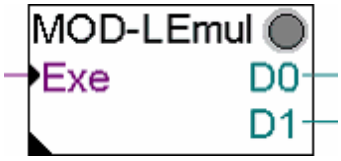
Modbus error are returned to the master using the modbus exception replay.

Code	Message	Description	
0	OK	No error	
1	Function	Function not supported	
2	Address	Invalid address	
3	Data	Invalid data	
4	Slv Fail	not used	
5	Ack	not used	
6	Busy	not used	
7	Nack	not used	

Other Functions

7 Other Functions

7.1 Link Emulator



This function is only used for tests. It replaces the function of an external Master and the Modbus Slave Link. It allows to manually access directly a standard application or a gateway function.

Sub-Topics

8 Sub-Topics

8.1 FB Calls for IL Programs

Since version 2.5.030, FB calls are available for IL programming of a Modbus master application.

In fact, the first part of the programming including the Master Link and the Station definitions is still made in a Fupla file. The Send and the Receive functions can then be realized in an IL program or in IL code in Steps and Transitions of a Graftec program.

Don't forget that some internal check and security mechanisms are not anymore possible with these FB calls. Therefore, an IL programmer must take care at the correctness of it program structure and invest more debugging time in case of malfunction.

The FBs and some useful elements are published as system symbols in the **S.NgbMod** group (NgbMod stand for Engiby Modbus). From this main group subgroups will be found with the name of the MasterLink Fbox and further extended with the name of each Station Fboxes.
The general structure of these symbols will be
S.NgbMod.<master_link>.<symbol>
or
S.NgbMod.<master_link>.<slave_station>.<symbol>
with

S.NgbMod	Fixed part
<master_link>	Name of the Master Link Fbox
<slave_station>	Name of Slave station Fbox
<symbol>	Symbol name

List of published symbols

Symbol	Type	R/W	Description
S.NgbMod.ModMst.fb_binary	FB		Send or Receive binary elements
S.NgbMod.ModMst.fb_numeric	FB		Send or Receive numeric elements
S.NgbMod.ModMst.fb_numeric23	FB		Send and Receive numeric elements supporting function 23 (Write/Read). Use this FB only for function 23.
S.NgbMod.ModMst.ModStn.enable	F	R	Internal enable state of the station. This signal is Low if the station is disabled and during reconnect time after an error.
S.NgbMod.ModMst.ModStn.connect	F	R	Shows the connect state of the station.
S.NgbMod.ModMst.ModStn.station	K		Slave station number as defined in the Slave station Fbox.
S.NgbMod.ModMst.ModStn.ipnode	K		IP node or IP address o the slave station as defined in the Slave station Fbox.
S.NgbMod.ModMst.ModStn.error	R	R/W	Last error code caused by the station. The error is not self cleared in case of good communication.

FB calls and parameters

FB / Parameter	Type	Description
S.NgbMod.ModMst.fb_binary	FB	FB Call for Tx/Rx Binary
Par 1	F	Busy flag
Par 2	F	Command flag

Par 3	I/O/F	Base address in master (Flag/Input/Output).
Par 4	R/K	Number of elements
Par 5	R/K	Slave, IP-Node
Par 6	R/K	Slave, Modbus station
Par 7	K	Multicast option. K 0 if not needed
Par 8	K	Multicast delay. K 0 if not needed
Par 9	R/K	Modbus function to execute
Par 10	R/K	Element, base address in slave
Par 11	F	Error flag. 0=Terminated without error. 1=Terminated with error, see error register.
Par 12	F	Update flag. 1=Values updated in PCD.
Par 13	R/K	Instance ID. Free code for internal debugging. K 0 id not used.

FB / Parameter	**Type**	**Description**
S.NgbMod.ModMst.fb_numeric	FB	FB Call for Tx/Rx Numeric (Integer and Float)
Par 1	F	Busy flag
Par 2	F	Command flag
Par 3	R	Register, base address in master.
Par 4	R/K	Number of elements
Par 5	K	Local addressing 0=Direct/1=Indirect
Par 6	R/K	Slave, IP-Node
Par 7	R/K	Slave, Modbus station
Par 8		Endianness 32 bits Integer (K 0=Default)
Par 9		Endianness 32 bits Float (K 0=Default)
Par 10	K	Multicast option. K 0 if not needed
Par 11	K	Multicast delay. K 0 if not needed
Par 12	R/K	Modbus function to execute
Par 13	R/K	Value format and conversion. See below.
Par 14	R/K	Element, base address in slave
Par 15	R/K	File address. K 0 if not used.
Par 16	F	Error flag. 0=Terminated without error. 1=Terminated with error, see error register.
Par 17	F	Update flag. 1=Values updated in PCD.
Par 18	K/R	Instance ID. Free code for internal debugging. K 0 id not used.

FB / Parameter	**Type**	**Description**
S.NgbMod.ModMst.fb_numeric23	FB	FB Call for Tx/Rx Numeric (Integer and Float) for function 23
Par 1	F	Busy flag
Par 2	F	Command flag
Par 3	R	Send, Register, base address in master.
Par 4	R/K	Send, Number of elements
Par 5	R	Receive, Register, base address in master.
Par 6	R/K	Receive, Number of elements
Par 7	K	Local addressing 0=Direct/1=Indirect
Par 8	R/K	Slave, IP-Node

Par 9	R/K	Slave, Modbus station
Par 10	K	Endianness 32 bits Integer (K 0=Default)
Par 11	K	Endianness 32 bits Float (K 0=Default)
Par 12	K	Multicast option. K 0 if not needed
Par 13	K	Multicast delay. K 0 if not needed
Par 14	R/K	Modbus function to execute
Par 15	R/K	Value format and conversion. See below.
Par 16	R/K	Send Element, base address in slave
Par 17	R/K	Receive Element, base address in slave
Par 18	F	Error flag. 0=Terminated without error. 1=Terminated with error, see error register.
Par 19	F	Update flag. 1=Values updated in PCD.
Par 20	K/R	Instance ID. Free code for internal debugging. K 0 id not used.

If you have installed more than one driver, it is important to use the corresponding FBs. Different symbols are published for each driver!

Modbus function

You should find the functions to use, and the available addresses in the manual of the slave device. You can consult the functions supported by the Modbus Slave driver as implemented in this library but remember that the implementation is manufacturer specific.

Code for Endianness

Code	Endianness	Description
0	Default	The default format defined in the Master Driver applies
1	Little Endian	Endianness forced to Little Endian
2	Big Endian	Endianness forced to Big Endian (swapped)

Code for value format and conversion

Code	Direction	Format	Description
0	Rcv	16 -> 32	Normal Modbus format for a Receive function. The 16 bits values are considered as signed values and converted into 32 bits signed integer for PCD.
1	Send	32 -> 16	Normal Modbus format for a Send function. Only the 16 bit values are supported. From a 32 bits PCD register only the lower 16 bits are sent. check with the partner if the values are considered as signed or unsigned. Range for signed values : 0 to 65535. Range for unsigned values : -32766 to 32768.
2	Rcv+Send	32 -> 32	All 32 bits of PCD registers are Send/Received. The effective Modbus request is extended with the double of Modbus elements.
3	Rcv	16US->32	The 16 bits values are considered as unsigned values. The higher 16 bits of the PCD register are always set to 0.

4	Send	32->16US	The PCD register is supposed to be a 16 bits unsigned value. Only the lower 16 bits are sent. Range : 0 to 65535 Note that the fact to consider the sent value as signed or unsigned is the task of the partner device.
5	Rcv+Send	32 bits, Byte-Swapped	For sending a 32 bits value (as with code 2), but the byte order is inverted. Note that word swapping is global option of the driver Fbox.
6	Rcv	16 bits, Byte-Swapped	For receiving a 16 bits value (as with code 0), but the byte order is inverted.
7	Rcv	16US, Byte-Swapped	For receiving an unsigned 16 bits value (as with code 3), but the byte order is inverted.
8		Reserved	
9	Rcv+Send	Float 32	Standard format for float values. The received values are supposed to be in IEEE format and are converted into the PCD format (FFP Motorola). The sent values are converted from PCD float format into IEEE format.
10	Rcv Send	Float*10 -> Int Int -> Float/10	This code is supported for compatibility. It is equivalent to the code 21. See below.
20	Rcv Send	Float -> Int Int -> Float	The received values are supposed to be in IEEE format and are converted into integer. The sent values are supposed to be in integer and are converted into IEEE format.
21	Rcv Send	Float*10 -> Int Int -> Float/10	The received values are supposed to be in IEEE format and are converted into integer with factor 10. E.g. float value 123.4 is converted into 1234 (integer). Value 1.234 is converted into 12 (lower digits are lost). The sent values are supposed to be in integer and are converted into IEEE format with factor 1/10. E.g. value 5678 (integer) is converted into 567.8 (IEEE).
22	Rcv Send	Float*100 -> Int Int -> Float/100	Similar as above, with factor 100.
23	Rcv Send	Float*1000 -> Int Int -> Float/1000	Similar as above, with factor 1000.

Principle of the FB calls

To execute a Send or a Receive you must program an FB call (binary or numeric). The FB must be called a first time with the command bit to High and then called cyclically until the busy flag is reset. After this, you can check the error flag to know if the transaction has correctly been executed. In case of error you can also check the error code in the corresponding register.

If you want to stop communication with during the reconnect time handled by the Station Fbox, check also the corresponding Enable flag.

Example of typical FB calls

```
;-------------------------------------------------------
;Reading of 100 binary elements
;From slave 1, address 200 to 299
;Into PCD Flags 300 to 399
;Setting flag 100 start execution
;-------------------------------------------------------
   STH   F 100      ;Command flag set
   ANH   S.NgbMod.ModMst.ModStn.enable ;And station enabled
   ORH   F 101      ;Call while busy
   CFB   H S.NgbMod.ModMst.fb_binary ;Call FB for Tx/Rx Binary
         F 101      ;Busy flag
         F 100      ;Command flag
         F 300      ;Base address Master
         K 100      ;Number of elements
         K 0        ;Slave IP-Node (not used in RS)
         K 1        ;Slave station
         K 0        ;Multicast option (0=not used)
         K 0        ;Multicast delay (0=not used)
         K 1        ;Function type. 1=Read bits
         K 200      ;Base address Slave
         F 102      ;Error flag
         F 103      ;Update flag
         K 1        ;FB call ID

;-------------------------------------------------------
;Reading of 10 numeric elements
;From slave 1, address 300 to 309
;Into PCD Registers 400 to 409
;Setting flag 110 start execution
;-------------------------------------------------------
   STH   F 110      ;Command flag set
   ANH   S.NgbMod.ModMst.ModStn.enable ;And station enabled
   ORH   F 111      ;Call while busy
   CFB   H S.NgbMod.ModMst.fb_numeric ;Call FB for Tx/Rx Integer
         F 111      ;Busy flag
         F 110      ;Command flag
         R 400      ;Base address Master
         K 10       ;Number of elements
         K 0        ;Local addressing (0=Direct)
         K 0        ;Slave IP-Node (not used in RS)
         K 1        ;Slave station
         K 0        ;Endianness 32 bits Integer (K 0=Default)
         K 0        ;Endianness 32 bits Float (K 0=Default)
         K 0        ;Multicast option (0=not used)
         K 0        ;Multicast delay (0=not used)
         K 3        ;Function type. 3=Read registers
         K 0        ;Value format (16->32 bits)
         K 300      ;Base address Slave
```

```
K 0         ;File address (not used with function 3)
F 112       ;Error flag
F 113       ;Update flag
K 99        ;FB call ID
```

Note that you can also use the symbols **S.NgbMod.ModMst.ModStn.ipnode** and **S.NgbMod.ModMst.ModStn.stati**

When programming in Graftec, you can put the FB call in a transition and test the command flag as transition condition. The transition and the FB call will be repeated until the command flag is reset.

Example / Step before the FB call

```
ACC   H
SET   F 110       ;Set Command flag
```

Transition with FB call

```
CFB   H S.NgbMod.ModMst.fb_numeric
   F 111      ;Busy flag
   F 110      ;Command flag
   ...see example above...
STL   F 110   ;Repeat until command ended
```

8.2 Public Line Modem

The library supports PLM in combination with the Standard SAIA Modem Library.
At least the following versions must be used:
Modbus 2 Library: 2.0.004
SAIA Modem Library: V 2.1.400

The calling station must be Modbus Master and the PCD with Modbus Slave will be the responding station. Both RTU and ASCII protocol are supported.

The Hardware type in the Modbus Slave Link Fbox must be set to 'RS232 / PLM'.

The SASI-Modem Fbox of the Standard Modem Library must be placed before the Modbus Slave Link Fbox. In the SASI-Modem, the standby mode must be set to 'C-Mode'. Select the same channel number in the Modbus Slave Link and in SASI-Modem.

Important notes:
The transmission speed and the bit settings of the SASI-Modem is used. The transmission speed and the bit settings of the Modbus Link Fbox are ignored.

The Modbus RTU protocol needs to transmit 8 bits characters. If the modem does not support 10 bits characters, the bits setting should be 8-N-1 with RTU protocol. The ASCII protocol can work with 7 or 8 bits.

This page is intentionally left blank.
Remove this text from the manual
template if you want it completely blank.

NG-Configurator

9 NG-Configurator

9.1 Installation

Installation of the Engiby Configurator

This description is valid for the Engiby Configurator version 2.2.xxx

The Modbus Master library versions 2.8.xxx is designed to be used with the Engiby Configurator, called NG-Configurator. This tool is used with the Modbus library but can also be used with other libraries. Therefore, you should install a new version only.

If you have an old Engiby Configurator installed, proceed as follow:

1. Uninstall the old version using the Windows installation function.
2. Proceed as described below for the new installation.

If you already have the correct version or even a new version of the NG-Configurator, skip this installation.

To install the Configurator, start the Setup program and follow the instructions.

We assume that the PG5 utility and MS-Excel are correctly installed on the PC. If it is not the case you must install these components before to be able to use the Configurator.

During installation you will have the possibility to register it as Add-On Tool in PG5. The registration in PG5 is ended the next time PG5 starts.

Once installed and registered, you will start the configurator from PG5 by creating a NG-Configurator file in the project. Use the New command, give a file name and select the File Type NG-Configurator.

The Help of the Configurator will give you more details about its general working principle.

See now the Working Principle and Use of the Library

9.2 Working Principle and Use of the Library

The use of NG-Configurator with Modbus 2 library requires the minimum PG5 version 2.1.xxx.

We assume that MS-Excel as well as the NG-Configurator are installed and registered in PG5. If not yet done, see the installation instructions.

To create your Modbus 2 NG-Configurator application, add a new file in the CPU and select the file type NG-Configurator. When the configurator starts, it will propose to create a new configuration file base on a template. Select the application Modbus 2 NG-Configurator. A default file is created.

The library 'Modbus 2 NG-Configurator' is intended to be used only with the Modbus Master function. The Master Link FBox and the Slave Station Fbox need to be placed and configured in a Fupla File. The configuration file for NG-Configurator can replace only the SEND and RCV FBoxes. It is still possible to use the SEND/RCV Fboxes in parallel in a Fupla file.

The Excel file has two useful sheets. The Rcv sheet is made to configure Read telegrams while the Send sheet is made made to configure Write telegrams.

9.3 Rcv Sheet

See first the topic Working Principle and Use of the Library

The Rcv sheet is made to configure Read telegrams. Each Excel line defines one Modbus telegram (except the BUFFER function).

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	CLC	Mode	Master	Enable	Function	Address	Scope	Count	Format	FromStation	FromAddress	Error	Update
2													
3		Examples											
4	E	Single	ModMst	Enable01	3	Symbol01	Public	1	16To32	ModStn	200	ErrFlag1	
5	E	Single	ModMst	Enable02	3	Symbol02	External	3	FloatToInt, 3	ModStn	201		
6	E	Cyclic	ModMst	F 10	1	F 203		5		ModStn	1000	F 11	F 12
7													
8	E	Cyclic	ModMst		3	BUFFER		8		ModStn	100		
9	E				BUFFER	Symbol03	Public		16To32		100		
10	E				BUFFER	Symbol04	External		Float		104		
11	E				BUFFER	R 300			FloatToInt, 0		106		
12													

Column name	Definition	Possible parameter / Comments
CLC	Groups selection for NG-Configurator compilation.	
Mode	Execution type. This parameter works with the 'Enable' cell. Cyclic: The transmission is executed as long as the 'Enable' flag is set. Single: The transmission is executed once on positive edge of the 'Enable' flag. Selfreset: The transmission is executed once and the 'Enable' flag is reset.	Cyclic / Single / Selfreset
Master	The name of the 'Master Link' FBox.	
Enable	Flag or Input to start the execution of the transmission. It can be left empty only if the Mode = Cyclic. The transmission is then permanent.	Depending on the Scope, it can be: - (left empty) - an absolute address - a symbol name (array not allowed) Read the Scope section below for more information. Type F or I.
Function	Modbus function. Check the page Functions supported by the Master for more information.	For receiving transmissions: 1, 2, 3, 4, 7 or BUFFER

	The function 23 Read/Write is not supported. See this topic for the BUFFER function	
Address	Variable base address on the Master. For the Send sheet, You can also send a constant value. See below.	Depending on the Scope, it can be: - an absolute address - a symbol name (array not allowed) Read the Scope section below for more information.
Scope	Define the scope for all used symbols (Enable, Address, Error and Update). If the Scope is left empty, you must give absolute addresses or Global symbols to these variables. If the Scope is External, the symbols of these variables have to be defined and published in another file. If the Scope is Public, the symbols of these variables will be defined and published by NG-Configurator.	The Scope can be : - (left empty) - External - Public
Count	Define the number of consecutive variables to be transmitted. If the 'Scope' is empty or External, be sure that the following addresses are reserved for this transmission, according to the 'Count'. If the 'Scope' is Public, the newly defined symbol is an array with the size of the 'Count'.	A number greater or equal to 1. Max values for numeric functions = 127. Max values for binary functions = 2040. Max values if address is a constant = 1.
Format	If the data to transmit is a flag, this cell must be left empty. If the data to transmit is 16 bits or 32 bits, you need to specify the format conversion. Check the table "Code for value format and conversion" on the page FB Calls for IL Programs for more information. Take care, not every format conversions are implemented in the NG-Configurator library. Formats to extract Bits from registers: See below.	Empty (Send/R 16To32 (Rcv) 32To16 (Send) 32To32 (Send/R 16usTo32 (Rcv) 32To16us (Send) Float (Send/R FloatToInt (Rcv) FloatToInt, 0 (Rcv) FloatToInt, 1 (Rcv) FloatToInt, 2 (Rcv) FloatToInt, 3 (Rcv) IntToFloat (Send) IntToFloat, 0 (Send) IntToFloat, 1 (Send) IntToFloat, 2 (Send) IntToFloat, 3 (Send)
FromStation	The name of the 'Slave Station' FBox.	
FromAddress	Variable base address on the Slave.	A number greater or equal to 0.
Error	Flag or Output to retrieve the error status of the transmission. 0 = Terminated without error.	Depending on the Scope, it can be: - (left empty) - an absolute address

	1 = Terminated with error. For more information about the error, check the adjust window of the FBox Master Link and Slave Station. This cell is optional. You can leave it empty.	- a symbol name (array not allowed) Read the Scope section above for more information. Type F or O.
Update	The specified flag is set to 1 when values are updated in PCD variable(s). You can reset the flag to detect the next reception of values without error. This cell is optional. You can leave it empty.	Depending on the Scope, it can be: - (left empty) - an absolute address - a symbol name (array not allowed) Read the Scope section above for more information. Type F or O.

9.4 Send Sheet

See first the topic Working Principle and Use of the Library

The Send sheet is made to configure Write telegrams. Each Excel line defines one Modbus telegram.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	CLC	Mode	Master	Enable	Function	Address	Scope	Count	Format	Delta	ToStation	ToAddress	Error
2													
3		Examples											
4	E	Single	ModMst	F 100	16	R 100		1	32To16		ModStn	200	F 200
5	E	Auto	ModMst	F 105	16	R 105		5	32To16	5	ModStn	205	F 201
6	E	Single	ModMst	F 110	16	R 110		3	IntToFloat, 3		ModStn	210	F 202
7	E	Auto	ModMst	F 115	16	R 115		3	Float	0.5	ModStn	20215	F 203
8	E	Cyclic	ModMst	F 120	5	F 150		1			ModStn	1000	F 204
9	E	Auto	ModMst	F 125	15	F 155		8			ModStn	1005	F 205
10													

Column name	Definition	Possible parameter / Comments
CLC	Groups selection for NG-Configurator compilation.	
Mode	Execution type. This parameter works with the 'Enable' cell. Cyclic: The transmission is executed as long as the 'Enable' flag is set. Single: The transmission is executed once on positive edge of the 'Enable' flag. Selfreset: The transmission is executed once and the 'Enable' flag is reset. Auto: The transmission is executed when a change of a value is detected and Enable is high. See also 'Delta' below.	Cyclic / Single / Selfreset / Auto
Master	The name of the 'Master Link' FBox.	
Enable	Flag or Input to start the execution of the transmission. It can be left empty only if the Mode = Cyclic. The transmission is then permanent.	Depending on the Scope, it can be: - (left empty) - an absolute address - a symbol name (array not allowed)

		Read the Scope section below for more information. Type F or I.
Function	Modbus function. Check the page Functions supported by the Master for more information. The function 23 Read/Write is not supported.	For the sending transmission: 5, 6, 15 or 16
Address	Variable base address on the Master. For the Send sheet, You can also send a constant value. See below.	Depending on the Scope, it can be: - an absolute address - a symbol name (array not allowed) Read the Scope section below for more information.
Scope	Define the scope for all used symbols (Enable, Address, Error and Update). If the Scope is left empty, you must give absolute addresses or Global symbols to these variables. If the Scope is External, the symbols of these variables have to be defined and published in another file. If the Scope is Public, the symbols of these variables will be defined and published by NG-Configurator.	The Scope can be : - (left empty) - External - Public
Count	Define the number of consecutive variables to be transmitted. If the 'Scope' is empty or External, be sure that the following addresses are reserved for this transmission, according to the 'Count'. If the 'Scope' is Public, the newly defined symbol is an array with the size of the 'Count'.	A number greater or equal to 1. Max values for numeric functions = 127. Max values for binary functions = 2040. Max values if address is a constant = 1.
Format	If the data to transmit is a flag, this cell must be left empty. If the data to transmit is 16 bits or 32 bits, you need to specify the format conversion. Check the table "Code for value format and conversion" on the page FB Calls for IL Programs for more information. Take care, not every format conversions are implemented in the NG-Configurator library. Formats to extract Bits from registers: See below.	Empty (Send/R 16To32 (Rcv) 32To16 (Send) 32To32 (Send/R 16usTo32 (Rcv) 32To16us (Send) Float (Send/R FloatToInt (Rcv) FloatToInt, 0 (Rcv) FloatToInt, 1 (Rcv) FloatToInt, 2 (Rcv) FloatToInt, 3 (Rcv) IntToFloat (Send) IntToFloat, 0 (Send) IntToFloat, 1 (Send) IntToFloat, 2 (Send) IntToFloat, 3 (Send)

Delta	For mode = Auto. Minimum delta between last transmitted value and actual value to send the telegram. Always all values are sent even if only one has changed. For Binary functions: left empty For Integer format: enter a positive integer value For Float format: enter a positive float value (with decimal point) The format of the value in the PCD is relevant to chose a integer or float format for delta. For float values, maximum 3 digits of the delta value are used.	For Integer : 1 to 1'000'000 For Float : 0.001 to 1'000'000 (max 3 decimals)
ToStation	The name of the 'Slave Station' FBox.	
ToAddress	Variable base address on the Slave.	A number greater or equal to 0.
Error	Flag or Output to retrieve the error status of the transmission. 0 = Terminated without error. 1 = Terminated with error. For more information about the error, check the adjust window of the FBox Master Link and Slave Station. This cell is optional. You can leave it empty.	Depending on the Scope, it can be: - (left empty) - an absolute address - a symbol name (array not allowed) Read the Scope section above for more information. Type F or O.
Update	For RCV Sheet only. Set to 1 when values are updated in PCD variable(s). You can reset the flag to detect the next reception of values without error. This cell is optional. You can leave it empty.	Depending on the Scope, it can be: - (left empty) - an absolute address - a symbol name (array not allowed) Read the Scope section above for more information. Type F or O.

Send a constant value

As to send a constant value, proceed as follow:
- Define the constant value to send in the field Address.
- Specify 1 in the field Count
- Specify the keyword 'Constant' in the field Format.

The value cannot be a public or external symbol. The Scope is ignored for the Address in this case.

It is useful for instance, if you must set a bit to 1 to execute a function in the partner device.
You will use the Enable flag with the mode 'Selfreset' to execute the sending of the command and always send the constant value 1.

9.5 Buffer Function

Introduction:

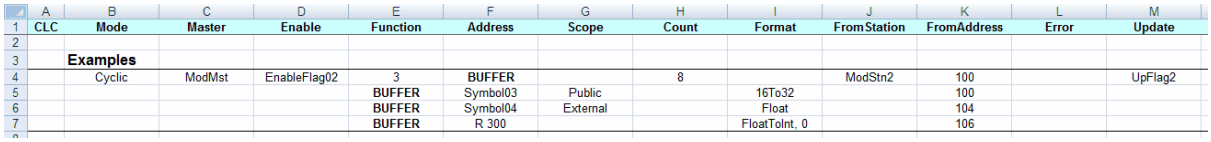
The buffer function is available only for the receiving transmission, on the 'Rcv' sheet.

The buffer function is very efficient in case you have a lot of data to retrieve from the Slave and they are not placed consecutively in the Slave memory. The retrieving is done in one single transmission, then the data you need are transferred directly in the variables you specify.

Description:

This function is configured in two steps.

The first step is:
The definition of the transmission. Excel line 4.
The method is similar to the standard transmission described in the page Rcv and Send Sheet except for the three cells described here under.



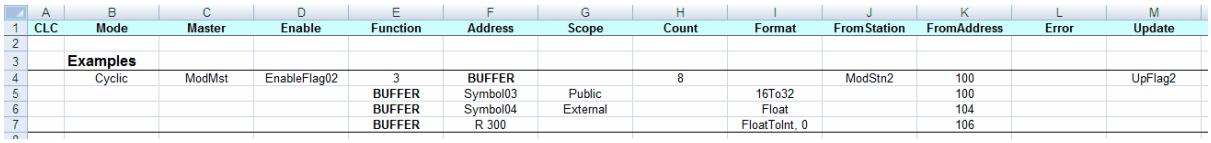
	A	B	C	D	E	F	G	H	I	J	K	L	M
1	CLC	Mode	Master	Enable	Function	Address	Scope	Count	Format	FromStation	FromAddress	Error	Update
2													
3		Examples											
4		Cyclic	ModMst	EnableFlag02	3	BUFFER		8		ModStn2	100		UpFlag2
5					BUFFER	Symbol03	Public		16To32		100		
6					BUFFER	Symbol04	External		Float		104		
7					BUFFER	R 300			FloatToInt, 0		106		

Column name	Possible parameter
Address	Must contain the word "BUFFER".
Scope	Must be left empty.
Format	Must be left empty.

Obviously the cells 'Count' and 'FromAddress' must cover every Slave address you want to retrieve.
In this example:
'Count' = 8
'FromAddress' = 100
The addresses range goes from 100 to 107.

The second step is:

The "distribution" of the received data. Excel line 5, 6 and 7.



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	CLC	Mode	Master	Enable	Function	Address	Scope	Count	Format	FromStation	FromAddress	Error	Update
2													
3		Examples											
4		Cyclic	ModMst	EnableFlag02	3	BUFFER		8		ModStn2	100		UpFlag2
5					BUFFER	Symbol03	Public		16To32		100		
6					BUFFER	Symbol04	External		Float		104		
7					BUFFER	R 300			FloatToInt, 0		106		

Column name	Definition	Possible parameter
CLC	Groups selection for NG-Configurator compilation.	
Mode		Must be left empty.
Master		Must be left empty.
Enable		Must be left empty.

Function	Must contain the word "BUFFER".	BUFFER
Address	Variable address on the Master. It is possible use an absolute address, a existing symbol or a new symbol name to be define. Fill this cell according to the 'Scope' cell.	If the 'Scope' = Empty : An absolute address or a Global symbol. If the 'Scope' = External : An External symbol. If the 'Scope' = Public : The new symbol name will be defined and published.
Scope	Define the scope of the 'Address' cell. More information above.	(Empty), External or Public
Count		Must be left empty.
Format	If the data to receive is a binary (flag), this cell must be left empty. If the data to receive is a register (16 bits or 32 bits), you need to specify a format conversion. Check the table "Code for value format and conversion" on the page FB Calls for IL Programs for more information. Take care, not every format conversions are implemented for the BUFFER function.	Empty (for flags) 16To32 32To32 Float FloatToInt See more options and more details below.
FromStation		Must be left empty.
FromAddress	Variable address on the Slave. Additional information here under.	A number between the range defined by the cells 'Count' and 'FromAddress'.
Error		Must be left empty.
Update		Must be left empty.

Supported Format options

Format	Description
16To32	Convert a 16 bits value into 32 bits considering a signed value. The valid range is -32768 to +32767.
16usTo32	Convert a 16 bits value into 32 bits considering an unsigned value. The valid range is 0 to 65535.
32To32	Convert a 32 bits value into a 32 bits value for a PCD register. Big Endian alignment is assumed. It uses 2 consecutive Modbus addresses.
32To32LE	Convert a 32 bits value into a 32 bits value for a PCD register. Little Endian alignment applies. It uses 2 consecutive Modbus addresses.
Float	Convert a Float value (always 32 bits) from IEEE to PCD float format. Big Endian alignment is assumed. It uses 2 consecutive Modbus addresses.
FloatLE	Convert a Float value (always 32 bits) from IEEE to PCD float format. Little Endian alignment applies. It uses 2 consecutive Modbus addresses.

FloatToInt	Convert a Float value (always 32 bits) from IEEE to integer format. Big Endian alignment is assumed. It uses 2 consecutive Modbus addresses.
FloatToInt, x	Convert a Float value from IEEE to integer as above. The x parameter (separated by a comma) indicates the number of decimal digits to include in the integer value. It is a multiplication factor in power of 10. FloatToInt, 0 (12.53 will be 12) FloatToInt, 1 (12.53 will be 125) FloatToInt, 2 (12.53 will be 1253) FloatToInt, 3 (12.53 will be 12530)
FloatLEToInt FloatLEToInt, x	Convert a Float value (always 32 bits) from IEEE to integer format. Same as above. Little Endian alignment applies.

Additional information

During the second step, you need to specify the cell 'FromAddress'. This parameter is dependant on the cell 'Format'. The formats '**32To32**', '**Float**' and '**FloatToInt**' need 32 bits values. This means that they needs two elements in the range defined by the cells 'Count' and 'FromAddress'.

An example is more explicit. In the following example, the table shows the 'Elements needed' according to the 'Format' chosen. Take care that the elements needed don't overlap each other.
The elements 101, 102 and 103 are not transferred to any register.

Address	Format	Elements needed
Symbol03	16To32 (16 bits)	Elements **100**
Symbol04	Float (32 bits)	Elements **104 and 105**
R 300	FloatToInt, 0 (32 bits)	Elements **106 and 107**

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	CLC	Mode	Master	Enable	Function	Address	Scope	Count	Format	FromStation	FromAddress	Error	Update
2													
3		Examples											
4		Cyclic	ModMst	EnableFlag02	3	BUFFER		8		ModStn2	100		UpFlag2
5					BUFFER	Symbol03	Public		16To32		100		
6					BUFFER	Symbol04	External		Float		104		
7					BUFFER	R 300			FloatToInt, 0		106		

Formats to extract Bits from registers

You can use the Format 'Bit' followed by a comma and a bit number to extract a single bit from a register. The output (field Address) must be a flag.
The bit number must be in range 0 to 15.
Eg.: **Bit,5**

You can use the Format 'BitArray' to extract several bits from a register, always starting from bit 0.
The number of bits to extract is specified in field 'Count' and must be in range 1 to 15.
The output (field Address) must be a flag array with a size of at least the number of bits to extract.

E	F	G	H	I	J	K
Function	**Address**	**Scope**	**Count**	**Format**	**From Station**	**From Address**
BUFFER	R 310			Float		101
BUFFER	R 311			Float		102
BUFFER	R 312			FloatToInt, 2		103
BUFFER	mySymbol	Public		Bit,0		101
BUFFER	myArray	Public	4	BitArray		101

This page is intentionally left blank.
Remove this text from the manual
template if you want it completely blank.

- A -

- B -

- F -

- G -

- H -

- I -

- K -

- L -

- M -

- N -

- P -

- Q -

- R -

- S -

- U -

- V -