Modbus
Remote Communication Protocol for REC 523

Technical Description

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1. Overview of the protocol

The Modbus protocol was first introduced by Modicon Inc. and is widely accepted as a communication standard for industrial device controllers and PLCs. The protocol determines how each controller connected to the Modbus network will recognize a message addressed to it. It also determines the task to be performed and extracts any data or other information contained in the message. If a reply is required, the controller will construct a reply message and send it using the Modbus protocol.

The connection of the master to the slaves can be established either directly or via modems by using the compatible serial interface RS-232C. This interface defines the connector pinouts, the cabling, the signal levels, the transmission baud rates, and the parity checking.

The communication technique used in the Modbus protocol is a master-slave technique. This means that only one device can be the master and initiate transactions, while other devices connected to the network are slaves and can accordingly not initiate any transactions.

A message sent by the master to the slave is called a query (see Fig. 1.-1). The master can address a query to an individual slave or to all slaves (that is, to broadcast). If a query is broadcast, the address code 00 will be used. After the slave has received a query, it will attempt to perform the requested task. If a query has been sent to an individual slave, the slave will send a message (called a response) to the master. If it has been broadcast, however, no response will be sent. The response can be either a normal response (in case of performing the requested task) or an exception response (otherwise).

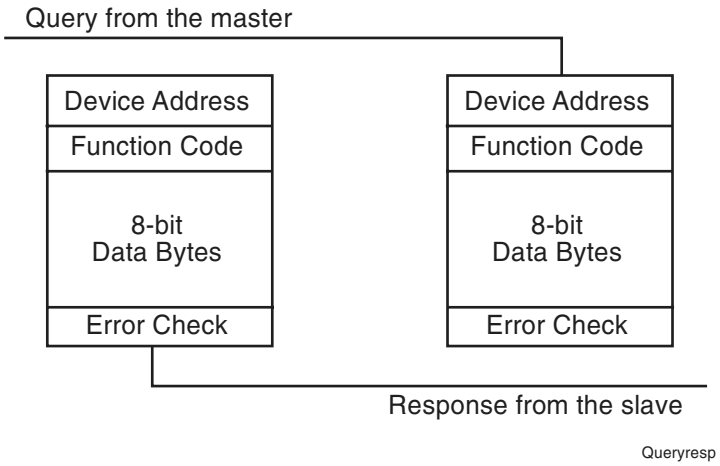


Fig. 1.-1 Query response cycle

The devices in the Modbus protocol are made up of four groups of scan or control points (Digital Inputs, Input Registers, Coils and Holding Registers). Each group consists of either scan or control points, which all have separate 16-bit addresses. Depending on the implementation, it is possible to maintain structures like the First–In–First–Out (FIFO), which is built on a selected set of Holding Registers.

All data addresses in the Modbus protocol are referenced to zero. The first occurrence of a data item is addressed as item number zero: for example the coil known as “coil 1” is addressed as coil 0000 in the data address field of a Modbus message and “coil 127” as coil 007E hex (126 in decimal format).

1.1. Transmission frame formats

The format of a query in the Modbus protocol is as follows. The first byte of the frame is the address of the slave to which the query is directed. If the query is broadcast, the address will be 00. The second byte is a function code defining the requested task to be performed. The following bytes are the data to be sent, and the last two bytes form an error-checking field. The mode specific frame formats are presented in Fig. 1.1.1.-2 and Fig. 1.1.2.-2.

The response includes fields containing the id of the slave, confirmation of the performed task in form of a function code, any data to be returned, and an error-checking field. If an error occurs in the receipt of the message, or if the slave is unable to perform the requested task, the slave will construct an error message and send it as its response.

The Modbus protocol has two serial transmission modes: ASCII and RTU. These modes define the bit contents of the message fields transmitted in the network. They also determine how information will be packed into the message fields and decoded. The selected mode and the serial parameters must be the same for all devices in a Modbus network.

1.1.1. ASCII mode

If the Modbus ASCII (American Standard Code for Information Interchange) mode is used, each 8-bit byte in a message will be sent as two ASCII characters forming a hexadecimal number. The allowable characters are the hexadecimals 0-9 and A-F. The advantage of this mode compared to the RTU is that the ASCII mode allows time intervals of up to one second to occur between the characters without causing an error. The format of each byte is presented in Table 1.1.1-1. Fig. 1.1.1.-1 describes the bit sequence of the ASCII mode.

Table 1.1.1-1 ASCII byte format

Coding System	8-bit byte sent as two ASCII characters representing a hexadecimal number
Bits per Byte	1 start bit 7 data bits, the least significant bit sent first 1 bit for even/odd parity; no bit for no parity 1 stop bit if parity is used; 2 bits if no parity
Error Check Field	Longitudinal Redundancy Check (LRC)

With parity checking

START	1	2	3	4	5	6	7	PARITY	STOP

Without parity checking

START	1	2	3	4	5	6	7	STOP	STOP

Fig. 1.1.1.-1 Description of the bit sequence for the ASCII mode

The message starts with a colon character (:), followed by ASCII 3A in hexadecimal format, and ends with a “carriage return - line feed” (CRLF) pair, that is, ASCII 0D and 0A in hexadecimal format. The other fields in the message frame (see Fig. 1.1.1.-2) are identical in both modes of the Modbus protocol, with the exception of the error-checking field. In the ASCII mode the LRC (Longitudinal Redundancy Check) method is applied, whereas the CRC (Cyclical Redundancy Check) method is applied in the RTU mode.

When a device that has been connected to the network detects a colon character, it decodes the following field to find out whether it is the device to which the query is directed. For this reason, each device must continuously monitor the Modbus network.

If a longer interval than one second occurs between the characters, the receiving device assumes that an error has occurred. Consequently, it clears the receive buffer and starts waiting for the colon character. A typical message frame is shown in Fig. 1.1.1.-2.

Start	**Address**	**Function**	**Data**	**LRC check**	**End**
1 char	2 chars	2 chars	2*n chars	2 chars	2 chars (CRLF)

Fig. 1.1.1.-2 Description of the standard frame format

1.1.2. RTU mode

In the RTU (Remote Terminal Unit) mode each message byte is sent in binary format. Each byte has one start bit, eight data bits, one even, odd or no parity bit, and one or two stop bits. The number of stop bits depends on whether a parity bit is used. If odd or even parity is used, the byte has one stop bit. If parity is not used, however, there are two stop bits. All together there are eleven bits in one byte. The format of one byte is presented in Table 1.1.2-1.

Table 1.1.2-1 RTU byte format

Coding system	8-bit binary
Bits per byte	1 start bit 8 data bits, the least significant bit sent first 1 bit for even/odd parity; no bit for no parity 1 stop bit if parity is used; 2 bits if no parity
Error check field	Cyclical redundancy check (CRC)

The messages are transmitted in the network from left to right, that is, the Least Significant Bit (LSB) first and the Most Significant Bit (MSB) last. The description of the bit sequence for the RTU mode is presented in Fig. 1.1.2.-1.

With parity checking

START	1	2	3	4	5	6	7	8	PARITY	STOP

Without parity checking

START	1	2	3	4	5	6	7	8	STOP	STOP

Fig. 1.1.2.-1 Description of the bit sequence for the RTU mode

The beginning of each frame is marked with a silent interval of at least 3.5 character times. This is implemented as a multiple of character times at the baud rate that is being used. The end of the frame is also marked with a silent interval of at least 3.5 character times.

The entire message frame must be transmitted continuously. If there is a silent interval longer than 1.5 character times between the characters, the next byte is considered as the beginning of a new frame. If a new message begins before the 3.5 character time silent interval, the characters received will be considered as part of the old message frame.

Start	**Address**	**Function**	**Data**	**CRC check**	**End**
T1-T2-T3-T4	8 bits	8 bits	N x 8 bits	16 bits	T1-T2-T3-T4

Fig. 1.1.2.-2 Description of the standard frame format

1.2. Master’s queries

The format of a master’s query depends on the function that is being used.

The format of a read function query (read coil status, read input status, read input registers, read holding registers) is as follows:

Mode	**ASCII**	**RTU**
Start character	‘:’	3.5 character time of the silent (idle) line
Address	2 characters	1 byte
Function	2 characters	1 byte
Starting data address	4 characters	2 bytes
Quantity of points	4 characters	2 bytes
Error check field	LRC 2 characters	CRC 2 bytes
End characters	CR LF (0x0C 0x0A)	3.5 character time of the silent (idle) line

The format of a force single coil or a preset single register function query is as follows:

Mode	ASCII	RTU
Start character	':'	3.5 character time of the silent (idle) line
Address	2 characters	1 byte
Function	2 characters	1 byte
Data address	4 characters	2 bytes
Data value	4 characters	2 bytes
Error check field	LRC 2 characters	CRC 2 bytes
End characters	CR LF (0x0C 0x0A)	3.5 character time of the silent (idle) line

The format of a force multiple coils or preset multiple registers function query is as follows:

Mode	ASCII	RTU
Start character	':'	3.5 character time of the silent (idle) line
Address	2 characters	1 byte
Function	2 characters	1 byte
Data address	4 characters	2 bytes
Quantity of points	4 characters	2 bytes
Byte count	2 characters	1 byte
Data values	2*N characters[a]	N bytes
Error check field	LRC 2 characters	CRC 2 bytes
End characters	CR LF (0x0C 0x0A)	3.5 character time of the silent (idle) line

a. N is equal to byte count

The format of a read FIFO query is as follows:

Mode	ASCII	RTU
Start character	':'	3.5 character time of the silent (idle) line
Address	2 characters	1 byte
Function	2 characters	1 byte
FIFO address	4 characters	2 bytes
Error check field	LRC 2 characters	CRC 2 bytes
End characters	CR LF (0x0C 0x0A)	3.5 character time of the silent (idle) line

The format of a diagnostics function query is as follows:

Mode	ASCII	RTU
Start character	':'	3.5 character time of the silent (idle) line
Address	2 characters	1 byte
Function	2 characters	1 byte
Subfunction	4 characters	2 bytes
Data field	4 characters	2 bytes

Mode	ASCII	RTU
Error check field	LRC 2 characters	CRC 2 bytes
End characters	CR LF (0x0C 0x0A)	3.5 character time of the silent (idle) line

1.3. Normal responses

The format of a normal response to a master's query depends on what function is being used.

The format of a response to a read function query is as follows:

Mode	ASCII	RTU
Start character	':'	3.5 character time of the silent line
Address	2 characters (echo of master's query)	1 byte (echo of master's query)
Function	2 characters (echo of master's query)	1 byte (echo of master's query)
Byte count	2 characters	1 byte
Data values	2*N characters[a]	N bytes
Error check field	LRC 2 characters	CRC 2 bytes
End characters	CR LF (0x0C 0x0A)	3.5 character time of the silent line

a. N is equal to byte count

The format of a response to a force single coil or a preset single register function query is an echo of the query itself.

Mode	ASCII	RTU
Start character	':'	3.5 character time of the silent (idle) line
Address	2 characters	1 byte
Function	2 characters	1 byte
Data address	4 characters	2 bytes
Data value	4 characters	2 bytes
Error check field	LRC 2 characters	CRC 2 bytes
End characters	CR LF (0x0C 0x0A)	3.5 character time of the silent (idle) line

The format of a response to a force multiple coils or a preset multiple registers function query is as follows:

Mode	ASCII	RTU
Start character	':'	3.5 character time of the silent (idle) line
Address	2 characters	1 byte
Function	2 characters	1 byte
Data address	4 characters	2 bytes
Quantity of points	4 characters	2 bytes
Error check field	LRC 2 characters	CRC 2 bytes
End characters	CR LF (0x0C 0x0A)	3.5 character time of the silent (idle) line

The format of a response to a read FIFO query is as follows:

Mode	ASCII	RTU
Start character	':'	3.5 character time of the silent line
Address	2 characters (echo of master's query)	1 byte (echo of master's query)
Function	2 characters (echo of master's query)	1 byte (echo of master's query)
Byte count	4 characters	2 byte
FIFO count	4 characters	2 byte
FIFO values	4*N characters[a]	2*N bytes
Error check field	LRC 2 characters	CRC 2 bytes
End characters	CR LF (0x0C 0x0A)	3.5 character time of the silent line

a. N is equal to FIFO count

The format of a response to a diagnostics function query is an echo of the query itself. If the request is directed to a counter, however, the slave returns the counter's value in the data field.

1.4. Exception responses

The format of an exception response to a master's query is as follows:

Mode	ASCII	RTU
Start character	':'	3.5 character time of the silent line
Address	2 characters (echo of master's query)	1 byte (echo of master's query)
Function	2 characters (echo of master's query with MSB set)	1 byte (echo of master's query with MSB set)
Exception code	2 characters	1 byte
Error check field	LRC 2 characters	CRC 2 bytes
End characters	CR LF (0x0C 0x0A)	3.5 character time of the silent line

An application program in the master is responsible for handling exception responses. Typical processes include successive attempts to send a query, sending diagnostic messages to the slave, and notifying the operators.

2. REC 523 profile of Modbus

2.1. Supported application functions

Function code (HEX)	Function description
01	Read Coil Status Reads the on/off status of discrete outputs
02	Read Input Status Reads on/off status of discrete inputs
03	Read Holding Registers Reads contents of output registers
04	Read Input Registers Reads contents of input registers
05	Force Single Coil Sets the status of a discrete output
06	Preset Single Register Sets the value of a holding register
08	Diagnostics Checks the communication system between the master and the slave
0F	Force Multiple Coils Sets the status of multiple discrete outputs
10	Preset Multiple Registers Sets the value of multiple holding registers
18	Read FIFO queue Reads the set of multiple holding registers interpreted as a FIFO queue

2.2. Supported diagnostic subfunctions

The implementation of the Modbus protocol in REC 523 supports the following subfunction codes:

Code	Name	Description
00	Return Query Data	The data in the query data field is to be returned (looped back) in the response. The entire response should be identical to the query.
01	Restart Communication Option	The slave's peripheral port is to be initialized and restarted, and all of its communications event counters are to be cleared. If the port is currently in the Listen Only Mode, no response will be sent. If the port is not currently in the Listen Only Mode, a normal response will be sent. This occurs before the restart is executed.
02	Return Diagnostic Register	The contents of the slave's diagnostic register is returned in the response.
04	Force Listen Only Mode	Forces the addressed slave to enter the Listen Only Mode for Modbus communications.
10	Clear Counters and Diagnostic Register	Clears all counters and the diagnostic register.
11	Return Bus Message Count	The response data field returns the quantity of messages that the slave has detected in the communications system since its last restart, clear counters operation, or power-up.

Code	Name	Description
12	Return Bus Communication Error Count	The response data field returns the quantity of CRC errors encountered by the slave since its last restart, clear counters operation, or power-up.
13	Return Bus Exception Error Count	The response data field returns the quantity of Modbus exception responses returned by the slave since its last restart, clear counters operation, or power-up.
14	Return Slave Message Count	The response data field returns the quantity of messages addressed to the slave, or broadcasted that the slave has processed since its last restart, clear counters operation, or power-up.
15	Return Slave No Response Count	The response data field returns the quantity of messages addressed to the slave for which it sent no response (neither a normal response nor an exception response) since its last restart, clear counters operation, or power-up.

Note: Sending other subfunction codes than those listed above will cause an “illegal data value” exception response.

2.3. Diagnostic counters

Name	Meaning
Bus Message Count	The number of messages that REC 523 has detected in the communications system since its last restart, clear counters operation, or power-up.
Bus Communication Error Count	The number of CRC or LRC errors encountered by REC 523 since its last restart, clear counters operation, or power-up.
Bus Exception Error Count	The number of Modbus exception responses sent by REC 523 since its last restart, clear counters operation, or power-up.
Slave Message Count	The number of messages addressed to REC 523 or broadcasted that REC 523 has processed since its last restart, clear counters operation, or power-up.
Slave No Response Count	The number of messages addressed to REC 523 for which it sent no response (neither a normal response nor an exception response) since its last restart, clear counters operation, or power-up.

2.4. Possible exception codes

The following exception codes may be generated by REC 523 Modbus Interface.

Code	Name	Meaning
01	ILLEGAL FUNCTION	The function code received in the query is not an allowable action for REC 523.
02	ILLEGAL DATA ADDRESS	The data address or number of items received in the query is not allowable or correct for REC 523. REC 523 will send this exception response if an attempt to read or write part of a multiple register database object is detected. Possible objects are time, strings and counters.

Code	Name	Meaning
03	ILLEGAL DATA VALUE	A value contained in the query data field is out of range. The contents of the register or the status of the coil is not changed.

Note: If an “Illegal data value” exception response is generated when attempting to preset multiple registers, the contents of the register to which an illegal value has been imposed and of the following registers will not be changed. Registers that have already been preset will not be restored.

2.5. Event reporting

The event reporting function has been added to the Modbus interface of REC 523 as a proprietary extension of the protocol specification. There is no defined standard way of representing and transmitting events in the Modbus protocol. However, some vendors have introduced such solutions in their systems.

The event support is configurable (See “Protocol parameters”, section 3.4.4.). There are two options: either the reporting function can be suppressed or one of six implemented methods of event handling can be selected.

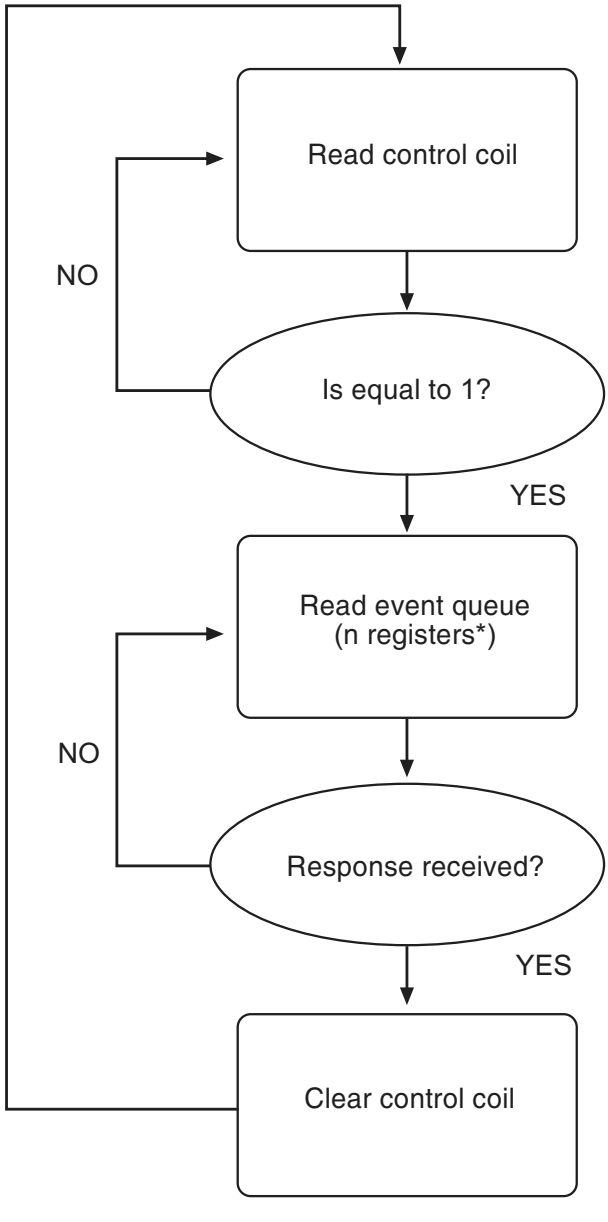
Method	Description
No events	No events are passed via the MODBUS interface
SACE with a short time stamp	The head of the event queue is mapped as a set of holding registers. The master acknowledges a successful read of the event by writing to the dedicated coil in the slave, which allows the next event to be submitted. The time stamp contains milliseconds, seconds and minutes.
SACE with a full time stamp	The same as above, but with a full time stamp (containing time and date)
MicroScada	The method used by the MicroScada: the events are placed in two event queues (separate for analog and digital events). The event queue contains the state (for indicating buffer overflow), the actual number of events, and an event buffer. There is a special holding register in the slave (EVCT) that is used for time synchronization and locking of the event buffers. The time stamps are 16-bit counters with 10ms resolution. This method requires time synchronization with cycles shorter than 5min.
MicroScada with a full time stamp	The same as above but with a full time stamp.
Modicon FIFO read method with a short time stamp	The function Read FIFO 24 (18 hex) is used to read the events. The event format is the same as for the SACE with short time stamp. The master locks the FIFO queue by setting the dedicated coil and acknowledges a successful read by resetting the coil. This clears the FIFO and allows the following events to be submitted.
Modicon FIFO read method with a full time stamp	The function Read FIFO 24 (18 hex) is used to read the events. The event format is the same as for the SACE with a full time stamp. The master locks the FIFO queue by setting the dedicated coil and acknowledges a successful read by resetting the coil. This clears the FIFO and allows the following events to be submitted.

The dial-up environment has an additional feature: after the Modbus has received an event from the application, it will try to open the communication channel to indicate to the master that the event buffer or buffers are not empty. The attempt to open the

channel is made after the configured dial timeout. If the slave fails to connect, the timeout will be reactivated. When it has expired, another attempt will be made to establish a connection (see section “Configuring dial-up connection” for details).

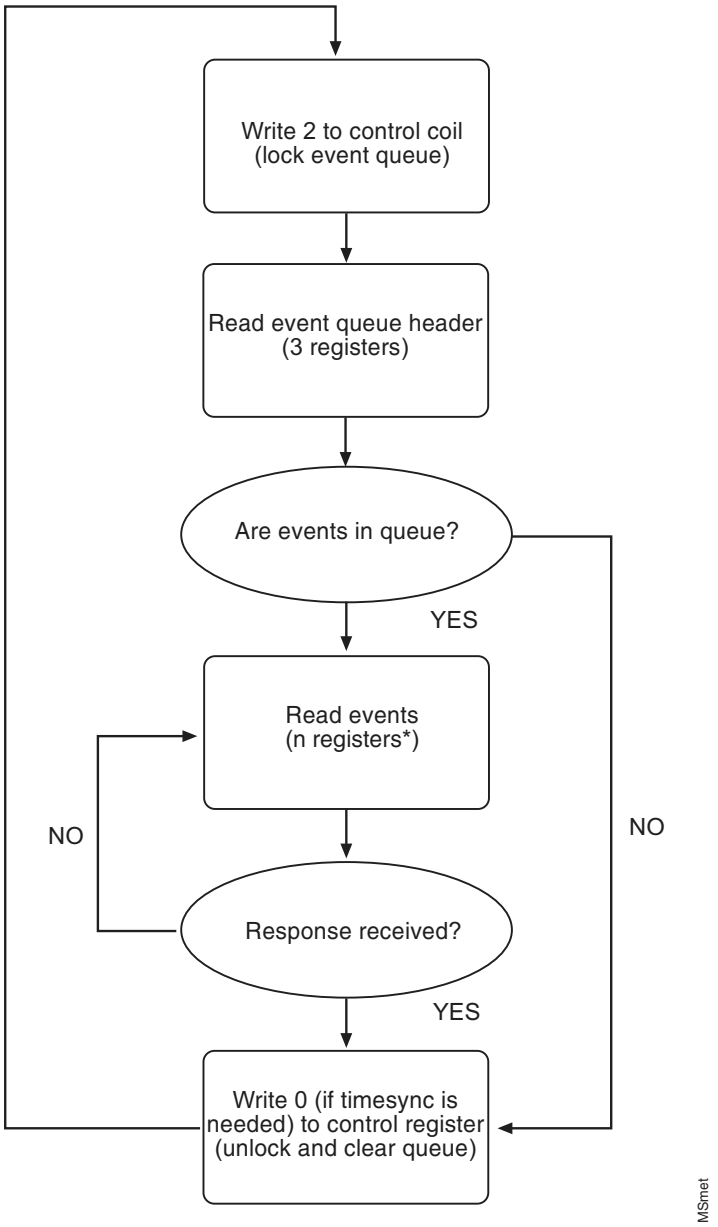
2.5.1. Event collecting algorithms

SACE methods



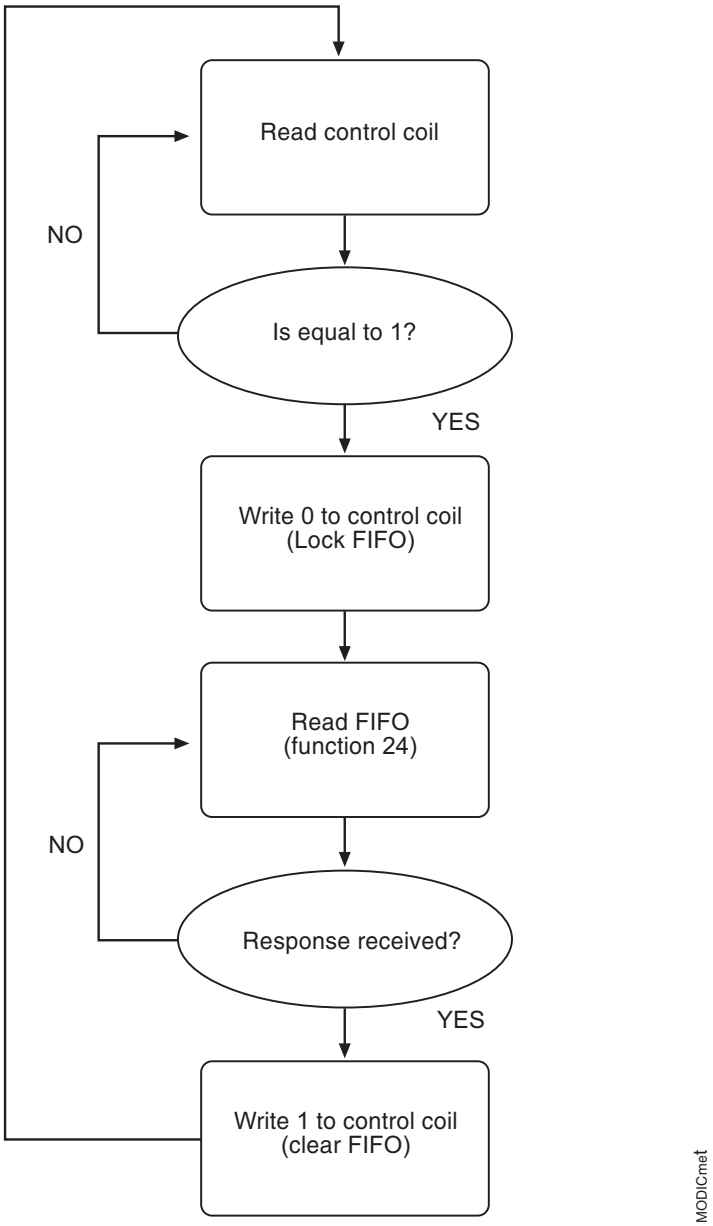
* **Note:**
For the short time stamp mode n=4
For the full time stamp mode n=5

MicroScada methods



*** Note:**
For the digital queue and the short time stamp mode n=2 for each event
For the analog queue and the short time stamp mode n=3 for each event
For the digital queue and the full time stamp mode n=4 for each event
For the analog queue and the full time stamp mode n=5 for each event

Modicon methods



Note: The contents of the FIFO queue is sent as a response. There are four registers for each event with a short time stamp and five registers for each event with a full time stamp.

2.5.2. Event queue descriptions

SACE method with a short time stamp

According to this method, the head of the event queue is mapped as a set of holding registers. The master acknowledges a successful read of the event by writing to the dedicated coil. This allows the next event to be submitted. The time stamp contains milliseconds, seconds and minutes.

Event structure:

Address	Meaning	Values
Base	The address and the type of the static data item that triggered the event	Address*2 for digital events Address*2+1 for analog events
Base+1	The value of the event	0 or 1 for digital events 0...65535 for analog events
Base+2	Time stamp LO (milliseconds)	0...999
Base+3	Time stamp HI (seconds and minutes)	0...3599

The use of the coil for event reception acknowledgment and for testing event availability:

Value	Meaning
Read 0	Event buffer empty
Read 1	Event buffer full
Write 0	Event successfully read – submit the next event

SACE method with a full time stamp

According to this method, the head of the event queue is mapped as a set of holding registers. The master acknowledges a successful read of the event by writing to the binary output, which allows the next event to be submitted. The time stamp contains full time counted since January 1, 1970, 00:00 (in milliseconds and seconds).

Event structure:

Address	Meaning	Values
Base	The address and the type of the static data item that triggered the event	Address*2 for digital events Address*2+1 for analog events
Base+1	The value of the event	0 or 1 for digital events 0...65535 for analog events
Base+2	Time stamp (milliseconds)	0...999
Base+3	Time stamp (seconds since beginning of 1970 lower word)	0...65535
Base+4	Time stamps (seconds since beginning of 1970 higher word)	0...65535

The use of the coil for event reception acknowledgment and for testing event availability:

Value	Meaning
Read 0	Event buffer empty
Read 1	Event buffer full
Write 0	Event successfully read – submit next event

MicroScada method

According to this method, the events are placed in two event queues (separate for analog and digital events). There is a special holding register in the slave (EVCT) that is used for time synchronization and locking of the event buffers. The accuracy of the time stamps is ten milliseconds. This method requires time synchronization with cycles shorter than five minutes.

Event queue structure:

Address	Meaning	Values
Base	10ms round counter value at last synchronization	0...65535
Base+1	The status of the event buffer	EV_QUEUE_OVERFLOW or OK_STATUS
Base+2	The number of events	0...100
Base+3	The first register of the event buffer	The address of the digital input (bits 15-1), the value of the event (bit 0) in the digital queue, or the address of the input register in the analog queue

Digital event structure:

Address	Meaning
EventBase	The address of the digital input (bits 15-1), the value of the event (bit 0)
EventBase+1	Time stamp (the value of the 10ms cyclic counter)

Analog event structure:

Address	Meaning
EventBase	The address of the input register
EventBase+1	The value of the event
EventBase+2	Time stamp (the value of the 10ms cyclic counter)

Event control register structure:

Bit	Meaning
0	Time synchronization (on change)
1	Event buffer lock (rising edge – lock, falling edge unlock and clear)
2-15	Not used

Note:

- Unlocking the event buffer causes clearance of all its contents. Both queues (digital and analogue) have separate control registers as well as a common one. When the common control register is being used, unlocking causes clearance of the previously read queue only. The separate control register operate on one queue only.
- Time synchronization should be performed at least once per five minutes

MicroScada method with a full time stamp

According to this method, the events are placed in two event queues (separate for analog and digital events). There is a special holding register in the slave (EVCT) that is used for time synchronization and locking of the event buffers. The time stamp contains full time counted since January 1, 1970, 00:00 (in milliseconds and seconds).

Event queue structure:

Address	Meaning	Values
Base	Not used	0
Base+1	The status of the event buffer	EV_QUEUE_OVERFLOW or OK_STATUS
Base+2	The number of events	0...100
Base+3	The first register of the event buffer	The address of the digital input (bits 15-1), the value of the event (bit 0) in the digital queue, or the address of the input register in the analog queue

Digital event structure:

Address	Meaning
EventBase	The address of the digital input (bits 15-1), the value of the event (bit 0)
EventBase+1	0...999
EventBase+2	Time stamp (seconds since beginning of 1970 lower word)
EventBase+3	Time stamps (seconds since beginning of 1970 higher word)

Analog event structure:

Address	Meaning
EventBase	The address of the input register
EventBase+1	The value of the event
EventBase+2	0...999
EventBase+3	Time stamp (seconds since beginning of 1970 lower word)
EventBase+4	Time stamps (seconds since beginning of 1970 higher word)

Event control register structure:

Bit	Meaning
0	Not used
1	Event buffer lock (rising edge – lock, falling edge unlock and clear)
2-15	Not used

Note: Unlocking the event buffer causes clearance of all its contents. Both queues have separate control registers (digital and analog) as well as a common one. When the common control register is being used, unlocking causes clearance of the previously read queue only. Separate control registers operate on one queue only.

Modicon method with a short time stamp

According to this method, function 24 is used for reading the events organized in the FIFO queue. The first holding register contains the number of holding registers in the FIFO queue (excluding itself), whereas the following ones contain the events. The time stamp contains milliseconds, seconds and minutes.

Event queue structure:

Address	Meaning	Values
Base	The number of registers in the FIFO	0...100
Base+1	The first register of the event buffer	Address*2 for digital events Address*2+1 for analog events

Event structure:

Address	Meaning	Values
EventBase	The address and the type of the static data item that triggered the event	Address*2 for digital events Address*2+1 for analog events
EventBase+1	The value of the event	0 or 1 for digital events 0...65535 for analog events
EventBase+2	Time stamp LO (milliseconds)	0...999
EventBase+3	Time stamp HI (seconds and minutes)	0...3599

The use of the coil for FIFO locking and a successful read acknowledgment:

Value	Meaning
Read 0	The FIFO empty
Read 1	The FIFO not empty
Write 0	Clear and unlock the FIFO
Write 1	Lock the FIFO

Modicon method with a full time stamp

According to this method, function 24 is used for reading the events organized in the FIFO queue. The first holding register contains the number of holding registers in the FIFO queue (excluding itself), whereas the following ones contain the events. The time stamp contains full time counted since January 1, 1970, 00:00 (in milliseconds and seconds).

Event queue structure:

Address	Meaning	Values
Base	The number of registers in the FIFO	0...100
Base+1	The first register of the event buffer	Address*2 for digital events Address*2+1 for analog events

Event structure:

Address	Meaning	Values
EventBase	The address and the type of the static data item that triggered the event	Address*2 for digital events Address*2+1 for analog events
EventBase+1	The value of the event	0 or 1 for digital events 0...65535 for analog events
EventBase+2	Time stamp (milliseconds)	0...999
EventBase+3	Time stamp (seconds since beginning of 1970 lower word)	0...65535

Address	Meaning	Values
EventBase+4	Time stamps (seconds since beginning of 1970 higher word)	0...65535

The usage of the coil for FIFO locking and a successful read acknowledgment:

Value	Meaning
Read 0	The FIFO empty
Read 1	The FIFO not empty
Write 0	Clear and unlock the FIFO
Write 1	Lock the FIFO

Note: In both Modicon methods, the FIFO count register contains the number of holding registers in the queue – NOT the number of events.

3. Protocol interface implementation

3.1. Application to protocol mapping

3.1.1. POD concept

The Protocol Object Dictionary (POD) is a cross-reference table between the REC 523 application and the Modbus protocol. This table defines what information can be accessed from the device using the protocol interface. As REC 523 is a programmable device and may run various application setups (different sets of function blocks), the POD is also re-configurable. This re-configurable table (called visible POD) is used during device initialization to create the POD used at runtime (called operational POD). The visible POD can cover all possible device application setups. During the start-up all present function blocks will be automatically detected and only data items of these blocks will be included in the operational POD.

3.1.2. POD configuration

A default version of the visible POD is provided in the device software. It includes the mapping of process data and events from all available function blocks, together with communication interface parameters for the Modbus protocol. Application settings, parameters, recorded measurement and disturbance data are not included in this mapping (except for communication parameters and power quality recordings, which are included).

The default POD contents can be uploaded for review and modified using the available Protocol Editing Tool available in the CAP 505 Tool Box. Following the changes the new POD contents can be downloaded to the REC 523 unit and activated by storing the changes and resetting the device.

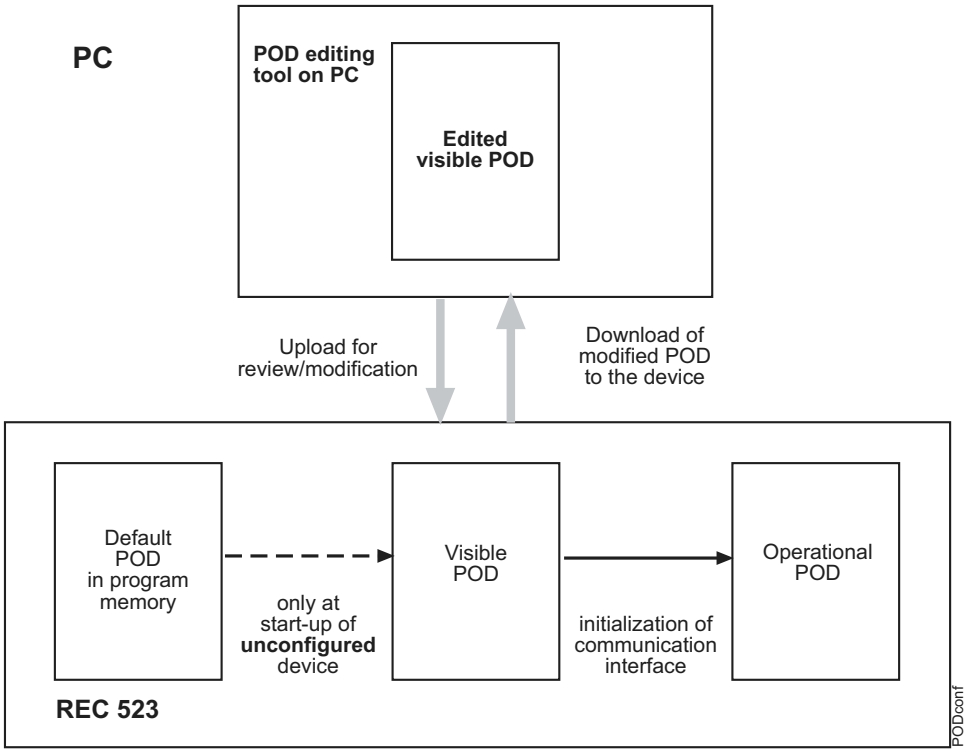


Fig. 3.1.2.-1 POD in the REC 523 device

Modification of the POD contents may be required due to the following situations:

- A different addressing concept is used in the system because of the requirements of the primary (controlling) station, or limitations in the protocol data addressing (readdressing of mapped application objects)
- Elimination of obsolete data and events from active function blocks (data items not required or not processed by the primary station)
- Changes in mapping (for example PDU type, conversion of data value, type of data acquisition (spontaneous or on request), assignment to groups, etc.)

3.1.2.1. Database mapping

The Modbus protocol interface supports six data types:

- Digital inputs - these entries contain “read only” discrete values (values of the range from 0 to 1)
- Coils (digital outputs) - these entries contain “read/write” discrete values (values of the range from 0 to 1)
- Input registers - these entries contain “read only” 16-bit register values (values of range from 0 to 65535, but is some cases signed values in U2 format will be used)
- Holding (output) registers - these entries contain “read/write” 16-bit register values (values of the range from 0 to 65535)
- Digital events - events associated with a change of the digital input status
- Analog events - events associated with a change of the input register status

3.1.2.2. Event control objects

The use of event control and queue entries in the POD depends on the chosen event reporting mode. The table below explains which entries are in use for each event reporting mode.

Mode	Name of entry	Description
SACE	EQCTRLCO	Event queue control coil
	COEVENTQ	Common event queue
MicroSCADA	ANEVENTQ	Analog event queue
	DIEVENTQ	Digital event queue
	CEQCTRLR	Common event queue control register
	AEQCTRLR	Analog event queue control register
	DEQCTRLR	Digital event queue control register
MODICON	EQCTRLCO	Event queue control coil
	FIFOEVTQ	FIFO queue pointer

3.1.3. Defining POD contents

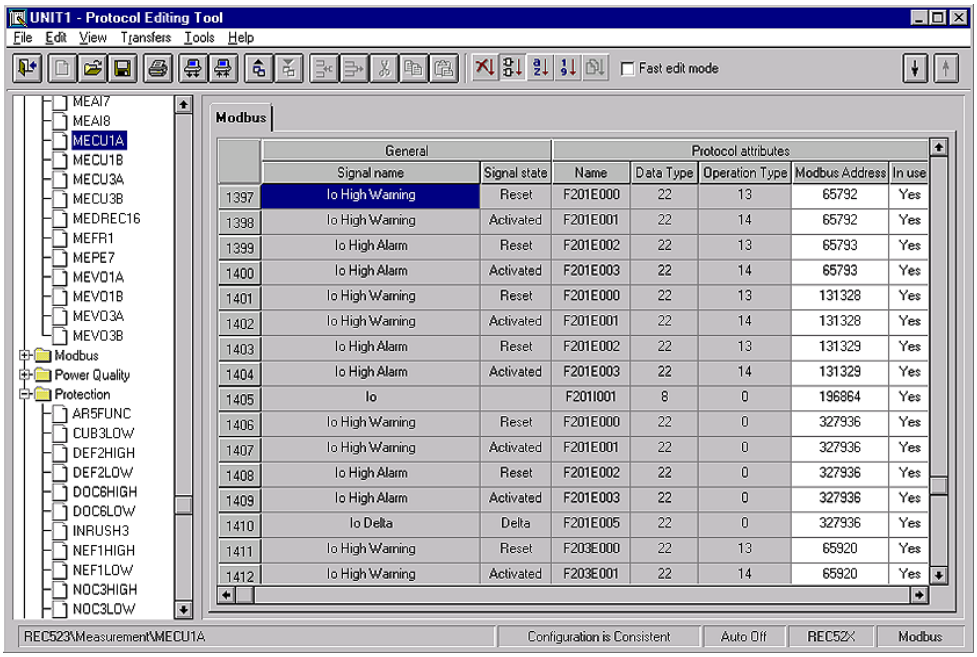
3.1.3.1. Visible POD entry format

A visible POD for the Modbus may contain a maximum of 2500 entries. The number of defined entries is revision dependent, for example, the default POD of revision D of REC 523 occupies 2203 entries.

The visible POD can be accessed using the Protocol Editing Tool. The attributes in the POD table can be divided into two main categories: general and protocol attributes. Protocol attributes of the visible POD can be further divided into two categories:

- Attributes of the application (application object name, data type and operation type)
- Attributes of the communication (object address)

The flag parameter “in use” can be used to facilitate the removal (masking) of POD entries from the operational POD. The structure of the Modbus POD is presented in Fig. 3.1.3.1.-1.



MB_POD

Fig. 3.1.3.1.-1 Protocol Editing Tool with the Modbus POD

The meaning of each item of a POD entry and its corresponding index is shown in the table below:

Index	Name	Description
0	Object name	The application name of the object, in most cases in SPA format, for example F031I001 (input 1 from channel 31), F031E000 (event 0 from channel 31) etc. with some exceptions like for example DEVCLOCK, that is, one field of the device clock
1	Data type	The type of item in the database or the type of event
2	Operation type	The type of operation that will be performed when accessing this item
3	Address	The Modbus address of the data item (containing 2 parts: high order word indicates the type according to the Modbus convention and the low order word point number, for example 00010001 HEX indicates the digital input number 1, and 00030005 HEX the input register number 5). Note that an address sent in Modbus frames is equal to the point number decreased by 1 (for example point number 1 has the address 0)
4	In use flag	0 - not available, 1 – available to the master station

In queries and responses addresses are used instead of point numbers, that is, low order words of addresses placed in the POD decreased by 1.

Data type codes:

Name	Code	Description
BOOL	0	Boolean value - 0 or 1
DPBOOL	1	Double point value: 00 - middle, 01 -closed (earthed), 10 - opened (freed), 11 – faulty
SINT	2	16-bit signed integer

Name	Code	Description
INT	3	16-bit signed integer
DINT	4	32-bit signed integer
USINT	5	16-bit unsigned integer
UINT	6	16-bit unsigned integer
UDINT	7	32-bit unsigned integer
REAL	8	32-bit floating point
TIME	9	32-bit unsigned integer containing number of milliseconds
TOD	10	32-bit unsigned integer containing time of the day since midnight in 100us units
DATE	11	32-bit unsigned integer containing number of days since 01-01-1980
CLOCK	12	Full time type used for time synchronisation (function)
STRING	13	String value
SPA	14	Transparent SPA message (function)
BYTE	15	8-bit unsigned integer
WORD	16	16-bit unsigned integer
DWORD	17	32-bit unsigned integer
EV_NODAT	18	Event without data
EV_1BIT	19	Event with 1-bit data
EV_2BIT	20	Event with 2-bit data
EV_3BIT	21	Event with 3-bit data (treated as EV_NODAT - phase information will be ignored)
EV_FLOAT	22	Event with floating point value
EV_INT16	23	Event with 16-bit integer value
EV_INT32	24	Event with 32-bit integer value
EV_COUNT	25	Event with counter value
EV_32BIT	26	Event with 32-bit value

Modbus data types:

Name	Code	Description
EV_CQ	50	A common event queue for analog and digital events (used by the SACE methods)
EV_AQ	51	An event queue for analog events (used by the MicroSCADA method)
EV_DQ	52	An event queue for digital events (used by the MicroSCADA method)
FIFO_CQ	53	A common event queue for analog and digital events (used by the MODICON methods)
TIME_YR	54	The year field of the device clock
TIME_MON	55	The month field of the device clock
TIME_DAY	56	The day field of the device clock
TIME_HR	57	The hour field of the device clock
TIME_MIN	58	The minute field of the device clock
TIME_SEC	59	The seconds field of the device clock
TIME_MS	60	The milliseconds field of the device clock

Note:

- The set of supported data types can be extended in future releases

- To enable the required conversion of data items before passing them on to the master through Modbus or vice versa, a set of operations (conversion routines) has been defined. Each type of operation is assigned a numeric code used by the POD.

List of operation types associated with data:

Operation type	Code	Description
No operation	0	No special handling all actions according to MODBUS and database type
Scale by 10	1	The value will be multiplied by 10 and treated as unsigned
Scale by 100	2	The value will be multiplied by 100 and treated as unsigned
Scale by 1000	3	The value will be multiplied by 1000 and treated as unsigned
Scale by 0.1	4	The value will be multiplied by 0.1 and treated as unsigned
Scale by 0.01	5	The value will be multiplied by 0.01 and treated as unsigned
Scale by 0.001	6	The value will be multiplied by 0.001 and treated as unsigned
Inverse 1 bit logic	7	0<->1 conversion
Inverse open/close	8	1<->2 conversion
Always close	9	Conversion for events of the type EV_NODAT or EV_3BIT used to set the analog value 1
Always open	10	Conversion for events of the type EV_NODAT or EV_3BIT used to set the analog value 2
Always middle	11	Conversion for events of the type EV_NODAT or EV_3BIT used to set the analog value 0
Always faulty	12	Conversion for events of the type EV_NODAT or EV_3BIT used to set the analog value 3
Always off	13	Conversion for events of the type EV_NODAT or EV_3BIT used to set the digital value 0
Always on	14	Conversion for events of the type EV_NODAT or EV_3BIT used to set the digital value 1
Dummy 0	15	Used for write only items
Event ACK	16	The coil used to acknowledge the receiving of events and the lock event queue while reading
Analog event control	17	The register used to control the analog event queue (used for both MicroSCADA methods)
Digital event control	18	The register used to control the digital event queue (used for both MicroSCADA methods)
Read event queue	19	This register icomes first in the event queue
Scale by 1 signed	20	The value will be treated as signed
Scale by 10 signed	21	The value will be multiplied by 10 and treated as signed
Scale by 100 signed	22	The value will be multiplied by 100 and treated as signed
Scale by 1000 signed	23	The value will be multiplied by 1000 and treated as signed
Scale by 0.1 signed	24	The value will be multiplied by 0.1 and treated as signed
Scale by 0.01 signed	25	The value will be multiplied by 0.01 and treated as signed
Scale by 0.001 signed	26	The value will be multiplied by 0.001 and treated as signed
Timer	27	The device clock will be read or written
Common event control	28	The register used to control both event queues (used for both MicroSCADA methods)

Note: The set of supported operation types can be extended in future releases.

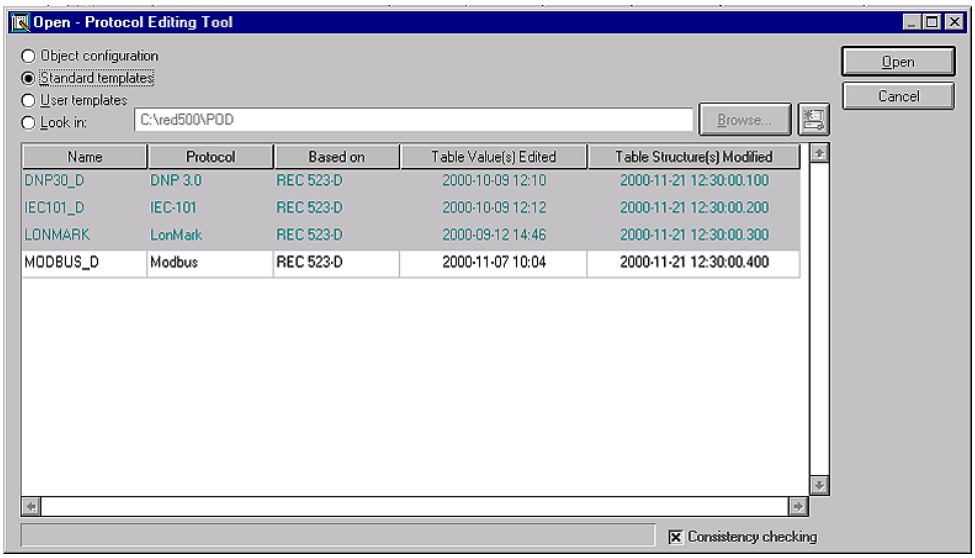
MODBUS addresses:

Point (hex)	Description
0000XXXX	The coil of address XXXX
0001XXXX	The digital input of address XXXX
0002XXXX	A digital event associated with digital input of XXXX
0003XXXX	The input register of address XXXX
0004XXXX	The holding register of address XXXX
0005XXXX	An analog event associated with input register of address XXXX

Note that digital and analog events are not directly accessible using point numbers. To access this data, the appropriate queue (according to the chosen event reporting mode) must be read.

3.1.3.2. POD diagnostics

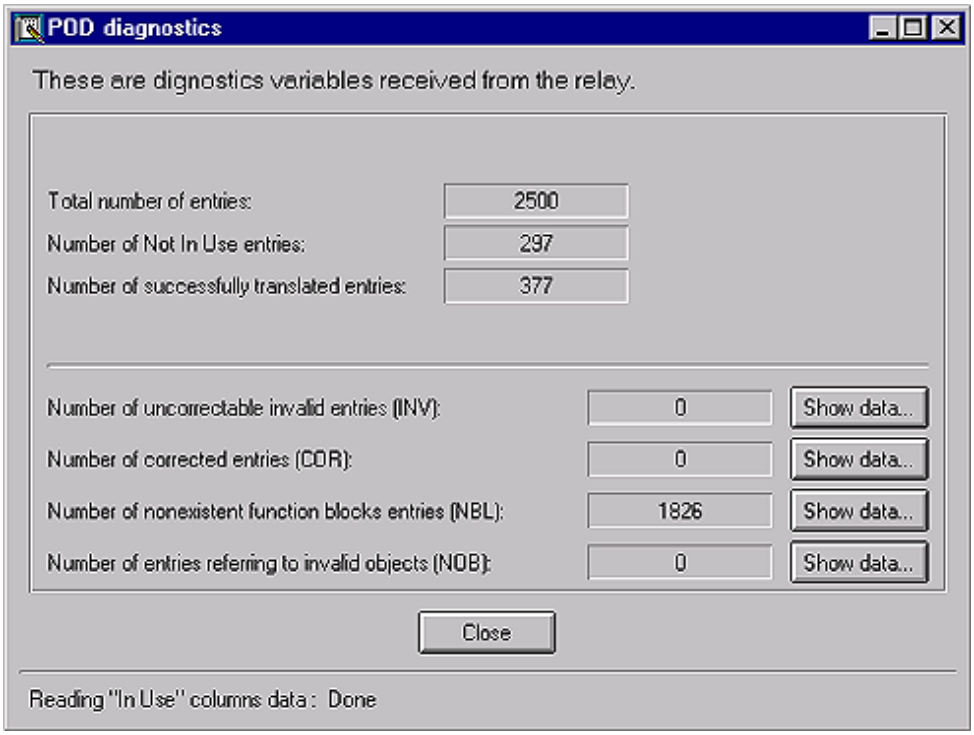
Each POD table that has been downloaded to the unit has an identification string. The identification string is used to check the consistency between the visible POD stored in REC 523 and the POD opened by Protocol Editing Tool. Refer to the POD Tool Operator's Manual for further information.



Prot_openMB

Fig. 3.1.3.2.-1 Protocol Editing Tool with Open dialog of the Modbus POD

After the POD has been downloaded to and stored in the unit, it is possible to upload the POD diagnostics from the unit.



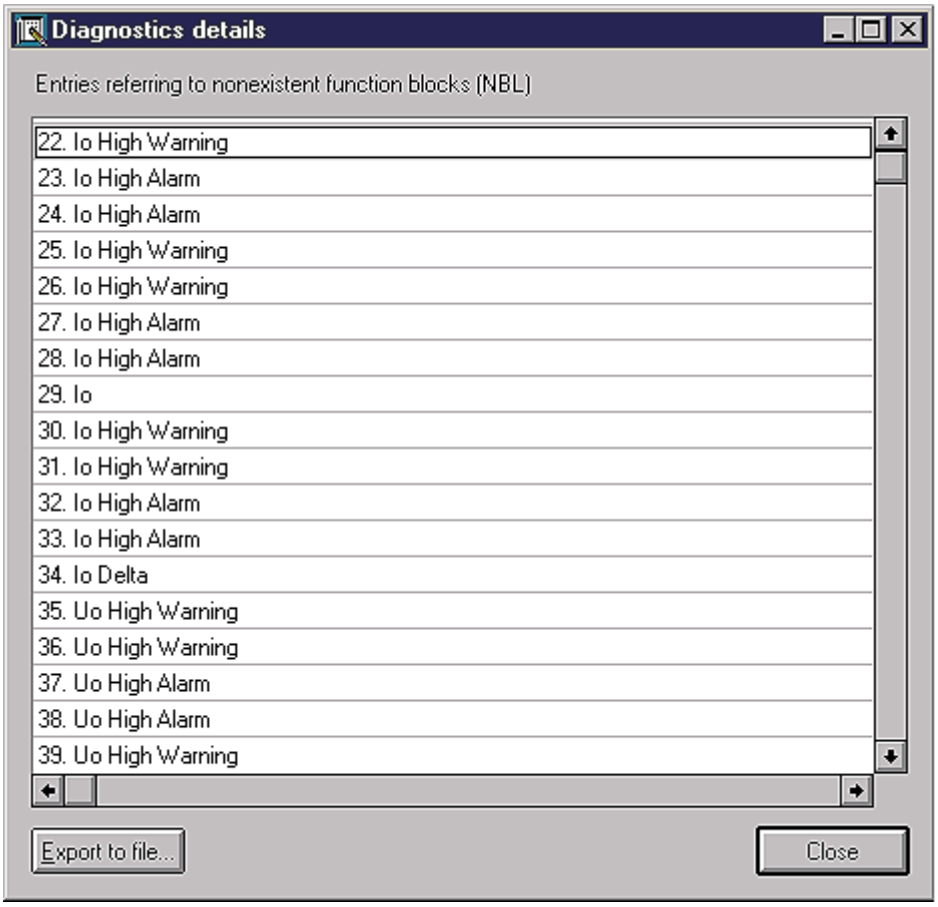
diagnostics

Fig. 3.1.3.2.-2 Protocol Editing Tool with POD diagnostics

The meaning of each parameter is presented in the table below:

Name	Description	SPA parameter
Total number of entries	The total number of visible POD entries This value is determined by the POD structure size. Both used and unused entries are counted.	F503V060
Number of Not In Use entries	The number of entries not in use (“in use” field set to 0) This number covers both defined and empty POD entries with the “in use” field set to 0.	F503V061
Number of entries translated into operational POD	The translation applies only to the entries with the “in use” flag set, correct or corrected contents, and referring to valid objects or events of the function blocks included in the application project.	F503V066
Number of uncorrectable invalid entries (INV)	This checking applies only to the entries with the “in use” flag set.	F503V062
Number of corrected entries (COR)	This checking applies only to the entries with the “in use” flag set.	F503V063
Number of nonexistent function block entries (NBL)	This checking applies only to the entries with the “in use” flag set.	F503V064
Number of entries referring to invalid objects (NOB)	This checking applies only to the entries with the “in use” flag set.	F503V065

If necessary, the results of the diagnostics can be further analyzed by selecting the “Show data…” (see Fig. 3.1.3.2.-3). Diagnostic details introduces a list of items belonging to the selected category. The list is sorted out based on the row number of the item. By using this information, the required changes and corrections can be made to the POD.



Diag_Det

Fig. 3.1.3.2.-3 Diagnostic Details

3.1.3.3. Examples of mapping application data into the Modbus protocol

An application object with a binary data value is accessible at request in the database (object name given):

- Changes are reported as binary events (event codes given)
- The same Modbus address should be used for sending object changes (binary events) and database values at request (binary static data)

Description	Name	Type	Operation	Point (hex)
Start signal from 3I> stage	F031O001	UINT	No operation	00011000
Start signal from 3I> stage reset	F031E000	EV_3BIT	Always off	00021000
Start signal from 3I> stage activated	F031E001	EV_3BIT	Always on	00021000

Application object with 2 point information (mapped as input register):

- Changes are reported as 2-bit events (event codes given)
- The same Modbus address should be used for sending object changes (analogue events) and database values at request (analogue static data)

Description	Name	Type	Operation	Point (hex)
Disconnector position	F122V001	UINT	No operation	00032500
Disconnector in position “open”	F122E000	EV_2BIT	Always open	00052500
Disconnector in position “closed”	F122E001	EV_2BIT	Always close	00052500
Disconnector in position “faulty”	F122E002	EV_2BIT	Always faulty	00052500
Disconnector in position “middle”	F122E003	EV_2BIT	Always middle	00052500

Note: When the code of operation is set to 0 (no operation), the data conversion will be performed according to the database and the Modbus type of the object. Because there is only single point binary information in the Modbus protocol, 2 point information is encoded as an input register.

Application object with analog data values accessible at request in the database (object name given):

- The binary data values are not accessible in the database but stored in the internal protocol tables according to the most recent event reported
- Changes are reported as two kinds of events: binary and analog
- The same Modbus address should be used for sending object changes (analog events) and database values at request (analog static data)
- The same Modbus address should be used for sending binary object changes (digital events) and static values accessible at request from the internal protocol data tables

Description	Name	Type	Operation	Point (hex)
Uo value	F205I001	REAL	Scale by 10	00030180
Uo high warning off (analog value)	F205E00	EV_FLOAT	Scale by 10	00050180
Uo high warning on (analog value)	F205E01	EV_FLOAT	Scale by 10	00050180
Uo high alarm off (analog value)	F205E02	EV_FLOAT	Scale by 10	00050180
Uo high alarm on (analog value)	F205E03	EV_FLOAT	Scale by 10	00050180
Uo delta	F205E05	EV_FLOAT	Scale by 10	00050180
Uo high warning off (digital value stored)	F205E00	EV_FLOAT	Always off	00010180
Uo high warning on (digital value stored)	F205E01	EV_FLOAT	Always on	00010180
Uo high alarm off (digital value stored)	F205E02	EV_FLOAT	Always off	00010181
Uo high alarm on (digital value stored)	F205E03	EV_FLOAT	Always on	00010181
Uo high warning off (digital event)	F205E00	EV_FLOAT	Always off	00020180
Uo high warning on (digital event)	F205E01	EV_FLOAT	Always on	00020180
Uo high alarm off (digital event)	F205E02	EV_FLOAT	Always off	00020181
Uo high alarm on (digital event)	F205E03	EV_FLOAT	Always on	00020181

Entries used to control the disconnector:

- Two types of operations are available: direct operations and two step (select/execute) operations

• It is also possible to cancel the selected operation

Description	Name	Type	Operation	Point (hex)
Direct open	F122V004	UINT	Dummy 0	00002500
Direct close	F122V005	UINT	Dummy 0	00002501
Select to open	F122V006	UINT	Dummy 0	00002502
Select to close	F122V007	UINT	Dummy 0	00002503
Cancel selection	F122V010	UINT	Dummy 0	00002504
Execute selection	F122V011	UINT	Dummy 0	00002505

Entry representing configurable protocol data item

Description	Name	Type	Operation	Point (hex)
Station address	F505V001	USINT	No operation	00044100

Entries representing internal clock of the device

Description	Name	Type	Operation	Point (hex)
Device time year	DEVCLOCK	TIME_YR	Timer	00040001
Device time month	DEVCLOCK	TIME_MON	Timer	00040002
Device time day	DEVCLOCK	TIME_DAY	Timer	00040003
Device time hour	DEVCLOCK	TIME_HR	Timer	00040004
Device time minute	DEVCLOCK	TIME_MIN	Timer	00040005
Device time second	DEVCLOCK	TIME_SEC	Timer	00040006
Device time millisecond	DEVCLOCK	TIME_MS	Timer	00040007

Event queue used by both SACE methods

Description	Name	Type	Operation	Point (hex)
Event queue control coil	EQCTRLCO	USINT	Event ACK	00007FFF
Common event queue	COEVENTQ	EV_CQ	No operation	00048000

Event queue used by both MicroSCADA methods

Description	Name	Type	Operation	Point (hex)
Common event queue control register	CEQCTRLR	UINT	Common event control	00047FFD
Analog event queue control register	AEQCTRLR	UINT	Analog event control	00047FFE
Digital event queue control register	DEQCTRLR	UINT	Digital event control	00047FFF
Analog event queue	ANEVENTQ	EV_AQ	Read event queue	00049000
Digital event queue	DIEVENTQ	EV_DQ	Read event queue	00048000

Event queue used by both MODICON methods

Description	Name	Type	Operation	Point (hex)
Common event queue	COEVENTQ	EV_CQ	Read event queue	00048000
Event queue control coil	EQCTRLCO	USINT	Event ACK	00007FFF

3.2. Protocol address map based on the default POD

The mapping presented in this section corresponds to the default POD.

For a given application setup, the visible POD can be reconfigured to omit unused function blocks and data items, and to change the point numbers if required. Each data item in the Modbus protocol is uniquely addressed by using the object type/ point. The object type can be coil, digital input, input register etc., whereas the point indicates the specific instance of the data item. All data accessible via the Modbus interface is presented below.

Function block MEAI1

Description	Name	Type	Point (hex)	Values
Input MEAI1 high warning state	F213E000 F213E001	Digital input	0800	0 – reset 1 – activated
Input MEAI1 high alarm state	F213E002 F213E003	Digital input	0801	0 – reset 1 – activated
Input MEAI1 low warning state	F213E004 F213E005	Digital input	0802	0 – reset 1 – activated
Input MEAI1 low alarm state	F213E006 F213E007	Digital input	0803	0 – reset 1 – activated
Input MEAI1 high warning change	F213E000 F213E001	Digital event	0800	0 – reset 1 – activated
Input MEAI1 high alarm change	F213E002 F213E003	Digital event	0801	0 – reset 1 – activated
Input MEAI1 low warning change	F213E004 F213E005	Digital event	0802	0 – reset 1 – activated
Input MEAI1 low alarm change	F213E006 F213E007	Digital event	0803	0 – reset 1 – activated
Input MEAI1	213I001	Input register	0800	-10000...10000
Input MEAI1 change	F213E000 F213E001 F213E002 F213E003 F213E004 F213E005 F213E006 F213E007 F213E011	Analog event	0800	-10000...10000

Function block MEAI2

Description	Name	Type	Point (hex)	Values
Input MEAI2 high warning state	F214E000 F214E001	Digital input	0810	0 – reset 1 – activated
Input MEAI2 high alarm state	F214E002 F214E003	Digital input	0811	0 – reset 1 – activated
Input MEAI2 low warning state	F214E004 F214E005	Digital input	0812	0 – reset 1 – activated
Input MEAI2 low alarm state	F214E006 F214E007	Digital input	0813	0 – reset 1 – activated
Input MEAI2 high warning change	F214E000 F214E001	Digital event	0810	0 – reset 1 – activated
Input MEAI2 high alarm change	F214E002 F214E003	Digital event	0811	0 – reset 1 – activated

Description	Name	Type	Point (hex)	Values
Input MEAI2 low warning change	F214E004 F214E005	Digital event	0812	0 – reset 1 – activated
Input MEAI2 low alarm change	F214E006 F214E007	Digital event	0813	0 – reset 1 – activated
Input MEAI2	F214I001	Input register	0810	-10000...10000
Input MEAI2 change	F214E000 F214E001 F214E002 F214E003 F214E004 F214E005 F214E006 F214E007 F214E011	Analog event	0810	-10000...10000

Function block MEAI3

Description	Name	Type	Point (hex)	Values
Input MEAI3 high warning state	F215E000 F215E001	Digital input	0820	0 – reset 1 – activated
Input MEAI3 high alarm state	F215E002 F215E003	Digital input	0821	0 – reset 1 – activated
Input MEAI3 low warning state	F215E004 F215E005	Digital input	0822	0 – reset 1 – activated
Input MEAI3 low alarm state	F215E006 F215E007	Digital input	0823	0 – reset 1 – activated
Input MEAI3 high warning change	F215E000 F215E001	Digital event	0820	0 – reset 1 – activated
Input MEAI3 high alarm change	F215E002 F215E003	Digital event	0821	0 – reset 1 – activated
Input MEAI3 low warning change	F215E004 F215E005	Digital event	0822	0 – reset 1 – activated
Input MEAI3 low alarm change	F215E006 F215E007	Digital event	0823	0 – reset 1 – activated
Input MEAI3	F215I001	Input register	0820	-10000...10000
Input MEAI3 change	F215E000 F215E001 F215E002 F215E003 F215E004 F215E005 F215E006 F215E007 F215E011	Analog event	0820	-10000...10000

Function block MEAI4

Description	Name	Type	Point (hex)	Values
Input MEAI4 high warning state	F216E000 F216E001	Digital input	0830	0 – reset 1 – activated
Input MEAI4 high alarm state	F216E002 F216E003	Digital input	0831	0 – reset 1 – activated
Input MEAI4 low warning state	F216E004 F216E005	Digital input	0832	0 – reset 1 – activated

Description	Name	Type	Point (hex)	Values
Input MEAI4 low alarm state	F216E006 F216E007	Digital input	0833	0 – reset 1 – activated
Input MEAI4 high warning change	F216E000 F216E001	Digital event	0830	0 – reset 1 – activated
Input MEAI4 high alarm change	F216E002 F216E003	Digital event	0831	0 – reset 1 – activated
Input MEAI4 low warning change	F216E004 F216E005	Digital event	0832	0 – reset 1 – activated
Input MEAI4 low alarm change	F216E006 F216E007	Digital event	0833	0 – reset 1 – activated
Input MEAI4	F216I001	Input register	0830	-10000...10000
Input MEAI4 change	F216E000 F216E001 F216E002 F216E003 F216E004 F216E005 F216E006 F216E007 F216E011	Analog event	0830	-10000...10000

Function block MEAI5

Description	Name	Type	Point (hex)	Values
Input MEAI5 high warning state	F217E000 F217E001	Digital input	0840	0 – reset 1 – activated
Input MEAI5 high alarm state	F217E002 F217E003	Digital input	0841	0 – reset 1 – activated
Input MEAI5 low warning state	F217E004 F217E005	Digital input	0842	0 – reset 1 – activated
Input MEAI5 low alarm state	F217E006 F217E007	Digital input	0843	0 – reset 1 – activated
Input MEAI5 high warning change	F217E000 F217E001	Digital event	0840	0 – reset 1 – activated
Input MEAI5 high alarm change	F217E002 F217E003	Digital event	0841	0 – reset 1 – activated
Input MEAI5 low warning change	F217E004 F217E005	Digital event	0842	0 – reset 1 – activated
Input MEAI5 low alarm change	F217E006 F217E007	Digital event	0843	0 – reset 1 – activated
Input MEAI5	F217I001	Input register	0840	-10000...10000
Input MEAI5 change	F217E000 F217E001 F217E002 F217E003 F217E004 F217E005 F217E006 F217E007 F217E011	Analog event	0840	-10000...10000

Function block MEAI6

Description	Name	Type	Point (hex)	Values
Input MEAI6 high warning state	F218E000 F218E001	Digital input	0850	0 – reset 1 – activated
Input MEAI6 high alarm state	F218E002 F218E003	Digital input	0851	0 – reset 1 – activated
Input MEAI6 low warning state	F218E004 F218E005	Digital input	0852	0 – reset 1 – activated
Input MEAI6 low alarm state	F218E006 F218E007	Digital input	0853	0 – reset 1 – activated
Input MEAI6 high warning change	F218E000 F218E001	Digital event	0850	0 – reset 1 – activated
Input MEAI6 high alarm change	F218E002 F218E003	Digital event	0851	0 – reset 1 – activated
Input MEAI6 low warning change	F218E004 F218E005	Digital event	0852	0 – reset 1 – activated
Input MEAI6 low alarm change	F218E006 F218E007	Digital event	0853	0 – reset 1 – activated
Input MEAI6	F218I001	Input register	0850	-10000...10000
Input MEAI6 change	F218E000 F218E001 F218E002 F218E003 F218E004 F218E005 F218E006 F218E007 F218E011	Analog event	0850	-10000...10000

Function block MEAI7

Description	Name	Type	Point (hex)	Values
Input MEAI7 high warning state	F219E000 F219E001	Digital input	0860	0 – reset 1 – activated
Input MEAI7 high alarm state	F219E002 F219E003	Digital input	0861	0 – reset 1 – activated
Input MEAI7 low warning state	F219E004 F219E005	Digital input	0862	0 – reset 1 – activated
Input MEAI7 low alarm state	F219E006 F219E007	Digital input	0863	0 – reset 1 – activated
Input MEAI7 high warning change	F219E000 F219E001	Digital event	0860	0 – reset 1 – activated
Input MEAI7 high alarm change	F219E002 F219E003	Digital event	0861	0 – reset 1 – activated
Input MEAI7 low warning change	F219E004 F219E005	Digital event	0862	0 – reset 1 – activated
Input MEAI7 low alarm change	F219E006 F219E007	Digital event	0863	0 – reset 1 – activated
Input MEAI7	F219I001	Input register	0860	-10000...10000

Description	Name	Type	Point (hex)	Values
Input MEAI7 change	F219E000 F219E001 F219E002 F219E003 F219E004 F219E005 F219E006 F219E007 F219E011	Analog event	0860	-10000...10000

Function block MEAI8

Description	Name	Type	Point (hex)	Values
Input MEAI8 high warning state	F220E000 F220E001	Digital input	0870	0 – reset 1 – activated
Input MEAI8 high alarm state	F220E002 F220E003	Digital input	0871	0 – reset 1 – activated
Input MEAI8 low warning state	F220E004 F220E005	Digital input	0872	0 – reset 1 – activated
Input MEAI8 low alarm state	F220E006 F220E007	Digital input	0873	0 – reset 1 – activated
Input MEAI8 high warning change	F220E000 F220E001	Digital event	0870	0 – reset 1 – activated
Input MEAI8 high alarm change	F220E002 F220E003	Digital event	0871	0 – reset 1 – activated
Input MEAI8 low warning change	F220E004 F220E005	Digital event	0872	0 – reset 1 – activated
Input MEAI8 low alarm change	F220E006 F220E007	Digital event	0873	0 – reset 1 – activated
Input MEAI8	F220I001	Input register	0870	-10000...10000
Input MEAI8 change	F220E000 F220E001 F220E002 F220E003 F220E004 F220E005 F220E006 F220E007 F220E011	Analog event	0870	-10000...10000

Function block MECU1A

Description	Name	Type	Point (hex)	Values
Io high warning state	F201E000 F201E001	Digital input	0100	0 – reset 1 – activated
Io high alarm state	F201E002 F201E003	Digital input	0101	0 – reset 1 – activated
Io high warning change	F201E000 F201E001	Digital event	0100	0 – reset 1 – activated
Io high alarm change	F201E002 F201E003	Digital event	0101	0 – reset 1 – activated
Io	F201I001	Input register	0100	0...20000 0A...20000A

Description	Name	Type	Point (hex)	Values
Io change	F201E000 F201E001 F201E002 F201E003 F201E005	Analog event	0100	0...20000 0A...20000A

Function block MECU1B

Description	Name	Type	Point (hex)	Values
Io LV side high warning state	F203E000 F203E001	Digital input	0180	0 – reset 1 – activated
Io LV side high alarm state	F203E002 F203E003	Digital input	0181	0 – reset 1 – activated
Io LV side high warning change	F203E000 F203E001	Digital event	0180	0 – reset 1 – activated
Io LV side high alarm change	F203E002 F203E003	Digital event	0181	0 – reset 1 – activated
Io LV side	F203I001	Input register	0180	0...20000 0A...20000A
Io LV side change	F203E000 F203E001 F203E002 F203E003 F203E005	Analog event	0180	0...20000 0A...20000A

Function block MECU3A

Description	Name	Type	Point (hex)	Values
IL1 high warning state	F200E000 F200E001	Digital input	0300	0 – reset 1 – activated
IL1 high alarm state	F200E006 F200E007	Digital input	0301	0 – reset 1 – activated
IL1 low warning state	F200E012 F200E013	Digital input	0302	0 – reset 1 – activated
IL1 low alarm state	F200E018 F200E019	Digital input	0303	0 – reset 1 – activated
IL2 high warning state	F200E002 F200E003	Digital input	0304	0 – reset 1 – activated
IL2 high alarm state	F200E008 F200E009	Digital input	0305	0 – reset 1 – activated
IL2 low warning state	F200E014 F200E015	Digital input	0306	0 – reset 1 – activated
IL2 low alarm state	F200E020 F200E021	Digital input	0307	0 – reset 1 – activated
IL3 high warning state	F200E004 F200E005	Digital input	0308	0 – reset 1 – activated
IL3 high alarm state	F200E010 F200E011	Digital input	0309	0 – reset 1 – activated
IL3 low warning state	F200E016 F200E017	Digital input	030A	0 – reset 1 – activated
IL3 low alarm state	F200E022 F200E023	Digital input	030B	0 – reset 1 – activated
IL1 high warning change	F200E000 F200E001	Digital event	0300	0 – reset 1 – activated

Description	Name	Type	Point (hex)	Values
IL1 high alarm change	F200E006 F200E007	Digital event	0301	0 – reset 1 – activated
IL1 low warning change	F200E012 F200E013	Digital event	0302	0 – reset 1 – activated
IL1 low alarm change	F200E018 F200E019	Digital event	0303	0 – reset 1 – activated
IL2 high warning change	F200E002 F200E003	Digital event	0304	0 – reset 1 – activated
IL2 high alarm change	F200E008 F200E009	Digital event	0305	0 – reset 1 – activated
IL2 low warning change	F200E014 F200E015	Digital event	0306	0 – reset 1 – activated
IL2 low alarm change	F200E020 F200E021	Digital event	0307	0 – reset 1 – activated
IL3 high warning change	F200E004 F200E005	Digital event	0308	0 – reset 1 – activated
IL3 high alarm change	F200E010 F200E011	Digital event	0309	0 – reset 1 – activated
IL3 low warning change	F200E016 F200E017	Digital event	030A	0 – reset 1 – activated
IL3 low alarm change	F200E022 F200E023	Digital event	030B	0 – reset 1 – activated
IL1	F200I001	Input register	0300	0...20000 0A...20000A
IL2	F200I002	Input register	0301	0...20000 0A...20000A
IL3	F200I003	Input register	0302	0...20000 0A...20000A
IL1 change	F200E000 F200E001 F200E006 F200E007 F200E012 F200E013 F200E018 F200E019 F200E025	Analog event	0300	0...20000 0A...20000A
IL2 change	F200E002 F200E003 F200E008 F200E009 F200E014 F200E015 F200E020 F200E021 F200E027	Analog event	0301	0...20000 0A...20000A
IL3 change	F200E004 F200E005 F200E010 F200E011 F200E016 F200E017 F200E022 F200E023 F200E029	Analog event	0302	0...20000 0A...20000A

Function block MECU3B

Description	Name	Type	Point (hex)	Values
IL1 LV side high warning state	F202E000 F202E001	Digital input	0380	0 - reset 1 - activated
IL1 LV side high alarm state	F202E006 F202E007	Digital input	0381	0 - reset 1 - activated
IL1 LV side low warning state	F202E012 F202E013	Digital input	0382	0 - reset 1 - activated
IL1 LV side low alarm state	F202E018 F202E019	Digital input	0383	0 - reset 1 - activated
IL2 LV side high warning state	F202E002 F202E003	Digital input	0384	0 - reset 1 - activated
IL2 LV side high alarm state	F202E008 F202E009	Digital input	0385	0 - reset 1 - activated
IL2 LV side low warning state	F202E014 F202E015	Digital input	0386	0 - reset 1 - activated
IL2 LV side low alarm state	F202E020 F202E021	Digital input	0387	0 - reset 1 - activated
IL3 LV side high warning state	F202E004 F202E005	Digital input	0388	0 - reset 1 - activated
IL3 LV side high alarm state	F202E010 F202E011	Digital input	0389	0 - reset 1 - activated
IL3 LV side low warning state	F202E016 F202E017	Digital input	038A	0 - reset 1 - activated
IL3 LV side low alarm state	F202E022 F202E023	Digital input	038B	0 - reset 1 - activated
IL1 LV side high warning change	F202E000 F202E001	Digital event	0380	0 - reset 1 - activated
IL1 LV side high alarm change	F202E006 F202E007	Digital event	0381	0 - reset 1 - activated
IL1 LV side low warning change	F202E012 F202E013	Digital event	0382	0 - reset 1 - activated
IL1 LV side low alarm change	F202E018 F202E019	Digital event	0383	0 - reset 1 - activated
IL2 LV side high warning change	F202E002 F202E003	Digital event	0384	0 - reset 1 - activated
IL2 LV side high alarm change	F202E008 F202E009	Digital event	0385	0 - reset 1 - activated
IL2 LV side low warning change	F202E014 F202E015	Digital event	0386	0 - reset 1 - activated
IL2 LV side low alarm change	F202E020 F202E021	Digital event	0387	0 - reset 1 - activated
IL3 LV side high warning change	F202E004 F202E005	Digital event	0388	0 - reset 1 - activated
IL3 LV side high alarm change	F202E010 F202E011	Digital event	0389	0 - reset 1 - activated
IL3 LV side low warning change	F202E016 F202E017	Digital event	038A	0 - reset 1 - activated
IL3 LV side low alarm change	F202E022 F202E023	Digital event	038B	0 - reset 1 - activated
IL1 LV side	F202I001	Input register	0380	0...20000 0A...20000A
IL2 LV side	F202I002	Input register	0381	0...20000 0A...20000A
IL3 LV side	F202I003	Input register	0382	0...20000 0A...20000A

Description	Name	Type	Point (hex)	Values
IL1 LV side change	F202E000 F202E001 F202E006 F202E007 F202E012 F202E013 F202E018 F202E019 F202E025	Analog event	0380	0...20000 0A...20000A
IL2 LV side change	F202E002 F202E003 F202E008 F202E009 F202E014 F202E015 F202E020 F202E021 F202E027	Analog event	0381	0...20000 0A...20000A
IL3 LV side change	F202E004 F202E005 F202E010 F202E011 F202E016 F202E017 F202E022 F202E023 F202E029	Analog event	0382	0...20000 0A...20000A

Function block MEDREC16

Description	Name	Type	Point (hex)	Values
Recorded memory full	F225E000 F225E001	Digital event	701	0 = OFF 1 = ON
Overwrite of recording	F225E003	Digital event	702	ON
Configuration error	F225E005	Digital event	703	ON
Recording triggered	F225E031	Digital event	704	ON
Recorded memory full	F225E000 F225E001	Digital input	701	0 = OFF 1 = ON
Overwrite of recording	F225E003	Digital input	702	ON
Configuration error	F225E005	Digital input	703	ON
Recording triggered	F225E031	Digital input	704	ON
Reset memory	F225M002	Coil	0700	1 – reset

Function block MEFR1

Description	Name	Type	Point (hex)	Values
Frequency high warning state	F208E000 F208E001	Digital input	0600	0 – reset 1 – activated
Frequency high alarm state	F208E002 F208E003	Digital input	0601	0 – reset 1 – activated
Frequency low warning state	F208E004 F208E005	Digital input	0602	0 – reset 1 – activated
Frequency low alarm state	F208E006 F208E007	Digital input	0603	0 – reset 1 – activated
Frequency high warning change	F208E000 F208E001	Digital event	0600	0 – reset 1 – activated

Description	Name	Type	Point (hex)	Values
Frequency high alarm change	F208E002 F208E003	Digital event	0601	0 – reset 1 – activated
Frequency low warning change	F208E004 F208E005	Digital event	0602	0 – reset 1 – activated
Frequency low alarm change	F208E006 F208E007	Digital event	0603	0 – reset 1 – activated
Frequency	F208I001	Input register	0600	1000...7500 10.00Hz...75.00Hz
Change of frequency	F208E000 F208E001 F208E002 F208E003 F208E004 F208E005 F208E006 F208E007 F208E009	Analog event	0600	1000...7500 10.00Hz...75.00Hz

Function block MEPE7

Description	Name	Type	Point (hex)	Values
Reset flag	F207V418	Digital input	0500	0 - All values valid 1 - "Last save Pos." values valid
P3 high warning state	F207E000 F207E001	Digital input	0501	0 – reset 1 – activated
P3 high alarm state	F207E002 F207E003	Digital input	0502	0 – reset 1 – activated
P3 low warning state	F207E008 F207E009	Digital input	0503	0 – reset 1 – activated
P3 low alarm state	F207E010 F207E011	Digital input	0504	0 – reset 1 – activated
Q3 high warning state	F207E004 F207E005	Digital input	0505	0 – reset 1 – activated
Q3 high alarm state	F207E006 F207E007	Digital input	0506	0 – reset 1 – activated
Q3 low warning state	F207E012 F207E013	Digital input	0507	0 – reset 1 – activated
Q3 low alarm state	F207E014 F207E015	Digital input	0508	0 – reset 1 – activated
P3 high warning change	F207E000 F207E001	Digital event	0501	0 – reset 1 – activated
P3 high alarm change	F207E002 F207E003	Digital event	0502	0 – reset 1 – activated
P3 low warning change	F207E008 F207E009	Digital event	0503	0 – reset 1 – activated
P3 low alarm change	F207E010 F207E011	Digital event	0504	0 – reset 1 – activated
Q3 high warning change	F207E004 F207E005	Digital event	0505	0 – reset 1 – activated
Q3 high alarm change	F207E006 F207E007	Digital event	0506	0 – reset 1 – activated
Q3 low warning change	F207E012 F207E013	Digital event	0507	0 – reset 1 – activated

Description	Name	Type	Point (hex)	Values
Q3 low alarm change	F207E014 F207E015	Digital event	0508	0 – reset 1 – activated
P3	F207I001	Input register	0500	-9999...9999 – 999900kW...999900kW
Q3	F207I002	Input register	0501	-9999...9999 – 999900kW...999900kvar
Power factor DPF	F207I003	Input register	0502	-100...100 -1.00...1.00
Power factor PF	F207I004	Input register	0503	-100...100 -1.00...1.00
P3 demand	F207I005	Input register	0504	-9999...9999 – 999900kW...999900kW
Q3 demand	F207I006	Input register	0505	-9999...9999 – 999900kW...999900kvar
S3	F207E021	Input register	0506	-9999...9999 – 999900kW...999900kva
Active energy	F207V414	Input register	0507	0...9999 0...999900 kWh
Active reverse energy	F207V415	Input register	0508	0...9999 0...999900 kWh
Reactive energy	F207V416	Input register	0509	0...9999 0...999900 kvarh
Reactive reverse energy	F207V417	Input register	050A	0...9999 0...999900 kvarh
Change of P3	F207E000 F207E001 F207E002 F207E003 F207E008 F207E009 F207E010 F207E011 F207E017	Analog event	0500	-9999...9999 – 999900kW...999900kW
Change of Q3	F207E004 F207E005 F207E006 F207E007 F207E012 F207E013 F207E014 F207E015 F207E019	Analog event	0501	-9999...9999 – 999900kW...999900kvar
Change of DPF	F207E023	Analog event	0502	-100...100 -1.00...1.00
Change of S3	F207E021	Analog event	0506	-9999...9999 – 999900kW...999900kva

Description	Name	Type	Point (hex)	Values
Active energy	F207E025	Analog event	0507	0...9999 0...999900 kWh
Active reverse energy	F207E027	Analog event	0508	0...9999 0...999900 kWh
Reactive energy	F207E029	Analog event	0509	0...9999 0...999900 kvarh
Reactive reverse energy	F207E031	Analog event	050A	0...9999 0...999900 kvarh

Function block MEVO1A

Description	Name	Type	Point (hex)	Values
Uo high warning state	F205E000 F205E001	Digital input	0200	0 – reset 1 – activated
Uo high alarm state	F205E002 F205E003	Digital input	0201	0 – reset 1 – activated
Uo high warning change	F205E000 F205E001	Digital event	0200	0 – reset 1 – activated
Uo high alarm change	F205E002 F205E003	Digital event	0201	0 – reset 1 – activated
Uo	F205I001	Input register	0200	0...15000 0V...150000V
Uo change	F205E000 F205E001 F205E002 F205E003 F205E005	Analog event	0200	0...15000 0V...150000V

Function block MEVO1B

Description	Name	Type	Point (hex)	Values
Uo LV side high warning state	F226E000 F226E001	Digital input	0280	0 – reset 1 – activated
Uo LV side high alarm state	F226E002 F226E003	Digital input	0281	0 – reset 1 – activated
Uo LV side high warning change	F226E000 F226E001	Digital event	0280	0 – reset 1 – activated
Uo LV side high alarm change	F226E002 F226E003	Digital event	0281	0 – reset 1 – activated
Uo LV side	F226I001	Input register	0280	0...15000 0V...150000V
Uo LV side change	F226E000 F226E001 F226E002 F226E003 F226E005	Analog event	0280	0...15000 0V...150000V

Function block MEVO3A

Description	Name	Type	Point (hex)	Values
U1 or U12 high warning state	F204E000 F204E001 F204E032 F204E033	Digital input	0400	0 – reset 1 – activated

Description	Name	Type	Point (hex)	Values
U1 or U12 high alarm state	F204E006 F204E007 F204E038 F204E039	Digital input	0401	0 – reset 1 – activated
U1 or U12 low warning state	F204E012 F204E013 F204E044 F204E045	Digital input	0402	0 – reset 1 – activated
U1 or U12 low alarm state	F204E018 F204E019 F204E050 F204E051	Digital input	0403	0 – reset 1 – activated
U2 or U23 high warning state	F204E002 F204E003 F204E034 F204E035	Digital input	0404	0 – reset 1 – activated
U2 or U23 high alarm state	F204E008 F204E009 F204E040 F204E041	Digital input	0405	0 – reset 1 – activated
U2 or U23 low warning state	F204E014 F204E015 F204E046 F204E047	Digital input	0406	0 – reset 1 – activated
U2 or U23 low alarm state	F204E020 F204E021 F204E052 F204E053	Digital input	0407	0 – reset 1 – activated
U3 or U31 high warning state	F204E004 F204E005 F204E036 F204E037	Digital input	0408	0 – reset 1 – activated
U3 or U31 high alarm state	F204E010 F204E011 F204E042 F204E043	Digital input	0409	0 – reset 1 – activated
U3 or U31 low warning state	F204E016 F204E017 F204E048 F204E049	Digital input	040A	0 – reset 1 – activated
U3 or U31 low alarm state	F204E022 F204E023 F204E054 F204E055	Digital input	040B	0 – reset 1 – activated
U1 or U12 high warning change	F204E000 F204E001 F204E032 F204E033	Digital event	0400	0 – reset 1 – activated
U1 or U12 high alarm change	F204E006 F204E007 F204E038 F204E039	Digital event	0401	0 – reset 1 – activated
U1 or U12 low warning change	F204E012 F204E013 F204E044 F204E045	Digital event	0402	0 – reset 1 – activated
U1 or U12 low alarm change	F204E018 F204E019 F204E050 F204E051	Digital event	0403	0 – reset 1 – activated

Description	Name	Type	Point (hex)	Values
U2 or U23 high warning change	F204E002 F204E003 F204E034 F204E035	Digital event	0404	0 – reset 1 – activated
U2 or U23 high alarm change	F204E008 F204E009 F204E040 F204E041	Digital event	0405	0 – reset 1 – activated
U2 or U23 low warning change	F204E014 F204E015 F204E046 F204E047	Digital event	0406	0 – reset 1 – activated
U2 or U23 low alarm change	F204E020 F204E021 F204E052 F204E053	Digital event	0407	0 – reset 1 – activated
U3 or U31 high warning change	F204E004 F204E005 F204E036 F204E037	Digital event	0408	0 – reset 1 – activated
U3 or U31 high alarm change	F204E010 F204E011 F204E042 F204E043	Digital event	0409	0 – reset 1 – activated
U3 or U31 low warning change	F204E016 F204E017 F204E048 F204E049	Digital event	040A	0 – reset 1 – activated
U3 or U31 low alarm change	F204E022 F204E023 F204E054 F204E055	Digital event	040B	0 – reset 1 – activated
U1 or U12	F204I001	Input register	0400	0...9999 0.0kV...999.9kV
U2 or U23	F204I002	Input register	0401	0...9999 0.0kV...999.9kV
U3 or U31	F204I003	Input register	0402	0...9999 0.0kV...999.9kV
U1 or U12 change	F204E000 F204E001 F204E006 F204E007 F204E012 F204E013 F204E018 F204E019 F204E025 F204E032 F204E033 F204E038 F204E039 F204E044 F204E045 F204E050 F204E051 F204E057	Analog event	0400	0...9999 0.0kV...999.9kV

Description	Name	Type	Point (hex)	Values
U2 or U23 change	F204E002 F204E003 F204E008 F204E009 F204E014 F204E015 F204E020 F204E021 F204E027 F204E034 F204E035 F204E040 F204E041 F204E046 F204E047 F204E052 F204E053 F204E059	Analog event	0401	0...9999 0.0kV...999.9kV
U3 or U31 change	F204E004 F204E005 F204E010 F204E011 F204E016 F204E017 F204E022 F204E023 F204E029 F204E036 F204E037 F204E042 F204E043 F204E048 F204E049 F204E054 F204E055 F204E061	Analog event	0402	0...9999 0.0kV...999.9kV

Function block MEVO3B

Description	Name	Type	Point (hex)	Values
U1 or U12 LV side high warning state	F206E000 F206E001 F206E032 F206E033	Digital input	0480	0 – reset 1 – activated
U1 or U12 LV side high alarm state	F206E006 F206E007 F206E038 F206E039	Digital input	0481	0 – reset 1 – activated
U1 or U12 LV side low warning state	F206E012 F206E013 F206E044 F206E045	Digital input	0482	0 – reset 1 – activated
U1 or U12 LV side low alarm state	F206E018 F206E019 F206E050 F206E051	Digital input	0483	0 – reset 1 – activated
U2 or U23 LV side high warning state	F206E002 F206E003 F206E034 F206E035	Digital input	0484	0 – reset 1 – activated

Description	Name	Type	Point (hex)	Values
U2 or U23 LV side high alarm state	F206E008 F206E009 F206E040 F206E041	Digital input	0485	0 – reset 1 – activated
U2 or U23 LV side low warning state	F206E014 F206E015 F206E046 F206E047	Digital input	0486	0 – reset 1 – activated
U2 or U23 LV side low alarm state	F206E020 F206E021 F206E052 F206E053	Digital input	0487	0 – reset 1 – activated
U3 or U31 LV side high warning state	F206E004 F206E005 F206E036 F206E037	Digital input	0488	0 – reset 1 – activated
U3 or U31 LV side high alarm state	F206E010 F206E011 F206E042 F206E043	Digital input	0489	0 – reset 1 – activated
U3 or U31 LV side low warning state	F206E016 F206E017 F206E048 F206E049	Digital input	048A	0 – reset 1 – activated
U3 or U31 LV side low alarm state	F206E022 F206E023 F206E054 F206E055	Digital input	048B	0 – reset 1 – activated
U1 or U12 LV side high warning change	F206E000 F206E001 F206E032 F206E033	Digital event	0480	0 – reset 1 – activated
U1 or U12 LV side high alarm change	F206E006 F206E007 F206E038 F206E039	Digital event	0481	0 – reset 1 – activated
U1 or U12 LV side low warning change	F206E012 F206E013 F206E044 F206E045	Digital event	0482	0 – reset 1 – activated
U1 or U12 LV side low alarm change	F206E018 F206E019 F206E050 F206E051	Digital event	0483	0 – reset 1 – activated
U2 or U23 LV side high warning change	F206E002 F206E003 F206E034 F206E035	Digital event	0484	0 – reset 1 – activated
U2 or U23 LV side high alarm change	F206E008 F206E009 F206E040 F206E041	Digital event	0485	0 – reset 1 – activated
U2 or U23 LV side low warning change	F206E014 F206E015 F206E046 F206E047	Digital event	0486	0 – reset 1 – activated
U2 or U23 LV side low alarm change	F206E020 F206E021 F206E052 F206E053	Digital event	0487	0 – reset 1 – activated

Description	Name	Type	Point (hex)	Values
U3 or U31 LV side high warning change	F206E004 F206E005 F206E036 F206E037	Digital event	0488	0 – reset 1 – activated
U3 or U31 LV side high alarm change	F206E010 F206E011 F206E042 F206E043	Digital event	0489	0 – reset 1 – activated
U3 or U31 LV side low warning change	F206E016 F206E017 F206E048 F206E049	Digital event	048A	0 – reset 1 – activated
U3 or U31 LV side low alarm change	F206E022 F206E023 F206E054 F206E055	Digital event	048B	0 – reset 1 – activated
U1 or U12 LV side	F206I001	Input register	0480	0...9999 0.0kV...999.9kV
U2 or U23 LV side	F206I002	Input register	0481	0...9999 0.0kV...999.9kV
U3 or U31 LV side	F206I003	Input register	0482	0...9999 0.0kV...999.9kV
U1 or U12 LV side change	F206E000 F206E001 F206E006 F206E007 F206E012 F206E013 F206E018 F206E019 F206E025 F206E032 F206E033 F206E038 F206E039 F206E044 F206E045 F206E050 F206E051 F206E057	Analog event	0480	0...9999 0.0kV...999.9kV
U2 or U23 LV side change	F206E002 F206E003 F206E008 F206E009 F206E014 F206E015 F206E020 F206E021 F206E027 F206E034 F206E035 F206E040 F206E041 F206E046 F206E047 F206E052 F206E053 F206E059	Analog event	0481	0...9999 0.0kV...999.9kV

Description	Name	Type	Point (hex)	Values
U3 or U31 LV side change	F206E004 F206E005 F206E010 F206E011 F206E016 F206E017 F206E022 F206E023 F206E029 F206E036 F206E037 F206E042 F206E043 F206E048 F206E049 F206E054 F206E055 F206E061	Analog event	0482	0...9999 0.0kV...999.9kV

Function block AR5Func, general parameters and events

Description	Name	Type	Point (hex)	Values
Reset registers	F080V013	Coil	4501	1 - Reset
Status of LOCKOUT signal	F080O014	Digital input	4500	0 – reset 1 – activated
AR oper. status	F080S004	Digital input	4501	0...1 0 - OFF 1 - ON
Auto-reclosing sequence off (stored)	F080E000 F080E001	Digital input	4502	0 – Ended 1 – Started
AR (shots 1...5) initiated by AR1 (stored)	F080E002	Digital input	4503	0
AR (shots 1...5) initiated by AR2 (stored)	F080E003	Digital input	4504	0
AR (shots 1...5) initiated by AR3 (stored)	F080E004	Digital input	4505	0
AR (shots 1...5) initiated by AR4 (stored)	F080E005	Digital input	4506	0
AR seq. initiated by AR1 successful (stored)	F080E013	Digital input	4507	0
AR seq. initiated by AR2 successful (stored)	F080E014	Digital input	4508	0
AR seq. initiated by AR3 successful (stored)	F080E015	Digital input	4509	0
AR seq. initiated by AR4 successful (stored)	F080E016	Digital input	450A	0
CB opening failed via auto-recloser (stored)	F080E026	Digital input	450B	0
CB closing failed via auto-recloser (stored)	F080E027	Digital input	450C	0
CB closing inhibited (stored)	F080E028	Digital input	450D	0
LOCKOUT change	F080E044 F080E045	Digital event	4500	0 - reset 1 - activated
AR in use	F080E034 F080E035	Digital event	4501	0 - in use 1 - not in use
Auto-reclosing sequence change	F080E000 F080E001	Digital event	4502	0 – Ended 1 – Started

Description	Name	Type	Point (hex)	Values
AR (shots 1...5) initiated by AR1	F080E002	Digital event	4503	1 - initiated
AR (shots 1...5) initiated by AR2	F080E003	Digital event	4504	1 - initiated
AR (shots 1...5) initiated by AR3	F080E004	Digital event	4505	1 - initiated
AR (shots 1...5) initiated by AR4	F080E005	Digital event	4506	1 - initiated
AR seq. initiated by AR1 successful	F080E013	Digital event	4507	1 - successful
AR seq. initiated by AR2 successful	F080E014	Digital event	4508	1 - successful
AR seq. initiated by AR3 successful	F080E015	Digital event	4509	1 - successful
AR seq. initiated by AR4 successful	F080E016	Digital event	450A	1 - successful
CB opening failed via auto-recloser	F080E026	Digital event	450B	1 - failed
CB closing failed via auto-recloser	F080E027	Digital event	450C	1 - failed
CB closing inhibited	F080E028	Digital event	450D	1 – inhibited
AR in progress	F080V001	Input register	4500	0...5 0 – AR not in progress; 1 – AR shot 1 in progress; 2 – AR shot 2 in progress; 3 – AR shot 3 in progress; 4 – AR shot 4 in progress; 5 – AR shot 5 in progress
Shot Pointer	F080V002	Input register	4501	1...7
AR operations	F080S003	Holding register	4500	0...2 0 – OFF 1 – ON 2 – Selected by the ON input

Function block AR5Func, shot 1 events

Description	Name	Type	Point (hex)	Values
Auto-reclose shot 1 off (stored)	F081E000 F081E001	Digital input	4510	0 - concluded 1 - in progress
AR shot 1 initiated via AR1 (stored)	F081E002	Digital input	4511	0
AR shot 1 initiated via AR2 (stored)	F081E003	Digital input	4512	0
AR shot 1 initiated via AR3 (stored)	F081E004	Digital input	4513	0
AR shot 1 initiated via AR4 (stored)	F081E005	Digital input	4514	0
AR shot 1 successful (stored)	F081E006	Digital input	4515	0
Auto-reclose shot 1 change	F081E000 F081E001	Digital event	4510	0 - concluded 1 - in progress
AR shot 1 initiated via AR1	F081E002	Digital event	4511	1 - initiated

Description	Name	Type	Point (hex)	Values
AR shot 1 initiated via AR2	F081E003	Digital event	4512	1 - initiated
AR shot 1 initiated via AR3	F081E004	Digital event	4513	1 - initiated
AR shot 1 initiated via AR4	F081E005	Digital event	4514	1 - initiated
AR shot 1 successful	F081E006	Digital event	4515	1 - successful

Function block AR5Func, shot 2 events

Description	Name	Type	Point (hex)	Values
Auto-reclose shot 2 off (stored)	F082E000 F082E001	Digital input	4520	0 - concluded 1 - in progress
AR shot 2 initiated via AR1 (stored)	F082E002	Digital input	4521	0
AR shot 2 initiated via AR2 (stored)	F082E003	Digital input	4522	0
AR shot 2 initiated via AR3 (stored)	F082E004	Digital input	4523	0
AR shot 2 initiated via AR4 (stored)	F082E005	Digital input	4524	0
AR shot 2 successful (stored)	F082E006	Digital input	4525	0
Auto-reclose shot 2 change	F082E000 F082E001	Digital event	4520	0 - concluded 1 - in progress
AR shot 2 initiated via AR1	F082E002	Digital event	4521	1 - initiated
AR shot 2 initiated via AR2	F082E003	Digital event	4522	1 - initiated
AR shot 2 initiated via AR3	F082E004	Digital event	4523	1 - initiated
AR shot 2 initiated via AR4	F082E005	Digital event	4524	1 - initiated
AR shot 2 successful	F082E006	Digital event	4525	1 - successful

Function block AR5Func, shot 3 events

Description	Name	Type	Point (hex)	Values
Auto-reclose shot 3 off (stored)	F083E000 F083E001	Digital input	4530	0 - concluded 1 - in progress
AR shot 3 initiated via AR1 (stored)	F083E002	Digital input	4531	0
AR shot 3 initiated via AR2 (stored)	F083E003	Digital input	4532	0
AR shot 3 initiated via AR3 (stored)	F083E004	Digital input	4533	0
AR shot 3 initiated via AR4 (stored)	F083E005	Digital input	4534	0
AR shot 3 successful (stored)	F083E006	Digital input	4535	0
Auto-reclose shot 3 change	F083E000 F083E001	Digital event	4530	0 - concluded 1 - in progress
AR shot 3 initiated via AR1	F083E002	Digital event	4531	1 - initiated
AR shot 3 initiated via AR2	F083E003	Digital event	4532	1 - initiated
AR shot 3 initiated via AR3	F083E004	Digital event	4533	1 - initiated
AR shot 3 initiated via AR4	F083E005	Digital event	4534	1 - initiated
AR shot 3 successful	F083E006	Digital event	4535	1 - successful

Function block AR5Func, shot 4 events

Description	Name	Type	Point (hex)	Values
Auto-reclose shot 4 off (stored)	F084E000 F084E001	Digital input	4540	0 - concluded 1 - in progress
AR shot 4 initiated via AR1 (stored)	F084E002	Digital input	4541	0
AR shot 4 initiated via AR2 (stored)	F084E003	Digital input	4542	0
AR shot 4 initiated via AR3 (stored)	F084E004	Digital input	4543	0
AR shot 4 initiated via AR4 (stored)	F084E005	Digital input	4544	0
AR shot 4 successful (stored)	F084E006	Digital input	4545	0
Auto-reclose shot 4 change	F084E000 F084E001	Digital event	4540	0 - concluded 1 - in progress
AR shot 4 initiated via AR1	F084E002	Digital event	4541	1 - initiated
AR shot 4 initiated via AR2	F084E003	Digital event	4542	1 - initiated
AR shot 4 initiated via AR3	F084E004	Digital event	4543	1 - initiated
AR shot 4 initiated via AR4	F084E005	Digital event	4544	1 - initiated
AR shot 4 successful	F084E006	Digital event	4545	1 - successful

Function block AR5Func, shot 5 events

Description	Name	Type	Point (hex)	Values
Auto-reclose shot 5 off (stored)	F085E000 F085E001	Digital input	4550	0 - concluded 1 - in progress
AR shot 5 initiated via AR1 (stored)	F085E002	Digital input	4551	0
AR shot 5 initiated via AR2 (stored)	F085E003	Digital input	4552	0
AR shot 5 initiated via AR3 (stored)	F085E004	Digital input	4553	0
AR shot 5 initiated via AR4 (stored)	F085E005	Digital input	4554	0
AR shot 5 successful (stored)	F085E006	Digital input	4555	0
Auto-reclose shot 5 change	F085E000 F085E001	Digital event	4550	0 - concluded 1 - in progress
AR shot 5 initiated via AR1	F085E002	Digital event	4551	1 - initiated
AR shot 5 initiated via AR2	F085E003	Digital event	4552	1 - initiated
AR shot 5 initiated via AR3	F085E004	Digital event	4553	1 - initiated
AR shot 5 initiated via AR4	F085E005	Digital event	4554	1 - initiated
AR shot 5 successful	F085E006	Digital event	4555	1 - successful

Function block AR5Func, final trip events

Description	Name	Type	Point (hex)	Values
Final trip (stored)	F086E000	Digital input	4560	0
Final trip via AR1 (stored)	F086E001	Digital input	4561	0
Final trip via AR1 (stored)	F086E002	Digital input	4562	0
Final trip via AR1 (stored)	F086E003	Digital input	4563	0
Final trip via AR1 (stored)	F086E004	Digital input	4564	0
Final trip	F086E000	Digital event	4560	1 - trip

Description	Name	Type	Point (hex)	Values
Final trip via AR1	F086E001	Digital event	4561	1 - trip
Final trip via AR1	F086E002	Digital event	4562	1 - trip
Final trip via AR1	F086E003	Digital event	4563	1 - trip
Final trip via AR1	F086E004	Digital event	4564	1 - trip

Function block CUB3LOW

Description	Name	Type	Point (hex)	Values
START signal from DI > stage	F051O001	Digital input	1200	0 – reset 1 - activated
TRIP signal from DI > stage	F051O002	Digital input	1201	0 – reset 1 – activated
CBFP signal from DI > stage	F051O003	Digital input	1202	0 – reset 1 – activated
BS1 signal of DI > stage	F051I005	Digital input	1203	0 – reset 1 – activated
BS2 signal of DI > stage	F051I006	Digital input	1204	0 – reset 1 – activated
START signal from DI > stage change	F051E000 F051E001	Digital event	1200	0 – reset 1 - activated
TRIP signal from DI > stage change	F051E002 F051E003	Digital event	1201	0 – reset 1 – activated
CBFP signal from DI > stage change	F051E004 F051E005	Digital event	1202	0 – reset 1 – activated
BS1 signal of DI > stage change	F051E006 F051E007	Digital event	1203	0 – reset 1 – activated
BS2 signal of DI > stage change	F051E008 F051E009	Digital event	1204	0 – reset 1 – activated

Function block DEF2HIGH

Description	Name	Type	Point (hex)	Values
START signal from Io > ->	F041O001	Digital input	1480	0 – reset 1 – activated
TRIP signal from Io > ->	F041O002	Digital input	1481	0 – reset 1 – activated
CBFP signal from Io > ->	F041O003	Digital input	1482	0 – reset 1 – activated
BS1 signal of Io > ->	F041I005	Digital input	1483	0 – reset 1 – activated
BS2 signal of Io > ->	F041I006	Digital input	1484	0 – reset 1 – activated
START signal from Io > -> change	F041E000 F041E001	Digital event	1480	0 – reset 1 – activated
TRIP signal from Io > -> change	F041E002 F041E003	Digital event	1481	0 – reset 1 – activated
CBFP signal from Io > -> change	F041E004 F041E005	Digital event	1482	0 – reset 1 – activated
BS1 signal of Io > -> change	F041E006 F041E007	Digital event	1483	0 – reset 1 – activated
BS2 signal of Io > -> change	F041E008 F041E009	Digital event	1484	0 – reset 1 – activated

Function block DEF2LOW

Description	Name	Type	Point (hex)	Values
START signal from Io > ->	F040O001	Digital input	1400	0 – reset 1 - activated
TRIP signal from Io > ->	F040O002	Digital input	1401	0 – reset 1 – activated
CBFP signal from Io > ->	F040O003	Digital input	1402	0 – reset 1 – activated
BS1 signal of Io > ->	F040I005	Digital input	1403	0 – reset 1 – activated
BS2 signal of Io > ->	F040I006	Digital input	1404	0 – reset 1 – activated
START signal from Io > -> change	F040E000 F040E001	Digital event	1400	0 – reset 1 - activated
TRIP signal from Io > -> change	F040E002 F040E003	Digital event	1401	0 – reset 1 – activated
CBFP signal from Io > -> change	F040E004 F040E005	Digital event	1402	0 – reset 1 – activated
BS1 signal of Io > -> change	F040E006 F040E007	Digital event	1403	0 – reset 1 – activated
BS2 signal of Io > -> change	F040E008 F040E009	Digital event	1404	0 – reset 1 – activated

Function block DOC6HIGH

Description	Name	Type	Point (hex)	Values
START signal from 3I >> -> stage	F036O003	Digital input	1380	0 – reset 1 – activated
TRIP signal from 3I >> -> stage	F036O004	Digital input	1381	0 – reset 1 – activated
CBFP signal from 3I >> -> stage	F036O005	Digital input	1382	0 – reset 1 – activated
DIR. signal from 3I >> -> stage	F036O001	Digital input	1383	0 – reset 1 – activated
BSOUT signal from 3I >> -> stage	F036O002	Digital input	1384	0 – reset 1 – activated
BS1 signal of 3I >> -> stage	F036I016	Digital input	1385	0 – reset 1 – activated
BS2 signal of 3I >> -> stage	F036I017	Digital input	1386	0 – reset 1 – activated
START signal from 3I >> -> stage change	F036E000 F036E001	Digital event	1380	0 – reset 1 – activated
TRIP signal from 3I >> -> stage change	F036E002 F036E003	Digital event	1381	0 – reset 1 – activated
CBFP signal from 3I >> -> stage change	F036E004 F036E005	Digital event	1382	0 – reset 1 – activated
DIR. signal from 3I >> -> stage change	F036E008 F036E009	Digital event	1383	0 – reset 1 – activated
BSOUT signal from 3I >> -> stage change	F036E006 F036E007	Digital event	1384	0 – reset 1 – activated
BS1 signal of 3I >> -> stage change	F036E010 F036E011	Digital event	1385	0 – reset 1 – activated
BS2 signal of 3I >> -> stage change	F036E012 F036E013	Digital event	1386	0 – reset 1 – activated

Function block DOC6LOW

Description	Name	Type	Point (hex)	Values
START signal from 3I > -> stage	F035O002	Digital input	1300	0 – reset 1 – activated
TRIP signal from 3I > -> stage	F035O003	Digital input	1301	0 – reset 1 – activated
CBFP signal from 3I > -> stage	F035O004	Digital input	1302	0 – reset 1 – activated
DIR. signal from 3I > -> stage	F035O001	Digital input	1303	0 – reset 1 – activated
BS1 signal of 3I > -> stage	F035I016	Digital input	1304	0 – reset 1 – activated
BS2 signal of 3I > -> stage	F035I017	Digital input	1305	0 – reset 1 – activated
START signal from 3I > -> stage change	F035E000 F035E001	Digital event	1300	0 – reset 1 – activated
TRIP signal from 3I > -> stage change	F035E002 F035E003	Digital event	1301	0 – reset 1 – activated
CBFP signal from 3I > -> stage change	F035E004 F035E005	Digital event	1302	0 – reset 1 – activated
DIR. signal from 3I > -> stage change	F035E006 F035E007	Digital event	1303	0 – reset 1 – activated
BS1 signal of 3I > -> stage change	F035E008 F035E009	Digital event	1304	0 – reset 1 – activated
BS2 signal of 3I > -> stage change	F035E010 F035E011	Digital event	1305	0 – reset 1 – activated

Function block INRUSH3

Description	Name	Type	Point (hex)	Values
START signal from Inrush3 stage	F034O001	Digital input	1700	0 – reset 1 – activated
START signal from Inrush3 stage change	F034E000 F034E001	Digital event	1700	0 – reset 1 – activated

Function block NEF1HIGH

Description	Name	Type	Point (hex)	Values
START signal from Io >> stage	F039O001	Digital input	1180	0 – reset 1 - activated
TRIP signal from Io >> stage	F039O002	Digital input	1181	0 – reset 1 – activated
CBFP signal from Io >> stage	F039O003	Digital input	1182	0 – reset 1 – activated
BS1 signal of Io >> stage	F039I002	Digital input	1183	0 – reset 1 – activated
BS2 signal of Io >> stage	F039I003	Digital input	1184	0 – reset 1 – activated
START signal from Io >> stage change	F039E000 F039E001	Digital event	1180	0 – reset 1 - activated
TRIP signal from Io >> stage change	F039E002 F039E003	Digital event	1181	0 – reset 1 – activated
CBFP signal from Io >> stage change	F039E004 F039E005	Digital event	1182	0 – reset 1 – activated

Description	Name	Type	Point (hex)	Values
BS1 signal of Io >> stage change	F039E006 F039E007	Digital event	1183	0 – reset 1 – activated
BS2 signal of Io >> stage change	F039E008 F039E009	Digital event	1184	0 – reset 1 – activated

Function block NEF1LOW

Description	Name	Type	Point (hex)	Values
START signal from Io > stage	F038O001	Digital input	1100	0 – reset 1 – activated
TRIP signal from Io > stage	F038O002	Digital input	1101	0 – reset 1 – activated
CBFP signal from Io > stage	F038O003	Digital input	1102	0 – reset 1 – activated
BS1 signal of Io > stage	F038I002	Digital input	1103	0 – reset 1 – activated
BS2 signal of Io > stage	F038I003	Digital input	1104	0 – reset 1 – activated
START signal from Io > stage change	F038E000 F038E001	Digital event	1100	0 – reset 1 – activated
TRIP signal from Io > stage change	F038E002 F038E003	Digital event	1101	0 – reset 1 – activated
CBFP signal from Io > stage change	F038E004 F038E005	Digital event	1102	0 – reset 1 – activated
BS1 signal of Io > stage change	F038E006 F038E007	Digital event	1103	0 – reset 1 – activated
BS2 signal of Io > stage change	F038E008 F038E009	Digital event	1104	0 – reset 1 – activated

Function block NOC3HIGH

Description	Name	Type	Point (hex)	Values
START signal from 3I >> stage	F032O002	Digital input	1080	0 – reset 1 - activated
TRIP signal from 3I >> stage	F032O003	Digital input	1081	0 – reset 1 – activated
CBFP signal from 3I >> stage	F032O004	Digital input	1082	0 – reset 1 – activated
BSOUT signal from 3I >> stage	F032O001	Digital input	1083	0 – reset 1 – activated
BS1 signal of 3I >> stage	F032I004	Digital input	1084	0 – reset 1 – activated
BS2 signal of 3I >> stage	F032I005	Digital input	1085	0 – reset 1 – activated
START signal from 3I >> stage change	F032E000 F032E001	Digital event	1080	0 – reset 1 - activated
TRIP signal from 3I >> stage change	F032E002 F032E003	Digital event	1081	0 – reset 1 – activated
CBFP signal from 3I >> stage change	F032E004 F032E005	Digital event	1082	0 – reset 1 – activated
BSOUT signal from 3I >> stage change	F032E006 F032E007	Digital event	1083	0 – reset 1 – activated
BS1 signal of 3I >> stage change	F032E008 F032E009	Digital event	1084	0 – reset 1 – activated

Description	Name	Type	Point (hex)	Values
BS2 signal of 3I >> stage change	F032E010 F032E011	Digital event	1085	0 – reset 1 – activated

Function block NOC3LOW

Description	Name	Type	Point (hex)	Values
START signal from 3I > stage	F031O001	Digital input	1000	0 – reset 1 – activated
TRIP signal from 3I > stage	F031O002	Digital input	1001	0 – reset 1 – activated
CBFP signal from 3I > stage	F031O003	Digital input	1002	0 – reset 1 – activated
BS1 signal of 3I > stage	F031I004	Digital input	1003	0 – reset 1 – activated
BS2 signal of 3I > stage	F031I005	Digital input	1004	0 – reset 1 – activated
START signal from 3I > stage change	F031E000 F031E001	Digital event	1000	0 – reset 1 – activated
TRIP signal from 3I > stage change	F031E002 F031E003	Digital event	1001	0 – reset 1 – activated
CBFP signal from 3I > stage change	F031E004 F031E005	Digital event	1002	0 – reset 1 – activated
BS1 signal of 3I > stage change	F031E006 F031E007	Digital event	1003	0 – reset 1 – activated
BS2 signal of 3I > stage change	F031E008 F031E009	Digital event	1004	0 – reset 1 – activated

Function block UV3HIGH

Description	Name	Type	Point (hex)	Values
START signal from 3U<< stage	F065O001	Digital input	1680	0 – reset 1 – activated
TRIP signal from 3U<< stage	F065O002	Digital input	1681	0 – reset 1 – activated
BS1 signal of 3U<< stage	F065I004	Digital input	1682	0 – reset 1 – activated
BS2 signal of 3U<< stage	F065I005	Digital input	1683	0 – reset 1 – activated
START signal from 3U<< stage change	F065E000 F065E001	Digital event	1680	0 – reset
TRIP signal from 3U<< stage change	F065E002 F065E003	Digital event	1681	0 – reset
BS1 signal of 3U<< stage change	F065E004 F065E005	Digital event	1682	0 – reset
BS2 signal of 3U<< stage change	F065E006 F065E007	Digital event	1683	0 – reset

Function block UV3LOW

Description	Name	Type	Point (hex)	Values
START signal from 3U< stage	F064O001	Digital input	1600	0 – reset 1 – activated

Description	Name	Type	Point (hex)	Values
TRIP signal from 3U< stage	F064O002	Digital input	1601	0 – reset 1 – activated
BS1 signal of 3U< stage	F064I004	Digital input	1602	0 – reset 1 – activated
BS2 signal of 3U< stage	F064I005	Digital input	1603	0 – reset 1 – activated
START signal from 3U< stage change	F064E000 F064E001	Digital event	1600	0 – reset 1 – activated
TRIP signal from 3U< stage change	F064E002 F064E003	Digital event	1601	0 – reset 1 – activated
BS1 signal of 3U< stage change	F064E004 F064E005	Digital event	1602	0 – reset 1 – activated
BS2 signal of 3U< stage change	F064E006 F064E007	Digital event	1603	0 – reset 1 – activated

Function block CO3DC1

Description	Name	Type	Point (hex)	Values
Direct open of CO3DC1	F139V004	Coil	2800	1 – execute
Direct close of CO3DC1	F139V005	Coil	2801	1 – execute
Select open of CO3DC1	F139V006	Coil	2802	1 – select
Select close of CO3DC1	F139V007	Coil	2803	1 – select
Direct earth of CO3DC1	F139V020	Coil	2804	1 – execute
Direct free of CO3DC1	F139V021	Coil	2805	1 – execute
Select earth of CO3DC1	F139V022	Coil	2806	1 – select
Select free of CO3DC1	F139V023	Coil	2807	1 – select
Cancel selection of CO3DC1	F139V010	Coil	2808	1 – cancel
Execute selection of CO3DC1	F139V011	Coil	2809	1 – execute
Alarm ACK of CO3DC1	F139V099	Coil	280A	1 – ACK
Opening time alarm of CO3DC1 status	F139O005	Digital input	2800	0 – normal 1 – alarm
Closing time alarm of CO3DC1 status	F139O006	Digital input	2801	0 – normal 1 – alarm
Earthing time alarm of CO3DC1 status	F139O007	Digital input	2802	0 – normal 1 – alarm
Freeing time alarm of CO3DC1 status	F139O008	Digital input	2803	0 – normal 1 – alarm
Interlock close of CO3DC1	F139V030	Digital input	2804	0 – disabled 1 – enabled
Interlock open of CO3DC1	F139V031	Digital input	2805	0 – disabled 1 – enabled
Interlock earth of CO3DC1	F139V032	Digital input	2806	0 – disabled 1 – enabled
Interlock free of CO3DC1	F139V033	Digital input	2807	0 – disabled 1 – enabled
Invalid state of CO3DC1	F139V034	Digital input	2808	0 – inactive 1 – active
Command blocking of CO3DC1 status	F139V035	Digital input	2809	0 – deactivated 1 – activated
Command status of CO3DC1	F139E024 F139E025	Digital input	280A	0 – NACK 1 – ACK
Opening time alarm of CO3DC1 change	F139E016 F139E017	Digital event	2800	0 – normal 1 – alarm
Closing time alarm of CO3DC1 change	F139E018 F139E019	Digital event	2801	0 – normal 1 – alarm

Description	Name	Type	Point (hex)	Values
Earthing time alarm of CO3DC1 change	F139E034 F139E035	Digital event	2802	0 – normal 1 – alarm
Freeing time alarm of CO3DC1 change	F139E036 F139E037	Digital event	2803	0 – normal 1 – alarm
Close interlocking of CO3DC1 change	F139E006 F139E007	Digital event	2804	0 – disabled 1 – enabled
Open interlocking of CO3DC1 change	F139E004 F139E005	Digital event	2805	0 – disabled 1 – enabled
Earth interlocking of CO3DC1 change	F139E042 F139E043	Digital event	2806	0 – disabled 1 – enabled
Free interlocking of CO3DC1 change	F139E044 F139E045	Digital event	2807	0 – disabled 1 – enabled
Invalid state of CO3DC1 change	F139E008 F139E009	Digital event	2808	0 – inactive 1 – active
Command blocking of CO3DC1 change	F139E026 F139E027	Digital event	2809	0 – deactivated 1 – activated
Command status of CO3DC1	F139E024 F139E025	Digital event	280A	0 – NACK 1 – ACK
Position open/close of CO3DC1	F139V001	Input register	2800	0 – middle 1 – closed 2 – open 3 – faulty
Position earth/free of CO3DC1	F139V002	Input register	2801	0 – middle 1 – earth 2 – free 3 – faulty
Position open/close of CO3DC1 change	F139E000 F139E001 F139E002 F139E003	Analog event	2800	0 – middle 1 – closed 2 – open 3 – faulty
Position earth/free of CO3DC1 change	F139E038 F139E039 F139E040 F139E041	Analog event	2801	0 – middle 1 – earth 2 – free 3 – faulty

Function block CO3DC2

Description	Name	Type	Point (hex)	Values
Direct open of CO3DC2	F140V004	Coil	2880	1 – execute
Direct close of CO3DC2	F140V005	Coil	2881	1 – execute
Select open of CO3DC2	F140V006	Coil	2882	1 – select
Select close of CO3DC2	F140V007	Coil	2883	1 – select
Direct earth of CO3DC2	F140V020	Coil	2884	1 – execute
Direct free of CO3DC2	F140V021	Coil	2885	1 – execute
Select earth of CO3DC2	F140V022	Coil	2886	1 – select
Select free of CO3DC2	F140V023	Coil	2887	1 – select
Cancel selection of CO3DC2	F140V010	Coil	2888	1 – cancel
Execute selection of CO3DC2	F140V011	Coil	2889	1 – execute
Alarm ACK of CO3DC2	F140V099	Coil	288A	1 – ACK
Opening time alarm of CO3DC2 status	F140O005	Digital input	2880	0 – normal 1 – alarm
Closing time alarm of CO3DC2 status	F140O006	Digital input	2881	0 – normal 1 – alarm
Earthing time alarm of CO3DC2 status	F140O007	Digital input	2882	0 – normal 1 – alarm

Description	Name	Type	Point (hex)	Values
Freeing time alarm of CO3DC2 status	F140O008	Digital input	2883	0 – normal 1 – alarm
Interlock close of CO3DC2	F140V030	Digital input	2884	0 – disabled 1 – enabled
Interlock open of CO3DC2	F140V031	Digital input	2885	0 – disabled 1 – enabled
Interlock earth of CO3DC2	F140V032	Digital input	2886	0 – disabled 1 – enabled
Interlock free of CO3DC2	F140V033	Digital input	2887	0 – disabled 1 – enabled
Invalid state of CO3DC2	F140V034	Digital input	2888	0 – inactive 1 – active
Command blocking of CO3DC2 status	F140V035	Digital input	2889	0 – deactivated 1 – activated
Command status of CO3DC2	F140E024 F140E025	Digital input	288A	0 – NACK 1 – ACK
Opening time alarm of CO3DC2 change	F140E016 F140E017	Digital event	2880	0 – normal 1 – alarm
Closing time alarm of CO3DC2 change	F140E018 F140E019	Digital event	2881	0 – normal 1 – alarm
Earthing time alarm of CO3DC2 change	F140E034 F140E035	Digital event	2882	0 – normal 1 – alarm
Freeing time alarm of CO3DC2 change	F140E036 F140E037	Digital event	2883	0 – normal 1 – alarm
Close interlocking of CO3DC2 change	F140E006 F140E007	Digital event	2884	0 – disabled 1 – enabled
Open interlocking of CO3DC2 change	F140E004 F140E005	Digital event	2885	0 – disabled 1 – enabled
Earth interlocking of CO3DC2 change	F140E042 F140E043	Digital event	2886	0 – disabled 1 – enabled
Free interlocking of CO3DC2 change	F140E044 F140E045	Digital event	2887	0 – disabled 1 – enabled
Invalid state of CO3DC2 change	F140E008 F140E009	Digital event	2888	0 – inactive 1 – active
Command blocking of CO3DC2 change	F140E026 F140E027	Digital event	2889	0 – deactivated 1 – activated
Command status of CO3DC2	F140E024 F140E025	Digital event	288A	0 – NACK 1 – ACK
Position open/close of CO3DC2	F140V001	Input register	2880	0 – middle 1 – closed 2 – open 3 – faulty
Position earth/free of CO3DC2	F140V002	Input register	2881	0 – middle 1 – earth 2 – free 3 – faulty
Position open/close of CO3DC2 change	F140E000 F140E001 F140E002 F140E003	Analog event	2880	0 – middle 1 – closed 2 – open 3 – faulty
Position earth/free of CO3DC2 change	F140E038 F140E039 F140E040 F140E041	Analog event	2881	0 – middle 1 – earth 2 – free 3 – faulty

Function block COCB1

Description	Name	Type	Point (hex)	Values
Direct open of COCB1	F120V004	Coil	2400	1 – execute
Direct close of COCB1	F120V005	Coil	2401	1 – execute
Select open of COCB1	F120V006	Coil	2402	1 – select
Select close of COCB1	F120V007	Coil	2403	1 – select
Cancel selection of COCB1	F120V010	Coil	2404	1 – cancel
Execute selection of COCB1	F120V011	Coil	2405	1 – execute
Alarm ACK of COCB1	F120V099	Coil	2406	1 – ACK
Opening time alarm status of COCB1	F120O003	Digital input	2400	0 – normal 1 – alarm
Closing time alarm status of COCB1	F120O004	Digital input	2401	0 – normal 1 – alarm
Inactive time alarm status of COCB1	F120O005	Digital input	2402	0 – normal 1 – alarm
Cycle time alarm status of COCB1	F120O006	Digital input	2403	0 – normal 1 – alarm
Open command of COCB1	F120V031	Digital input	2404	0 – enabled 1 – interlocked
Close command of COCB1	F120V030	Digital input	2405	0 – enabled 1 – interlocked
Invalid state of COCB1	F120V034	Digital input	2406	0 – off 1 – on
Control blocking of COCB1	F120V035	Digital input	2407	0 – deactivated 1 – activated
Command status of COCB1	F120E024 F120E025	Digital input	2408	0 – NACK 1 – ACK
Opening time alarm of COCB1 change	F120E016 F120E017	Digital event	2400	0 – normal 1 – alarm
Closing time alarm of COCB1 change	F120E018 F120E019	Digital event	2401	0 – normal 1 – alarm
Inactive time alarm of COCB1 change	F120E020 F120E021	Digital event	2402	0 – normal 1 – alarm
Cycle time alarm of COCB1 change	F120E022 F120E023	Digital event	2403	0 – normal 1 – alarm
Open command enable of COCB1 change	F120E004 F120E005	Digital event	2404	0 – enabled 1 – interlocked
Close command enable of COCB1 change	F120E006 F120E007	Digital event	2405	0 – enabled 1 – interlocked
Invalid state of COCB1 change	F120E008 F120E009	Digital event	2406	0 – off 1 – on
Control blocking of COCB1 change	F120E026 F120E027	Digital event	2407	0 – deactivated 1 – activated
Command status of COCB1	F120E024 F120E025	Digital event	2408	0 – NACK 1 – ACK
Position of COCB1	F120V001	Input register	2400	0 – middle 1 – closed 2 – open 3 – faulty
Position of COCB1 change	F120E000 F120E001 F120E002 F120E003	Analog event	2400	0 – middle 1 – closed 2 – open 3 – faulty

Function block COCB2

Description	Name	Type	Point (hex)	Values
Direct open of COCB2	F121V004	Coil	2480	1 – execute
Direct close of COCB2	F121V005	Coil	2481	1 – execute
Select open of COCB2	F121V006	Coil	2482	1 – select
Select close of COCB2	F121V007	Coil	2483	1 – select
Cancel selection of COCB2	F121V010	Coil	2484	1 – cancel
Execute selection of COCB2	F121V011	Coil	2485	1 – execute
Alarm ACK of COCB2	F121V099	Coil	2486	1 – ACK
Opening time alarm status of COCB2	F121O003	Digital input	2480	0 – normal 1 – alarm
Closing time alarm status of COCB2	F121O004	Digital input	2481	0 – normal 1 – alarm
Inactive time alarm status of COCB2	F121O005	Digital input	2482	0 – normal 1 – alarm
Cycle time alarm status of COCB2	F121O006	Digital input	2483	0 – normal 1 – alarm
Open command of COCB2	F121V031	Digital input	2484	0 – enabled 1 – interlocked
Close command of COCB2	F121V030	Digital input	2485	0 – enabled 1 – interlocked
Invalid state of COCB2	F121V034	Digital input	2486	0 – off 1 – on
Control blocking of COCB2	F121V035	Digital input	2487	0 – deactivated 1 – activated
Command status of COCB2	F121E024 F121E025	Digital input	2488	0 – NACK 1 – ACK
Opening time alarm of COCB2 change	F121E016 F121E017	Digital event	2480	0 – normal 1 – alarm
Closing time alarm of COCB2 change	F121E018 F121E019	Digital event	2481	0 – normal 1 – alarm
Inactive time alarm of COCB2 change	F121E020 F121E021	Digital event	2482	0 – normal 1 – alarm
Cycle time alarm of COCB2 change	F121E022 F121E023	Digital event	2483	0 – normal 1 – alarm
Open command enable of COCB2 change	F121E004 F121E005	Digital event	2484	0 – enabled 1 – interlocked
Close command enable of COCB2 change	F121E006 F121E007	Digital event	2485	0 – enabled 1 – interlocked
Invalid state of COCB2 change	F121E008 F121E009	Digital event	2486	0 – off 1 – on
Control blocking of COCB2 change	F121E026 F121E027	Digital event	2487	0 – deactivated 1 – activated
Command status of COCB2	F121E024 F121E025	Digital event	2488	0 – NACK 1 – ACK
Position of COCB2	F121V001	Input register	2480	0 – middle 1 – closed 2 – open 3 – faulty
Position of COCB2 change	F121E000 F121E001 F121E002 F121E003	Analog event	2480	0 – middle 1 – closed 2 – open 3 – faulty

Function block CODC1

Description	Name	Type	Point (hex)	Values
Direct open of CODC1	F122V004	Coil	2500	1 – execute
Direct close of CODC1	F122V005	Coil	2501	1 – execute
Select open of CODC1	F122V006	Coil	2502	1 – select
Select close of CODC1	F122V007	Coil	2503	1 – select
Cancel selection of CODC1	F122V010	Coil	2504	1 – cancel
Execute selection of CODC1	F122V011	Coil	2505	1 – execute
Alarm ACK of CODC1	F122V099	Coil	2506	1 – ACK
Opening time alarm status of CODC1	F122O003	Digital input	2500	0 – normal 1 – alarm
Closing time alarm status of CODC1	F122O004	Digital input	2501	0 – normal 1 – alarm
Open command of CODC1	F122V031	Digital input	2502	0 – enabled 1 – interlocked
Close command of CODC1	F122V030	Digital input	2503	0 – enabled 1 – interlocked
Invalid state of CODC1	F122V034	Digital input	2504	0 – off 1 – on
Control blocking of CODC1	F122V035	Digital input	2505	0 – deactivated 1 – activated
Command status of CODC1	F122E024 F122E025	Digital input	2506	0 – NACK 1 – ACK
Opening time alarm of CODC1 change	F122E016 F122E017	Digital event	2500	0 – normal 1 – alarm
Closing time alarm of CODC1 change	F122E018 F122E019	Digital event	2501	0 – normal 1 – alarm
Open command enable of CODC1 change	F122E004 F122E005	Digital event	2502	0 – enabled 1 – interlocked
Close command enable of CODC1 change	F122E006 F122E007	Digital event	2503	0 – enabled 1 – interlocked
Invalid state of CODC1 change	F122E008 F122E009	Digital event	2504	0 – off 1 – on
Command blocking of CODC1 change	F122E026 F122E027	Digital event	2505	0 – deactivated 1 – activated
Command status of CODC1	F122E024 F122E025	Digital event	2506	0 – NACK 1 – ACK
Position of CODC1	F122V001	Input register	2500	0 – middle 1 – closed 2 – open 3 – faulty
Position of CODC1 change	F122E000 F122E001 F122E002 F122E003	Analog event	2500	0 – middle 1 – closed 2 – open 3 – faulty

Function block CODC2

Description	Name	Type	Point (hex)	Values
Direct open of CODC2	F123V004	Coil	2580	1 – execute
Direct close of CODC2	F123V005	Coil	2581	1 – execute
Select open of CODC2	F123V006	Coil	2582	1 – select
Select close of CODC2	F123V007	Coil	2583	1 – select
Cancel selection of CODC2	F123V010	Coil	2584	1 – cancel
Execute selection of CODC2	F123V011	Coil	2585	1 – execute

Description	Name	Type	Point (hex)	Values
Alarm ACK of CODC2	F123V099	Coil	2586	1 – ACK
Opening time alarm status of CODC2	F123O003	Digital input	2580	0 – normal 1 – alarm
Closing time alarm status of CODC2	F123O004	Digital input	2581	0 – normal 1 – alarm
Open command of CODC2	F123V031	Digital input	2582	0 – enabled 1 – interlocked
Close command of CODC2	F123V030	Digital input	2583	0 – enabled 1 – interlocked
Invalid state of CODC2	F123V034	Digital input	2584	0 – off 1 – on
Control blocking of CODC2	F123V035	Digital input	2585	0 – deactivated 1 – activated
Command status of CODC2	F123E024 F123E025	Digital input	2586	0 – NACK 1 – ACK
Opening time alarm of CODC2 change	F123E016 F123E017	Digital event	2580	0 – normal 1 – alarm
Closing time alarm of CODC2 change	F123E018 F123E019	Digital event	2581	0 – normal 1 – alarm
Open command enable of CODC2 change	F123E004 F123E005	Digital event	2582	0 – enabled 1 – interlocked
Close command enable of CODC2 change	F123E006 F123E007	Digital event	2583	0 – enabled 1 – interlocked
Invalid state of CODC2 change	F123E008 F123E009	Digital event	2584	0 – off 1 – on
Command blocking of CODC2 change	F123E026 F123E027	Digital event	2585	0 – deactivated 1 – activated
Command status of CODC2	F123E024 F123E025	Digital event	2586	0 – NACK 1 – ACK
Position of CODC2	F123V001	Input register	2580	0 – middle 1 – closed 2 – open 3 – faulty
Position of CODC2 change	F123E000 F123E001 F123E002 F123E003	Analog event	2580	0 – middle 1 – closed 2 – open 3 – faulty

Function block CODC3

Description	Name	Type	Point (hex)	Values
Direct open of CODC3	F124V004	Coil	2600	1 – execute
Direct close of CODC3	F124V005	Coil	2601	1 – execute
Select open of CODC3	F124V006	Coil	2602	1 – select
Select close of CODC3	F124V007	Coil	2603	1 – select
Cancel selection of CODC3	F124V010	Coil	2604	1 – cancel
Execute selection of CODC3	F124V011	Coil	2605	1 – execute
Alarm ACK of CODC3	F124V099	Coil	2606	1 – ACK
Opening time alarm status of CODC3	F124O003	Digital input	2600	0 – normal 1 – alarm
Closing time alarm status of CODC3	F124O004	Digital input	2601	0 – normal 1 – alarm
Open command of CODC3	F124V031	Digital input	2602	0 – enabled 1 – interlocked

Description	Name	Type	Point (hex)	Values
Close command of CODC3	F124V030	Digital input	2603	0 – enabled 1 – interlocked
Invalid state of CODC3	F124V034	Digital input	2604	0 – off 1 – on
Control blocking of CODC3	F124V035	Digital input	2605	0 – deactivated 1 – activated
Command status of CODC3	F124E024 F124E025	Digital input	2606	0 – NACK 1 – ACK
Opening time alarm of CODC3 change	F124E016 F124E017	Digital event	2600	0 – normal 1 – alarm
Closing time alarm of CODC3 change	F124E018 F124E019	Digital event	2601	0 – normal 1 – alarm
Open command enable of CODC3 change	F124E004 F124E005	Digital event	2602	0 – enabled 1 – interlocked
Close command enable of CODC3 change	F124E006 F124E007	Digital event	2603	0 – enabled 1 – interlocked
Invalid state of CODC3 change	F124E008 F124E009	Digital event	2604	0 – off 1 – on
Command blocking of CODC3 change	F124E026 F124E027	Digital event	2605	0 – deactivated 1 – activated
Command status of CODC3	F124E024 F124E025	Digital event	2606	0 – NACK 1 – ACK
Position of CODC3	F124V001	Input register	2600	0 – middle 1 – closed 2 – open 3 – faulty
Position of CODC3 change	F124E000 F124E001 F124E002 F124E003	Analog event	2600	0 – middle 1 – closed 2 – open 3 – faulty

Function block CODC4

Description	Name	Type	Point (hex)	Values
Direct open of CODC4	F125V004	Coil	2680	1 – execute
Direct close of CODC4	F125V005	Coil	2681	1 – execute
Select open of CODC4	F125V006	Coil	2682	1 – select
Select close of CODC4	F125V007	Coil	2683	1 – select
Cancel selection of CODC4	F125V010	Coil	2684	1 – cancel
Execute selection of CODC4	F125V011	Coil	2685	1 – execute
Alarm ACK of CODC4	F125V099	Coil	2686	1 – ACK
Opening time alarm status of CODC4	F125O003	Digital input	2680	0 – normal 1 – alarm
Closing time alarm status of CODC4	F125O004	Digital input	2681	0 – normal 1 – alarm
Open command of CODC4	F125V031	Digital input	2682	0 – enabled 1 – interlocked
Close command of CODC4	F125V030	Digital input	2683	0 – enabled 1 – interlocked
Invalid state of CODC4	F125V034	Digital input	2684	0 – off 1 – on
Control blocking of CODC4	F125V035	Digital input	2685	0 – deactivated 1 – activated
Command status of CODC4	F125E024 F125E025	Digital input	2686	0 – NACK 1 – ACK

Description	Name	Type	Point (hex)	Values
Opening time alarm of CODC4 change	F125E016 F125E017	Digital event	2680	0 – normal 1 – alarm
Closing time alarm of CODC4 change	F125E018 F125E019	Digital event	2681	0 – normal 1 – alarm
Open command enable of CODC4 change	F125E004 F125E005	Digital event	2682	0 – enabled 1 – interlocked
Close command enable of CODC4 change	F125E006 F125E007	Digital event	2683	0 – enabled 1 – interlocked
Invalid state of CODC4 change	F125E008 F125E009	Digital event	2684	0 – off 1 – on
Command blocking of CODC4 change	F125E026 F125E027	Digital event	2685	0 – deactivated 1 – activated
Command status of CODC4	F125E024 F125E025	Digital event	2686	0 – NACK 1 – ACK
Position of CODC4	F125V001	Input register	2680	0 – middle 1 – closed 2 – open 3 – faulty
Position of CODC4 change	F125E000 F125E001 F125E002 F125E003	Analog event	2680	0 – middle 1 – closed 2 – open 3 – faulty

Function block CODC5

Description	Name	Type	Point (hex)	Values
Direct open of CODC5	F126V004	Coil	2700	1 – execute
Direct close of CODC5	F126V005	Coil	2701	1 – execute
Select open of CODC5	F126V006	Coil	2702	1 – select
Select close of CODC5	F126V007	Coil	2703	1 – select
Cancel selection of CODC5	F126V010	Coil	2704	1 – cancel
Execute selection of CODC5	F126V011	Coil	2705	1 – execute
Alarm ACK of CODC5	F126V099	Coil	2706	1 – ACK
Opening time alarm status of CODC5	F126O003	Digital input	2700	0 – normal 1 – alarm
Closing time alarm status of CODC5	F126O004	Digital input	2701	0 – normal 1 – alarm
Open command of CODC5	F126V031	Digital input	2702	0 – enabled 1 – interlocked
Close command of CODC5	F126V030	Digital input	2703	0 – enabled 1 – interlocked
Invalid state of CODC5	F126V034	Digital input	2704	0 – off 1 – on
Control blocking of CODC5	F126V035	Digital input	2705	0 – deactivated 1 – activated
Command status of CODC5	F126E024 F126E025	Digital input	2706	0 – NACK 1 – ACK
Opening time alarm of CODC5 change	F126E016 F126E017	Digital event	2700	0 – normal 1 – alarm
Closing time alarm of CODC5 change	F126E018 F126E019	Digital event	2701	0 – normal 1 – alarm
Open command enable of CODC5 change	F126E004 F126E005	Digital event	2702	0 – enabled 1 – interlocked
Close command enable of CODC5 change	F126E006 F126E007	Digital event	2703	0 – enabled 1 – interlocked

Description	Name	Type	Point (hex)	Values
Invalid state of CODC5 change	F126E008 F126E009	Digital event	2704	0 – off 1 – on
Command blocking of CODC5 change	F126E026 F126E027	Digital event	2705	0 – deactivated 1 – activated
Command status of CODC5	F126E024 F126E025	Digital event	2706	0 – NACK 1 – ACK
Position of CODC5	F126V001	Input register	2700	0 – middle 1 – closed 2 – open 3 – faulty
Position of CODC5 change	F126E000 F126E001 F126E002 F126E003	Analog event	2700	0 – middle 1 – closed 2 – open 3 – faulty

Function block COIND1

Description	Name	Type	Point (hex)	Values
Invalid state of COIND1	F127V034	Digital input	2000	0 – off 1 – on
Invalid state of COIND1 change	F127E008 F127E009	Digital event	2000	0 – off 1 – on
Position of COIND1	F127V001	Input register	2000	0 – middle 1 – closed 2 – open 3 – faulty
Position of COIND1 change	F127E000 F127E001 F127E002 F127E003	Analog event	2000	0 – middle 1 – closed 2 – open 3 – faulty

Function block COIND2

Description	Name	Type	Point (hex)	Values
Invalid state of COIND2	F128V034	Digital input	2080	0 – off 1 – on
Invalid state of COIND2 change	F128E008 F128E009	Digital event	2080	0 – off 1 – on
Position of COIND2	F128V001	Input register	2080	0 – middle 1 – closed 2 – open 3 – faulty
Position of COIND2 change	F128E000 F128E001 F128E002 F128E003	Analog event	2080	0 – middle 1 – closed 2 – open 3 – faulty

Function block COIND3

Description	Name	Type	Point (hex)	Values
Invalid state of COIND3	F129V034	Digital input	2100	0 – off 1 – on
Invalid state of COIND3 change	F129E008 F129E009	Digital event	2100	0 – off 1 – on

Description	Name	Type	Point (hex)	Values
Position of COIND3	F129V001	Input register	2100	0 – middle 1 – closed 2 – open 3 – faulty
Position of COIND3 change	F129E000 F129E001 F129E002 F129E003	Analog event	2100	0 – middle 1 – closed 2 – open 3 – faulty

Function block COIND4

Description	Name	Type	Point (hex)	Values
Invalid state of COIND4	F130V034	Digital input	2180	0 – off 1 – on
Invalid state of COIND4 change	F130E008 F130E009	Digital event	2180	0 – off 1 – on
Position of COIND4	F130V001	Input register	2180	0 – middle 1 – closed 2 – open 3 – faulty
Position of COIND4 change	F130E000 F130E001 F130E002 F130E003	Analog event	2180	0 – middle 1 – closed 2 – open 3 – faulty

Function block COIND5

Description	Name	Type	Point (hex)	Values
Invalid state of COIND5	F131V034	Digital input	2200	0 – off 1 – on
Invalid state of COIND5 change	F131E008 F131E009	Digital event	2200	0 – off 1 – on
Position of COIND5	F131V001	Input register	2200	0 – middle 1 – closed 2 – open 3 – faulty
Position of COIND5 change	F131E000 F131E001 F131E002 F131E003	Analog event	2200	0 – middle 1 – closed 2 – open 3 – faulty

Function block COIND6

Description	Name	Type	Point (hex)	Values
Invalid state of COIND6	F132V034	Digital input	2280	0 – off 1 – on
Invalid state of COIND6 change	F132E008 F132E009	Digital event	2280	0 – off 1 – on
Position of COIND6	F132V001	Input register	2280	0 – middle 1 – closed 2 – open 3 – faulty

Description	Name	Type	Point (hex)	Values
Position of COIND6 change	F132E000 F132E001 F132E002 F132E003	Analog event	2280	0 – middle 1 – closed 2 – open 3 – faulty

Function block COIND7

Description	Name	Type	Point (hex)	Values
Invalid state of COIND7	F133V034	Digital input	2300	0 – off 1 – on
Invalid state of COIND7 change	F133E008 F133E009	Digital event	2300	0 – off 1 – on
Position of COIND7	F133V001	Input register	2300	0 – middle 1 – closed 2 – open 3 – faulty
Position of COIND7 change	F133E000 F133E001 F133E002 F133E003	Analog event	2300	0 – middle 1 – closed 2 – open 3 – faulty

Function block COIND8

Description	Name	Type	Point (hex)	Values
Invalid state of COIND8	F134V034	Digital input	2380	0 – off 1 – on
Invalid state of COIND8 change	F134E008 F134E009	Digital event	2380	0 – off 1 – on
Position of COIND8	F134V001	Input register	2380	0 – middle 1 – closed 2 – open 3 – faulty
Position of COIND8 change	F134E000 F134E001 F134E002 F134E003	Analog event	2380	0 – middle 1 – closed 2 – open 3 – faulty

Function block COLOCAT

Description	Name	Type	Point (hex)	Values
Logic position setting	F142V001	Digital input	2900	0 – inactive 1 – active
Logic position setting inactive/ active	F142E000 F142E001	Digital event	2900	0 – inactive 1 – active

Function block COPFC

Description	Name	Type	Point (hex)	Values
Blocking automatic and manual operations	F143I005	Digital input	4600	0 - not active 1 - active
Day / night cos phi switch	F143I006	Digital input	4601	0 - day target PF 1 - night target PF

Description	Name	Type	Point (hex)	Values
Disconnect capacitor banks simultaneously	F143I007	Digital input	4602	0 - not active 1 - active
Reset	F143I008	Digital input	4603	0 - not active 1 - active
Duration demand time REQ_UP	F143O001	Digital input	4604	0 - not active 1 - active
Duration demand time REQ_DOWN	F143O002	Digital input	4605	0 - not active 1 - active
Control operation failure status	F143O003	Digital input	4606	0 - not active 1 - active
Q out of the limits alarm status	F143O004	Digital input	4607	0 - not active 1 - active
Pumping alarm status	F143O005	Digital input	4608	0 - not active 1 - active
Automatic testing mode status	F143O006	Digital input	4609	0 - not active 1 - in progress
Manual commands allowed	F143V015	Digital input	460A	0 - Disabled 1 - Enabled
Not discharged yet, COPFC (stored)	F143E006 F143E007	Digital input	460B	0 - reset 1 - activated
Testing finished, COPFC (stored)	F143E010 F143E011	Digital input	460C	0 - OK 1 - failed
Overvoltage inhibition, COPFC (stored)	F143E012 F143E013	Digital input	460D	0 - reset 1 - activated
BLOCK signal of COPFC	F143E014 F143E015	Digital event	4600	0 - reset 1 - activated
DISCONNECT signal of COPFC	F143E016 F143E017	Digital event	4602	0 - reset 1 - activated
Control oper. failed, COPFC	F143E000 F143E001	Digital event	4606	0 - reset 1 - activated
Q not within limits, COPFC	F143E002 F143E003	Digital event	4607	0 - reset 1 - activated
Pumping situation alarm, COPFC	F143E004 F143E005	Digital event	4608	0 - reset 1 - activated
Automatic testing mode, COPFC	F143E008 F143E009	Digital event	4609	0 - reset 1 - activated
Not discharged yet, COPFC	F143E006 F143E007	Digital event	460B	0 - reset 1 - activated
Testing finished, COPFC	F143E010 F143E011	Digital event	460C	0 - OK 1 - failed
Overvoltage inhibition, COPFC	F143E012 F143E013	Digital event	460D	0 - reset 1 - activated
P3 (kW)	F143I001	Input register	4600	-999999...999999
Q3 (kvar)	F143I002	Input register	4601	-999999...999999
Power factor DPF	F143I003	Input register	4602	0.00...1.00
Connected banks	F143I004	Input register	4603	0...65535
Number of switching operations per day	F143V011	Input register	4604	0...65535
Operation mode	F143V001	Holding register	4600	0 - Not in use 1 - Automatic mode 2 - Manual mode 3 - Testing mode
Giving switching commands in the manual mode	F143V006	Holding register	4601	0 - Not activated 1 - Remove one step 2 - Add one step 3 - Disconnect all

Description	Name	Type	Point (hex)	Values
Day and night target switching	F143V008	Holding register	4602	0 - Not activated 1 - Day target PF 2 - Night target PF

Function block CMBWEAR1

Description	Name	Type	Point (hex)	Values
CMBWEAR1 alarm ACK	F187V099	Coil	3300	1 – ACK
CMBWEAR1 alarm state	F187O001	Digital input	3300	0 – normal 1 – alarm
Breaker 1 electric wear alarm change	F187E000 F187E001	Digital event	3300	0 – normal 1 – alarm
Accumulated breaker 1 wear at pole 1	F187V001	Holding register	3300	0...10000
Accumulated breaker 1 wear at pole 2	F187V002	Holding register	3301	0...10000
Accumulated breaker 1 wear at pole 3	F187V003	Holding register	3302	0...10000

Function block CMBWEAR2

Description	Name	Type	Point (hex)	Values
CMBWEAR2 alarm ACK	F188V099	Coil	3380	1 – ACK
CMBWEAR2 alarm state	F188O001	Digital input	3380	0 – normal 1 – alarm
Breaker 2 electric wear alarm change	F188E000 F188E001	Digital event	3380	0 – normal 1 – alarm
Accumulated breaker 2 wear at pole 1	F188V001	Holding register	3380	0...10000
Accumulated breaker 2 wear at pole 2	F188V002	Holding register	3381	0...10000
Accumulated breaker 2 wear at pole 3	F188V003	Holding register	3382	0...10000

Function block CMCU3

Description	Name	Type	Point (hex)	Values
Input current circuit alarm	F181O001	Digital input	3000	0 – normal 1 – alarm
Input current circuit alarm off/on	F181E000 F181E001	Digital event	3000	0 – normal 1 – alarm

Function block CMGAS1

Description	Name	Type	Point (hex)	Values
CMGAS1 alarm ACK	F186V099	Coil	3200	1 – ACK
Low gas density alarm state	F186O001	Digital input	3200	0 – normal 1 – alarm
Gas pressure	F186I001	Digital input	3201	0 – invalid 1 – valid

Description	Name	Type	Point (hex)	Values
Low gas density alarm change	F186E000 F186E001	Digital event	3200	0 – normal 1 – alarm
Low gas density warning change	F186E002 F186E003	Digital event	3201	0 – invalid 1 – valid

Function block CMGAS3

Description	Name	Type	Point (hex)	Values
Alarm ACK	F194V099	Coil	0800	1 - ACK
Low gas pressure alarm	F194O001	Digital input	4800	0 - inactive 1 - active
Gas pressure L1	F194I001	Digital input	4801	0 - invalid 1 - valid
Gas pressure L2	F194I002	Digital input	4802	0 - invalid 1 - valid
Gas pressure L3	F194I003	Digital input	4803	0 - invalid 1 - valid
Low gas density alarm change	F194E000 F194E001	Digital event	4800	0 - inactive 1 - active
Low gas density warning L1 change	F194E002 F194E003	Digital event	4801	0 - invalid 1 - valid
Low gas density warning L2 change	F194E004 F194E005	Digital event	4802	0 - invalid 1 - valid
Low gas density warning L3 change	F194E006 F194E007	Digital event	4803	0 - invalid 1 - valid

Function block CMSCHED

Description	Name	Type	Point (hex)	Values
Scheduled maintenance alarm ACK	F189V099	Coil	3400	1 – ACK
Scheduled maintenance alarm state	F189O001	Digital input	3400	0 – normal 1 – alarm
Scheduled maintenance alarm change	F189E000 F189E001	Digital event	3400	0 – normal 1 – alarm

Function block CMSPRC1

Description	Name	Type	Point (hex)	Values
Alarm ACK	F190V099	Coil	3600	1 – ACK
Spring 1 max. charging alarm state	F190O002	Digital input	3600	0 – inactive 1 – active
Spring 1 min. charging alarm state	F190O003	Digital input	3601	0 – inactive 1 – active
Spring 1 charge status	F190I002	Digital input	3602	0 – uncharged 1 – charged
Spring 1 max. charging alarm change	F190E002 F190E003	Digital event	3600	0 – inactive 1 – active
Spring 1 min. charging alarm change	F190E004 F190E005	Digital event	3601	0 – inactive 1 – active
Spring 1 uncharged/charged	F190E008 F190E009	Digital event	3602	0 – uncharged 1 – charged

Function block CMTIME1

Description	Name	Type	Point (hex)	Values
Time 1 alarm ACK	F184V099	Coil	3500	1 – ACK
Accumulated time 1 alarm state	F184O001	Digital input	3500	0 – reset 1 – activated
Accumulated time 1 measurement state	F184I001	Digital input	3501	0 – inactive 1 – active
Accumulated time 1 alarm change	F184E000 F184E001	Digital event	3500	0 – reset 1 – activated
Accumulated time 1 measurement change	F184E002 F184E003	Digital event	3501	0 – inactive 1 – active

Function block CMTIME2

Description	Name	Type	Point (hex)	Values
Time 2 alarm ACK	F185V099	Coil	3580	1 – ACK
Accumulated time 2 alarm state	F185O001	Digital input	3580	0 – reset 1 – activated
Accumulated time 2 measurement state	F185I001	Digital input	3581	0 – inactive 1 – active
Accumulated time 2 alarm change	F185E000 F185E001	Digital event	3580	0 – reset 1 – activated
Accumulated time 2 measurement change	F185E002 F185E003	Digital event	3581	0 – inactive 1 – active

Function block CMTRAV1

Description	Name	Type	Point (hex)	Values
Alarm ACK	F193V099	Coil	3800	1 – ACK
Breaker 1 open travel alarm	F193O001	Digital input	3800	0 – inactive 1 – active
Breaker 1 close travel alarm	F193O002	Digital input	3801	0 – inactive 1 – active
Breaker 1 open travel alarm deactivated	F193E000 F193E001	Digital event	3800	0 – inactive 1 – active
Breaker 1 close travel alarm deactivated	F193E002 F193E003	Digital event	3801	0 – inactive 1 – active

Function block CMVO3

Description	Name	Type	Point (hex)	Values
Input voltage circuit alarm	F182O001	Digital input	3100	0 – normal 1 – alarm
Input voltage circuit alarm off/on	F182E000 F182E001	Digital event	3100	0 – normal 1 – alarm

Function block PQCU3H

Description	Name	Type	Point (hex)	Values
Reset registers	F512V025	Coil	4900	1 - Reset

Description	Name	Type	Point (hex)	Values
Status of output HAR_HIGH	F512O001	Digital input	4900	0 - Not active 1 - Active
Status of output CUM_HIGH	F512O002	Digital input	4901	0 - Not active 1 - Active
Observation period near end (stored)	F512E003	Digital input	4902	0
Observation period ended (stored)	F512E004	Digital input	4903	0
Harmonic limit	F512E000 F512E001	Digital event	4900	0 - Reset 1 - Exceed
Cumulative limit	F512E002	Digital event	4901	1 - Exceed
Observation period near end	F512E003	Digital event	4902	1 – on
Observation period ended	F512E004	Digital event	4903	1 – on
Total Harmonic Distortion 3s value	F512I002	Input register	4900	0...10000 0.0...1000.0%
Fundamental component 3s value	F512I003	Input register	4901	0...10000 0.0...1000.0%
2nd harmonic 3s value	F512I004	Input register	4902	0...10000 0.0...1000.0%
3rd harmonic 3s value	F512I005	Input register	4903	0...10000 0.0...1000.0%
4th harmonic 3s value	F512I006	Input register	4904	0...10000 0.0...1000.0%
5th harmonic 3s value	F512I007	Input register	4905	0...10000 0.0...1000.0%
6th harmonic 3s value	F512I008	Input register	4906	0...10000 0.0...1000.0%
7th harmonic 3s value	F512I009	Input register	4907	0...10000 0.0...1000.0%
8th harmonic 3s value	F512I010	Input register	4908	0...10000 0.0...1000.0%
9th harmonic 3s value	F512I011	Input register	4909	0...10000 0.0...1000.0%
10th harmonic 3s value	F512I012	Input register	490A	0...10000 0.0...1000.0%
11th harmonic 3s value	F512I013	Input register	490B	0...10000 0.0...1000.0%
12th harmonic 3s value	F512I014	Input register	490C	0...10000 0.0...1000.0%
13th harmonic 3s value	F512I015	Input register	490D	0...10000 0.0...1000.0%
Total Harmonic Distortion	F512I018	Input register	490E	0...10000 0.0...1000.0%
2nd harmonic short time sliding value	F512I019	Input register	490F	0...10000 0.0...1000.0%
3rd harmonic short time sliding value	F512I020	Input register	4910	0...10000 0.0...1000.0%
4th harmonic short time sliding value	F512I021	Input register	4911	0...10000 0.0...1000.0%
5th harmonic short time sliding value	F512I022	Input register	4912	0...10000 0.0...1000.0%
6th harmonic short time sliding value	F512I023	Input register	4913	0...10000 0.0...1000.0%
7th harmonic short time sliding value	F512I024	Input register	4914	0...10000 0.0...1000.0%

Description	Name	Type	Point (hex)	Values
8th harmonic short time sliding value	F512I025	Input register	4915	0...10000 0.0...1000.0%
9th harmonic short time sliding value	F512I026	Input register	4916	0...10000 0.0...1000.0%
10th harmonic short time sliding value	F512I027	Input register	4917	0...10000 0.0...1000.0%
11th harmonic short time sliding value	F512I028	Input register	4918	0...10000 0.0...1000.0%
12th harmonic short time sliding value	F512I029	Input register	4919	0...10000 0.0...1000.0%
13th harmonic short time sliding value	F512I030	Input register	491A	0...10000 0.0...1000.0%
Max THD at last obs. period	F512V206	Input register	491B	0...10000 0.0...1000.0%
Max THD at active obs. period	F512V306	Input register	491C	0...10000 0.0...1000.0%
THD	F512V404	Input register	491D	0...10000 0.0...1000.0%

Function block PQVO3H

Description	Name	Type	Point (hex)	Values
Reset registers	F513V024	Coil	4A00	1 – Reset
Status of output HAR_HIGH	F513O001	Digital input	4A00	0 - Not active 1 – Active
Status of output CUM_HIGH	F513O002	Digital input	4A01	0 - Not active 1 – Active
Observation period near end (stored)	F513E003	Digital input	4A02	0
Observation period ended (stored)	F513E004	Digital input	4A03	0
Harmonic limit	F513E000 F513E001	Digital event	4A00	0 – Reset 1 – Exceed
Cumulative limit	F513E002	Digital event	4A01	1 – Exceed
Observation period near end	F513E003	Digital event	4A02	1 – on
Observation period ended	F513E004	Digital event	4A03	1 – on
Total Harmonic Distortion 3s value	F513I002	Input register	4A00	0...1200 0.0...120.0 %
Fundamental component 3s value	F513I003	Input register	4A01	0...1200 0.0...120.0 %
2nd harmonic 3s value	F513I004	Input register	4A02	0...1200 0.0...120.0 %
3rd harmonic 3s value	F513I005	Input register	4A03	0...1200 0.0...120.0 %
4th harmonic 3s value	F513I006	Input register	4A04	0...1200 0.0...120.0 %
5th harmonic 3s value	F513I007	Input register	4A05	0...1200 0.0...120.0 %
6th harmonic 3s value	F513I008	Input register	4A06	0...1200 0.0...120.0 %
7th harmonic 3s value	F513I009	Input register	4A07	0...1200 0.0...120.0 %
8th harmonic 3s value	F513I010	Input register	4A08	0...1200 0.0...120.0 %

Description	Name	Type	Point (hex)	Values
9th harmonic 3s value	F513I011	Input register	4A09	0...1200 0.0...120.0 %
10th harmonic 3s value	F513I012	Input register	4A0A	0...1200 0.0...120.0 %
11th harmonic 3s value	F513I013	Input register	4A0B	0...1200 0.0...120.0 %
12th harmonic 3s value	F513I014	Input register	4A0C	0...1200 0.0...120.0 %
13th harmonic 3s value	F513I015	Input register	4A0D	0...1200 0.0...120.0 %
Total Harmonic Distortion	F513I018	Input register	4A0E	0...1200 0.0...120.0 %
2nd harmonic short time sliding value	F513I019	Input register	4A0F	0...1200 0.0...120.0 %
3rd harmonic short time sliding value	F513I020	Input register	4A10	0...1200 0.0...120.0 %
4th harmonic short time sliding value	F513I021	Input register	4A11	0...1200 0.0...120.0 %
5th harmonic short time sliding value	F513I022	Input register	4A12	0...1200 0.0...120.0 %
6th harmonic short time sliding value	F513I023	Input register	4A13	0...1200 0.0...120.0 %
7th harmonic short time sliding value	F513I024	Input register	4A14	0...1200 0.0...120.0 %
8th harmonic short time sliding value	F513I025	Input register	4A15	0...1200 0.0...120.0 %
9th harmonic short time sliding value	F513I026	Input register	4A16	0...1200 0.0...120.0 %
10th harmonic short time sliding value	F513I027	Input register	4A17	0...1200 0.0...120.0 %
11th harmonic short time sliding value	F513I028	Input register	4A18	0...1200 0.0...120.0 %
12th harmonic short time sliding value	F513I029	Input register	4A19	0...1200 0.0...120.0 %
13th harmonic short time sliding value	F513I030	Input register	4A1A	0...1200 0.0...120.0 %
Max THD at last obs. period	F513V206	Input register	4A1B	0...1200 0.0...120.0 %
Max THD at active obs. period	F513V306	Input register	4A1C	0...1200 0.0...120.0 %
THD	F513V404	Input register	4A1D	0...1200 0.0...120.0 %

Function block BIO

Description	Name	Type	Point (hex)	Values
BIO binary input 1 state	F013I001	Digital input	4300	0 – reset 1 – activated
BIO binary input 2 state	F013I002	Digital input	4301	0 – reset 1 – activated
BIO binary input 3 state	F013I003	Digital input	4302	0 – reset 1 – activated

Description	Name	Type	Point (hex)	Values
BIO binary input 4 state	F013I004	Digital input	4303	0 – reset 1 – activated
BIO binary input 5 state	F013I005	Digital input	4304	0 – reset 1 – activated
BIO binary input 6 state	F013I006	Digital input	4305	0 – reset 1 – activated
BIO binary input 7 state	F013I007	Digital input	4306	0 – reset 1 – activated
BIO binary input 8 state	F013I008	Digital input	4307	0 – reset 1 – activated
BIO binary input 9 state	F013I009	Digital input	4308	0 – reset 1 – activated
BIO binary input 10 state	F013I010	Digital input	4309	0 – reset 1 – activated
BIO binary input 11 state	F013I011	Digital input	430A	0 – reset 1 – activated
BIO binary input 12 state	F013I012	Digital input	430B	0 – reset 1 – activated
BIO binary output 1 state	F013O001	Digital input	430C	0 – reset 1 – activated
BIO binary output 2 state	F013O002	Digital input	430D	0 – reset 1 – activated
BIO binary output 3 state	F013O003	Digital input	430E	0 – reset 1 – activated
BIO binary output 4 state	F013O004	Digital input	430F	0 – reset 1 – activated
BIO binary output 5 state	F013O005	Digital input	4310	0 – reset 1 – activated
BIO binary output 6 state	F013O006	Digital input	4311	0 – reset 1 – activated
BIO binary input 1 oscillate	F013I021	Digital input	4312	0 – stop 1 – start
BIO binary input 2 oscillate	F013I022	Digital input	4313	0 – stop 1 – start
BIO binary input 3 oscillate	F013I023	Digital input	4314	0 – stop 1 – start
BIO binary input 4 oscillate	F013I024	Digital input	4315	0 – stop 1 – start
BIO binary input 5 oscillate	F013I025	Digital input	4316	0 – stop 1 – start
BIO binary input 6 oscillate	F013I026	Digital input	4317	0 – stop 1 – start
BIO binary input 7 oscillate	F013I027	Digital input	4318	0 – stop 1 – start
BIO binary input 8 oscillate	F013I028	Digital input	4319	0 – stop 1 – start
BIO binary input 9 oscillate	F013I029	Digital input	431A	0 – stop 1 – start
BIO binary input 10 oscillate	F013I030	Digital input	431B	0 – stop 1 – start
BIO binary input 11 oscillate	F013I031	Digital input	431C	0 – stop 1 – start
BIO binary input 12 oscillate	F013I032	Digital input	431D	0 – stop 1 – start
BIO binary input 1 reset/ activated	F013E000 F013E001	Digital event	4300	0 – reset 1 – activated

Description	Name	Type	Point (hex)	Values
BIO binary input 2 reset/ activated	F013E002 F013E003	Digital event	4301	0 – reset 1 – activated
BIO binary input 3 reset/ activated	F013E004 F013E005	Digital event	4302	0 – reset 1 – activated
BIO binary input 4 reset/ activated	F013E006 F013E007	Digital event	4303	0 – reset 1 – activated
BIO binary input 5 reset/ activated	F013E008 F013E009	Digital event	4304	0 – reset 1 – activated
BIO binary input 6 reset/ activated	F013E010 F013E011	Digital event	4305	0 – reset 1 – activated
BIO binary input 7 reset/ activated	F013E012 F013E013	Digital event	4306	0 – reset 1 – activated
BIO binary input 8 reset/ activated	F013E014 F013E015	Digital event	4307	0 – reset 1 – activated
BIO binary input 9 reset/ activated	F013E016 F013E017	Digital event	4308	0 – reset 1 – activated
BIO binary input 10 reset/ activated	F013E018 F013E019	Digital event	4309	0 – reset 1 – activated
BIO binary input 11 reset/ activated	F013E020 F013E021	Digital event	430A	0 – reset 1 – activated
BIO binary input 12 reset/ activated	F013E022 F013E023	Digital event	430B	0 – reset 1 – activated
BIO binary output 1 reset/ activated	F013E024 F013E025	Digital event	430C	0 – reset 1 – activated
BIO binary output 2 reset/ activated	F013E026 F013E027	Digital event	430D	0 – reset 1 – activated
BIO binary output 3 reset/ activated	F013E028 F013E029	Digital event	430E	0 – reset 1 – activated
BIO binary output 4 reset/ activated	F013E030 F013E031	Digital event	430F	0 – reset 1 – activated
BIO binary output 5 reset/ activated	F013E032 F013E033	Digital event	4310	0 – reset 1 – activated
BIO binary output 6 reset/ activated	F013E034 F013E035	Digital event	4311	0 – reset 1 – activated
BIO binary input 1 oscillate start/ stop	F013E036 F013E037	Digital event	4312	0 – stop 1 – start
BIO binary input 2 oscillate start/ stop	F013E038 F013E039	Digital event	4313	0 – stop 1 – start
BIO binary input 3 oscillate start/ stop	F013E040 F013E041	Digital event	4314	0 – stop 1 – start
BIO binary input 4 oscillate start/ stop	F013E042 F013E043	Digital event	4315	0 – stop 1 – start
BIO binary input 5 oscillate start/ stop	F013E044 F013E045	Digital event	4316	0 – stop 1 – start
BIO binary input 6 oscillate start/ stop	F013E046 F013E047	Digital event	4317	0 – stop 1 – start
BIO binary input 7 oscillate start/ stop	F013E048 F013E049	Digital event	4318	0 – stop 1 – start
BIO binary input 8 oscillate start/ stop	F013E050 F013E051	Digital event	4319	0 – stop 1 – start
BIO binary input 9 oscillate start/ stop	F013E052 F013E053	Digital event	431A	0 – stop 1 – start
BIO binary input 10 oscillate start/stop	F013E054 F013E055	Digital event	431B	0 – stop 1 – start
BIO binary input 11 oscillate start/stop	F013E056 F013E057	Digital event	431C	0 – stop 1 – start

Description	Name	Type	Point (hex)	Values
BIO binary input 12 oscillate start/stop	F013E058 F013E059	Digital event	431D	0 – stop 1 – start

CH000, CH001 and CH002

Description	Name	Type	Point (hex)	Values
Reset device	F000V250	Coil	0001	1 – reset
Reset indication	F001V011	Coil	0002	1 – reset
Reset outputs	F001V012	Coil	0003	1 – reset
Reset registers	F001V013	Coil	0004	1 – reset
IRF error state	F001V015	Digital input	0001	0 – reset 1 – activated
Interlocking bypass mode	F002V004	Digital input	0002	0 – inactive 1 – active
Module startup (stored)	F000E050	Digital input	0003	1 – startup
Event buffer overflow (stored)	F000E051	Digital input	0004	1 – overflow
IRF error deactivated/activated	F000E056	Digital event	0001	0 – deactivated 1 – activated
Interlocking bypass mode change	F002E004 F002E005	Digital event	0002	0 – inactive 1 – active
Module startup	F000E050	Digital event	0003	1 – startup
Event buffer overflow	F000E051	Digital event	0004	1 – overflow
Recent control position	F002V005	Input register	0001	0 – disable 1 – local 2 – remote
Store	F000V151	Holding register	0008	0 - store completed 1 - store in progress 2 - error 160 - fast store in progress
Recent control position change	F002E000 F002E001 F002E002	Analog event	0001	0 – disable 1 – local 2 – remote

Function block PSC1

Description	Name	Type	Point (hex)	Values
PSC binary output 1 off/on status	F017O001	Digital input	4200	0 – reset 1 – activated
PSC binary output 2 off/on status	F017O002	Digital input	4201	0 – reset 1 – activated
PSC binary output 3 off/on status	F017O003	Digital input	4202	0 – reset 1 – activated
PSC binary input 1 off/on status	F017I001	Digital input	4203	0 – reset 1 – activated
PSC binary input 2 off/on status	F017I002	Digital input	4204	0 – reset 1 – activated
PSC binary input 3 off/on status	F017I003	Digital input	4205	0 – reset 1 – activated
PSC AC status	F017I004	Digital input	4206	0 – OK 1 – fail
PSC overheat status	F017I005	Digital input	4207	0 – OK 1 – overheated

Description	Name	Type	Point (hex)	Values
PSC battery status	F017I006	Digital input	4208	0 – good 1 – low
PSC heating status	F017I009	Digital input	4209	0 – off 1 – on
PSC binary input 1 osc. stop/ start status	F017I021	Digital input	420A	0 – stop 1 – start
PSC binary input 2 osc. Stop/ start status	F017I022	Digital input	420B	0 – stop 1 – start
PSC binary input 3 osc. Stop/ start status	F017I023	Digital input	420C	0 – stop 1 – start
PSC binary output 1 reset/ activated	F017E010 F017E011	Digital event	4200	0 – reset 1 – activated
PSC binary output 2 reset/ activated	F017E012 F017E013	Digital event	4201	0 – reset 1 – activated
PSC binary output 3 reset/ activated	F017E014 F017E015	Digital event	4202	0 – reset 1 – activated
PSC binary input 1 reset/ activated	F017E000 F017E001	Digital event	4203	0 – reset 1 – activated
PSC binary input 2 reset/ activated	F017E002 F017E003	Digital event	4204	0 – reset 1 – activated
PSC binary input 3 reset/ activated	F017E004 F017E005	Digital event	4205	0 – reset 1 – activated
PSC AC fail reset/activated	F017E006 F017E007	Digital event	4206	0 – OK 1 – fail
PSC overheat temperature reset/activated	F017E008 F017E009	Digital event	4207	0 – OK 1 – overheated
PSC battery voltage good/low	F017E022 F017E023	Digital event	4208	0 – good 1 – low
PSC heating status off/on	F017E024 F017E025	Digital event	4209	0 – off 1 – on
PSC binary input 1 oscillate stop/start	F017E016 F017E017	Digital event	420A	0 – stop 1 – start
PSC binary input 2 oscillate stop/start	F017E018 F017E019	Digital event	420B	0 – stop 1 – start
PSC binary input 3 oscillate stop/start	F017E020 F017E021	Digital event	420C	0 – stop 1 – start
PSC temperature updated	F017I007	Input register	4200	- 40...70 - 40°C...+70°C*
PSC battery voltage updated	F017I008	Input register	4201	180...330 18.0Vdc...33.0Vdc
PSC battery voltage reset	F017I011	Holding register	4200	180...330 18.0Vdc...33.0Vdc
PSC temperature change	F017E026	Analog event	4200	-40..70 -40°C..+70°C*
PSC battery voltage change	F017E027	Analog event	4201	180..330 18.0Vdc..33.0Vdc

* Modbus register values are normally unsigned but will in this case be interpreted as signed in U2 format.

SWITCH groups

Description	Name	Type	Point (hex)	Values
Actual settings of SWGRP1	F030S001	Input register	4D01	0...255
Actual settings of SWGRP2	F030S002	Input register	4D02	0...255
Actual settings of SWGRP3	F030S003	Input register	4D03	0...255

Description	Name	Type	Point (hex)	Values
Actual settings of SWGRP4	F030S004	Input register	4D04	0...255
Actual settings of SWGRP5	F030S005	Input register	4D05	0...255
Actual settings of SWGRP6	F030S006	Input register	4D06	0...255
Actual settings of SWGRP7	F030S007	Input register	4D07	0...255
Actual settings of SWGRP8	F030S008	Input register	4D08	0...255
Actual settings of SWGRP9	F030S009	Input register	4D09	0...255
Actual settings of SWGRP10	F030S010	Input register	4D0A	0...255
Actual settings of SWGRP11	F030S011	Input register	4D0B	0...255
Actual settings of SWGRP12	F030S012	Input register	4D0C	0...255
Actual settings of SWGRP13	F030S013	Input register	4D0D	0...255
Actual settings of SWGRP14	F030S014	Input register	4D0E	0...255
Actual settings of SWGRP15	F030S015	Input register	4D0F	0...255
Actual settings of SWGRP16	F030S016	Input register	4D10	0...255
Actual settings of SWGRP17	F030S017	Input register	4D11	0...255
Actual settings of SWGRP18	F030S018	Input register	4D12	0...255
Actual settings of SWGRP19	F030S019	Input register	4D13	0...255
Actual settings of SWGRP20	F030S020	Input register	4D14	0...255
Control settings of SWGRP1	F030V001	Holding register	4D01	0 - Checksum 1 1 - Checksum 2 2 - GROUP input
Setting group 1 of SWGRP1	F030S041	Holding register	4D02	0...255
Setting group 2 of SWGRP1	F030S071	Holding register	4D03	0...255
Control settings of SWGRP2	F030V002	Holding register	4D04	0 - Checksum 1 1 - Checksum 2 2 - GROUP input
Setting group 1 of SWGRP2	F030S042	Holding register	4D05	0...255
Setting group 2 of SWGRP2	F030S072	Holding register	4D06	0...255
Control settings of SWGRP3	F030V003	Holding register	4D07	0 - Checksum 1 1 - Checksum 2 2 - GROUP input
Setting group 1 of SWGRP3	F030S043	Holding register	4D08	0...255
Setting group 2 of SWGRP3	F030S073	Holding register	4D09	0...255
Control settings of SWGRP4	F030V004	Holding register	4D0A	0 - Checksum 1 1 - Checksum 2 2 - GROUP input
Setting group 1 of SWGRP4	F030S044	Holding register	4D0B	0...255
Setting group 2 of SWGRP4	F030S074	Holding register	4D0C	0...255
Control settings of SWGRP5	F030V005	Holding register	4D0D	0 - Checksum 1 1 - Checksum 2 2 - GROUP input
Setting group 1 of SWGRP5	F030S045	Holding register	4D0E	0...255
Setting group 2 of SWGRP5	F030S075	Holding register	4D0F	0...255
Control settings of SWGRP6	F030V006	Holding register	4D10	0 - Checksum 1 1 - Checksum 2 2 - GROUP input
Setting group 1 of SWGRP6	F030S046	Holding register	4D11	0...255
Setting group 2 of SWGRP6	F030S076	Holding register	4D12	0...255
Control settings of SWGRP7	F030V007	Holding register	4D13	0 - Checksum 1 1 - Checksum 2 2 - GROUP input
Setting group 1 of SWGRP7	F030S047	Holding register	4D14	0...255
Setting group 2 of SWGRP7	F030S077	Holding register	4D15	0...255
Control settings of SWGRP8	F030V008	Holding register	4D16	0 - Checksum 1 1 - Checksum 2 2 - GROUP input

Description	Name	Type	Point (hex)	Values
Setting group 1 of SWGRP8	F030S048	Holding register	4D17	0...255
Setting group 2 of SWGRP8	F030S078	Holding register	4D18	0...255
Control settings of SWGRP9	F030V009	Holding register	4D19	0 - Checksum 1 1 - Checksum 2 2 - GROUP input
Setting group 1 of SWGRP9	F030S049	Holding register	4D1A	0...255
Setting group 2 of SWGRP9	F030S079	Holding register	4D1B	0...255
Control settings of SWGRP10	F030V010	Holding register	4D1C	0 - Checksum 1 1 - Checksum 2 2 - GROUP input
Setting group 1 of SWGRP10	F030S050	Holding register	4D1D	0...255
Setting group 2 of SWGRP10	F030S080	Holding register	4D1E	0...255
Control settings of SWGRP11	F030V011	Holding register	4D1F	0 - Checksum 1 1 - Checksum 2 2 - GROUP input
Setting group 1 of SWGRP11	F030S051	Holding register	4D20	0...255
Setting group 2 of SWGRP11	F030S081	Holding register	4D21	0...255
Control settings of SWGRP12	F030V012	Holding register	4D22	0 - Checksum 1 1 - Checksum 2 2 - GROUP input
Setting group 1 of SWGRP12	F030S052	Holding register	4D23	0...255
Setting group 2 of SWGRP12	F030S082	Holding register	4D24	0...255
Control settings of SWGRP13	F030V013	Holding register	4D25	0 - Checksum 1 1 - Checksum 2 2 - GROUP input
Setting group 1 of SWGRP13	F030S053	Holding register	4D26	0...255
Setting group 2 of SWGRP13	F030S083	Holding register	4D27	0...255
Control settings of SWGRP14	F030V014	Holding register	4D28	0 - Checksum 1 1 - Checksum 2 2 - GROUP input
Setting group 1 of SWGRP14	F030S054	Holding register	4D29	0...255
Setting group 2 of SWGRP14	F030S084	Holding register	4D2A	0...255
Control settings of SWGRP15	F030V015	Holding register	4D2B	0 - Checksum 1 1 - Checksum 2 2 - GROUP input
Setting group 1 of SWGRP15	F030S055	Holding register	4D2C	0...255
Setting group 2 of SWGRP15	F030S085	Holding register	4D2D	0...255
Control settings of SWGRP16	F030V016	Holding register	4D2E	0 - Checksum 1 1 - Checksum 2 2 - GROUP input
Setting group 1 of SWGRP16	F030S056	Holding register	4D2F	0...255
Setting group 2 of SWGRP16	F030S086	Holding register	4D30	0...255
Control settings of SWGRP17	F030V017	Holding register	4D31	0 - Checksum 1 1 - Checksum 2 2 - GROUP input
Setting group 1 of SWGRP17	F030S057	Holding register	4D32	0...255
Setting group 2 of SWGRP17	F030S087	Holding register	4D33	0...255
Control settings of SWGRP18	F030V018	Holding register	4D34	0 - Checksum 1 1 - Checksum 2 2 - GROUP input
Setting group 1 of SWGRP18	F030S058	Holding register	4D35	0...255
Setting group 2 of SWGRP18	F030S088	Holding register	4D36	0...255
Control settings of SWGRP19	F030V019	Holding register	4D37	0 - Checksum 1 1 - Checksum 2 2 - GROUP input
Setting group 1 of SWGRP19	F030S059	Holding register	4D38	0...255

Description	Name	Type	Point (hex)	Values
Setting group 2 of SWGRP19	F030S089	Holding register	4D39	0...255
Control settings of SWGRP20	F030V020	Holding register	4D3A	0 - Checksum 1 1 - Checksum 2 2 - GROUP input
Setting group 1 of SWGRP20	F030S060	Holding register	4D3B	0...255
Setting group 2 of SWGRP20	F030S090	Holding register	4D3C	0...255

RECCH025 (LON virtual inputs and outputs)

Description	Name	Type	Point (hex)	Values
COMM OUT33	F025O017	Coil	4B10#	0...1
COMM OUT34	F025O018	Coil	4B11#	0...1
COMM OUT35	F025O019	Coil	4B12#	0...1
COMM OUT36	F025O020	Coil	4B13#	0...1
COMM OUT37	F025O021	Coil	4B14#	0...1
COMM OUT38	F025O022	Coil	4B15#	0...1
COMM OUT39	F025O023	Coil	4B16#	0...1
COMM OUT40	F025O024	Coil	4B17#	0...1
COMM OUT41	F025O025	Coil	4B18#	0...1
COMM OUT42	F025O026	Coil	4B19#	0...1
COMM OUT43	F025O027	Coil	4B1A#	0...1
COMM OUT44	F025O028	Coil	4B1B#	0...1
COMM OUT45	F025O029	Coil	4B1C#	0...1
COMM OUT46	F025O030	Coil	4B1D#	0...1
COMM OUT47	F025O031	Coil	4B1E#	0...1
COMM OUT48	F025O032	Coil	4B1F#	0...1
COMM IN33	F025I017	Digital input	4B10*	0...1
COMM IN34	F025I018	Digital input	4B11*	0...1
COMM IN35	F025I019	Digital input	4B12*	0...1
COMM IN36	F025I020	Digital input	4B13*	0...1
COMM IN37	F025I021	Digital input	4B14*	0...1
COMM IN38	F025I022	Digital input	4B15*	0...1
COMM IN39	F025I023	Digital input	4B16*	0...1
COMM IN40	F025I024	Digital input	4B17*	0...1
COMM IN41	F025I025	Digital input	4B18*	0...1
COMM IN42	F025I026	Digital input	4B19*	0...1
COMM IN43	F025I027	Digital input	4B1A*	0...1
COMM IN44	F025I028	Digital input	4B1B*	0...1
COMM IN45	F025I029	Digital input	4B1C*	0...1
COMM IN46	F025I030	Digital input	4B1D*	0...1
COMM IN47	F025I031	Digital input	4B1E*	0...1
COMM IN48	F025I032	Digital input	4B1F*	0...1
COMM IN33 change	F025I017	Digital event	4B10*$	0...1
COMM IN34 change	F025I018	Digital event	4B11*$	0...1
COMM IN35 change	F025I019	Digital event	4B12*$	0...1

Description	Name	Type	Point (hex)	Values
COMM IN36 change	F025I020	Digital event	4B13*$	0...1
COMM IN37 change	F025I021	Digital event	4B14*$	0...1
COMM IN38 change	F025I022	Digital event	4B15*$	0...1
COMM IN39 change	F025I023	Digital event	4B16*$	0...1
COMM IN40 change	F025I024	Digital event	4B17*$	0...1
COMM IN41 change	F025I025	Digital event	4B18*$	0...1
COMM IN42 change	F025I026	Digital event	4B19*$	0...1
COMM IN43 change	F025I027	Digital event	4B1A*$	0...1
COMM IN44 change	F025I028	Digital event	4B1B*$	0...1
COMM IN45 change	F025I029	Digital event	4B1C*$	0...1
COMM IN46 change	F025I030	Digital event	4B1D*$	0...1
COMM IN47 change	F025I031	Digital event	4B1E*$	0...1
COMM IN48 change	F025I032	Digital event	4B1F*$	0...1
COMM IN1	F025I001	Input register	4B00	0...65535
COMM IN2	F025I002	Input register	4B01	0...65535
COMM IN3	F025I003	Input register	4B02	0...65535
COMM IN4	F025I004	Input register	4B03	0...65535
COMM IN5	F025I005	Input register	4B04	0...65535
COMM IN6	F025I006	Input register	4B05	0...65535
COMM IN7	F025I007	Input register	4B06	0...65535
COMM IN8	F025I008	Input register	4B07	0...65535
COMM IN9	F025I009	Input register	4B08	0...65535
COMM IN10	F025I010	Input register	4B09	0...65535
COMM IN11	F025I011	Input register	4B0A	0...65535
COMM IN12	F025I012	Input register	4B0B	0...65535
COMM IN13	F025I013	Input register	4B0C	0...65535
COMM IN14	F025I014	Input register	4B0D	0...65535
COMM IN15	F025I015	Input register	4B0E	0...65535
COMM IN16	F025I016	Input register	4B0F	0...65535
COMM OUT1	F025O001	Holding register	4B00	0...65535
COMM OUT2	F025O002	Holding register	4B01	0...65535
COMM OUT3	F025O003	Holding register	4B02	0...65535
COMM OUT4	F025O004	Holding register	4B03	0...65535
COMM OUT5	F025O005	Holding register	4B04	0...65535
COMM OUT6	F025O006	Holding register	4B05	0...65535
COMM OUT7	F025O007	Holding register	4B06	0...65535
COMM OUT8	F025O008	Holding register	4B07	0...65535
COMM OUT9	F025O009	Holding register	4B08	0...65535
COMM OUT10	F025O010	Holding register	4B09	0...65535
COMM OUT11	F025O011	Holding register	4B0A	0...65535
COMM OUT12	F025O012	Holding register	4B0B	0...65535
COMM OUT13	F025O013	Holding register	4B0C	0...65535
COMM OUT14	F025O014	Holding register	4B0D	0...65535
COMM OUT15	F025O015	Holding register	4B0E	0...65535
COMM OUT16	F025O016	Holding register	4B0F	0...65535
COMM IN1 change	F025I001	Analog event	4B00$	0...65535
COMM IN2 change	F025I002	Analog event	4B01$	0...65535
COMM IN3 change	F025I003	Analog event	4B02$	0...65535
COMM IN4 change	F025I004	Analog event	4B03$	0...65535

Description	Name	Type	Point (hex)	Values
COMM IN5 change	F025I005	Analog event	4B04$	0...65535
COMM IN6 change	F025I006	Analog event	4B05$	0...65535
COMM IN7 change	F025I007	Analog event	4B06$	0...65535
COMM IN8 change	F025I008	Analog event	4B07$	0...65535
COMM IN9 change	F025I009	Analog event	4B08$	0...65535
COMM IN10 change	F025I010	Analog event	4B09$	0...65535
COMM IN11 change	F025I011	Analog event	4B0A$	0...65535
COMM IN12 change	F025I012	Analog event	4B0B$	0...65535
COMM IN13 change	F025I013	Analog event	4B0C$	0...65535
COMM IN14 change	F025I014	Analog event	4B0D$	0...65535
COMM IN15 change	F025I015	Analog event	4B0E$	0...65535
COMM IN16 change	F025I016	Analog event	4B0F$	0...65535

Output NVs interpreted as boolean type are implemented as points of coil type (xxxx). If a change of their interpretation to enum type is required, they should be implemented as holding registers (xxxx).

* Events associated with input NVs interpreted as boolean type are implemented as points of digital event type (xxxx). If a change of the interpretation of these NVs to enum type is required, they should be implemented as analogue events (0005xxxx). Input NVs interpreted as boolean type are implemented as points of digital input type (xxxx). If it is required to change their interpretation to enum type, they should be implemented as input registers (xxxx).

$ Events associated with LON input NVs have time stamps set to “not used”.

RECCH026 (LON virtual inputs and outputs)

Description	Name	Type	Point (hex)	Values
COMM OUT49	F026O017	Coil	0C10	0...1
COMM OUT50	F026O018	Coil	0C11#	0...1
COMM OUT51	F026O019	Coil	0C12#	0...1
COMM OUT52	F026O020	Coil	0C13#	0...1
COMM OUT53	F026O021	Coil	0C14#	0...1
COMM OUT54	F026O022	Coil	0C15#	0...1
COMM OUT55	F026O023	Coil	0C16#	0...1
COMM OUT56	F026O024	Coil	0C17#	0...1
COMM OUT57	F026O025	Coil	0C18#	0...1
COMM OUT58	F026O026	Coil	0C19#	0...1
COMM OUT59	F026O027	Coil	0C1A#	0...1
COMM OUT60	F026O028	Coil	0C1B#	0...1
COMM OUT61	F026O029	Coil	0C1C#	0...1
COMM OUT62	F026O030	Coil	0C1D#	0...1
COMM OUT63	F026O031	Coil	0C1E#	0...1
COMM OUT64	F026O032	Coil	0C1F#	0...1
COMM IN49	F026I017	Digital input	4C10*	0...1
COMM IN50	F026I018	Digital input	4C11*	0...1
COMM IN51	F026I019	Digital input	4C12*	0...1

Description	Name	Type	Point (hex)	Values
COMM IN52	F026I020	Digital input	4C13*	0...1
COMM IN53	F026I021	Digital input	4C14*	0...1
COMM IN54	F026I022	Digital input	4C15*	0...1
COMM IN55	F026I023	Digital input	4C16*	0...1
COMM IN56	F026I024	Digital input	4C17*	0...1
COMM IN57	F026I025	Digital input	4C18*	0...1
COMM IN58	F026I026	Digital input	4C19*	0...1
COMM IN59	F026I027	Digital input	4C1A*	0...1
COMM IN60	F026I028	Digital input	4C1B*	0...1
COMM IN61	F026I029	Digital input	4C1C*	0...1
COMM IN62	F026I030	Digital input	4C1D*	0...1
COMM IN63	F026I031	Digital input	4C1E*	0...1
COMM IN64	F026I032	Digital input	4C1F*	0...1
COMM IN49 change	F026I017	Digital event	4C10*$	0...1
COMM IN50 change	F026I018	Digital event	4C11*$	0...1
COMM IN51 change	F026I019	Digital event	4C12*$	0...1
COMM IN52 change	F026I020	Digital event	4C13*$	0...1
COMM IN53 change	F026I021	Digital event	4C14*$	0...1
COMM IN54 change	F026I022	Digital event	4C15*$	0...1
COMM IN55 change	F026I023	Digital event	4C16*$	0...1
COMM IN56 change	F026I024	Digital event	4C17*$	0...1
COMM IN57 change	F026I025	Digital event	4C18*$	0...1
COMM IN58 change	F026I026	Digital event	4C19*$	0...1
COMM IN59 change	F026I027	Digital event	4C1A*$	0...1
COMM IN60 change	F026I028	Digital event	4C1B*$	0...1
COMM IN61 change	F026I029	Digital event	4C1C*$	0...1
COMM IN62 change	F026I030	Digital event	4C1D*$	0...1
COMM IN63 change	F026I031	Digital event	4C1E*$	0...1
COMM IN64 change	F026I032	Digital event	4C1F*$	0...1
COMM IN17	F026I001	Input register	4C00	0...65535
COMM IN18	F026I002	Input register	4C01	0...65535
COMM IN19	F026I003	Input register	4C02	0...65535
COMM IN20	F026I004	Input register	4C03	0...65535
COMM IN21	F026I005	Input register	4C04	0...65535
COMM IN22	F026I006	Input register	4C05	0...65535
COMM IN23	F026I007	Input register	4C06	0...65535
COMM IN24	F026I008	Input register	4C07	0...65535
COMM IN25	F026I009	Input register	4C08	0...65535
COMM IN26	F026I010	Input register	4C09	0...65535
COMM IN27	F026I011	Input register	4C0A	0...65535
COMM IN28	F026I012	Input register	4C0B	0...65535
COMM IN29	F026I013	Input register	4C0C	0...65535
COMM IN30	F026I014	Input register	4C0D	0...65535
COMM IN31	F026I015	Input register	4C0E	0...65535
COMM IN32	F026I016	Input register	4C0F	0...65535
COMM OUT17	F026O001	Holding register	4C00	0...65535
COMM OUT18	F026O002	Holding register	4C01	0...65535

Description	Name	Type	Point (hex)	Values
COMM OUT19	F026O003	Holding register	4C02	0...65535
COMM OUT20	F026O004	Holding register	4C03	0...65535
COMM OUT21	F026O005	Holding register	4C04	0...65535
COMM OUT22	F026O006	Holding register	4C05	0...65535
COMM OUT23	F026O007	Holding register	4C06	0...65535
COMM OUT24	F026O008	Holding register	4C07	0...65535
COMM OUT25	F026O009	Holding register	4C08	0...65535
COMM OUT26	F026O010	Holding register	4C09	0...65535
COMM OUT27	F026O011	Holding register	4C0A	0...65535
COMM OUT28	F026O012	Holding register	4C0B	0...65535
COMM OUT29	F026O013	Holding register	4C0C	0...65535
COMM OUT30	F026O014	Holding register	4C0D	0...65535
COMM OUT31	F026O015	Holding register	4C0E	0...65535
COMM OUT32	F026O016	Holding register	4C0F	0...65535
COMM IN17 change	F026I001	Analog event	4C00$	0...65535
COMM IN18 change	F026I002	Analog event	4C01$	0...65535
COMM IN19 change	F026I003	Analog event	4C02$	0...65535
COMM IN20 change	F026I004	Analog event	4C03$	0...65535
COMM IN21 change	F026I005	Analog event	4C04$	0...65535
COMM IN22 change	F026I006	Analog event	4C05$	0...65535
COMM IN23 change	F026I007	Analog event	4C06$	0...65535
COMM IN24 change	F026I008	Analog event	4C07$	0...65535
COMM IN25 change	F026I009	Analog event	4C08$	0...65535
COMM IN26 change	F026I010	Analog event	4C09$	0...65535
COMM IN27 change	F026I011	Analog event	4C0A$	0...65535
COMM IN28 change	F026I012	Analog event	4C0B$	0...65535
COMM IN29 change	F026I013	Analog event	4C0C$	0...65535
COMM IN30 change	F026I014	Analog event	4C0D$	0...65535
COMM IN31 change	F026I015	Analog event	4C0E$	0...65535
COMM IN32 change	F026I016	Analog event	4C0F$	0...65535

Output NVs interpreted as boolean type are implemented as points of coil type (xxxx). If a change of their interpretation to enum type is required, they should be implemented as holding registers (xxxx).

$ Events associated with LON input NVs have time stamps set to “not used”.

* Events associated with input NVs interpreted as boolean type are implemented as points of digital event type (xxxx). If a change of their interpretation to enum type is required, they should be implemented as analogue events (0005xxxx). Input NVs interpreted as boolean type are implemented as points of digital input type (xxxx). If a change of their interpretation to enum type is required , they should be implemented as input registers (xxxx).

Link handler

Description	Name	Type	Point (hex)	Values
Remote protocol CTS usage	F500V217	Coil	4000	0 – not used 1 - in use
Remote protocol RTS usage	F500V218	Coil	4001	0 – not used 1 - in use

Description	Name	Type	Point (hex)	Values
Remote protocol connection mode	F500V220	Coil	4002	0 – fixed line 1 – dial up
Remote protocol baud rate	F500V211	Holding register	4000	300...19200 300bps...19200bps
Remote protocol stop bits	F500V212	Holding register	4001	1...2
Remote protocol CTS delay	F500V213	Holding register	4002	0...1 0ms...10000ms
Remote protocol RTS delay	F500V214	Holding register	4003	0..10000 0ms..10000ms
Remote protocol next character timeout	F500V215	Holding register	4004	0 – not in use 1...10000 1ms...10000ms
Remote protocol end of frame timeout	F500V216	Holding register	4005	0 – not in use 1...10000 1ms...10000ms
Remote protocol parity	F500V230	Holding register	4006	0...2 0 – no parity 1 – odd parity 2 – even parity
Remote protocol data bits	F500V231	Holding register	4007	5...8

Note: Modem strings are not mapped in the Modbus interface. A reconfiguration requires the usage of the SPA or the LON interface.

Modbus Protocol data

Description	Name	Type	Point (hex)	Values
Station address	F504V001	Holding register	4100	1...247
CRC order	F504V002	Coil	4100	0 – LO/HI 1 – HI/LO
Mode	F504V003	Coil	4101	0 – ASCII 1 – RTU
Event reporting mode	F504V004	Holding register	4101	0 – no events 1 – SACE method with short time stamp 2 – SACE method with full time stamp 3 – MicroSCADA 4 – MicroSCADA method with full time stamp 5 – Modicon method with short time stamp 6 – Modicon method with full time stamp other – reserved
Dial timeout	F504V005	Holding register	4102	0 – not in use 1...65535 seconds
Channel idle watchdog timeout	F504V006	Holding register	4103	0 – not in use 1...65535 seconds

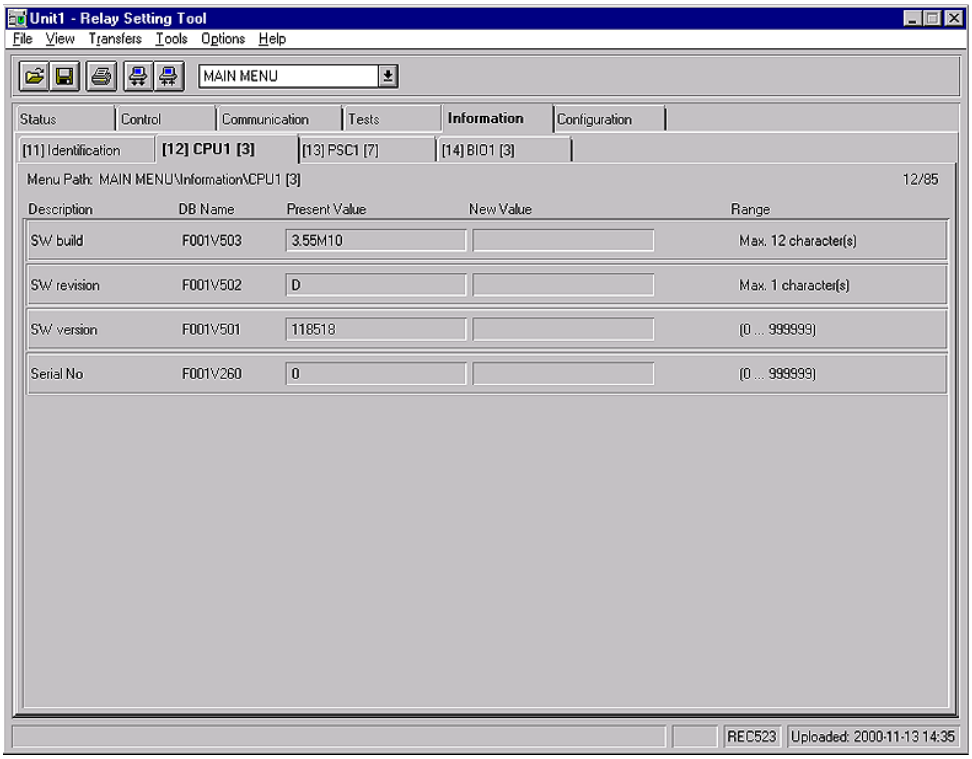
Modbus queues

Description	Name	Type	Point (hex)	Values
Event queue control coil	EQCTRLCO	Coil	7FFF	See event collecting description
Common event queue control register	CEQCTRLR	Holding register	7FFD	See event collecting description
Analog event queue control register	AEQCTRLR	Holding register	7FFE	See event collecting description
Digital event queue control register	DEQCTRLR	Holding register	7FFF	See event collecting description
Common event queue	COEVENTQ	Holding registers	8000	See event collecting description
Analog event queue	ANEVENTQ	Holding registers	9000	See event collecting description
Digital event queue	DIEVENTQ	Holding registers	8000	See event collecting description
FIFO queue pointer	FIFOEVTQ	Holding registers	8000	See event collecting description

Time synchronization

Description	Name	Type	Point (hex)	Values
Device time year	DEVCLOCK	Holding register	0001	0...65535
Device time month	DEVCLOCK	Holding register	0002	1...12
Device time day	DEVCLOCK	Holding register	0003	1...31
Device time hour	DEVCLOCK	Holding register	0004	0...23
Device time minute	DEVCLOCK	Holding register	0005	0...59
Device time second	DEVCLOCK	Holding register	0006	0...59
Device time millisecond	DEVCLOCK	Holding register	0007	0...999

3.3. Protocol software version



SW_vers

Fig. 3.3.-1 Software version

Name	Description of coding scheme
Software build	A system software version (for example 3.55), followed by a letter indicating that a certain remote protocol has been included (for example M – for Modbus protocol), and the remote protocol version (for example 10 for the initial version 1.0)
Software revision	A revision letter (for example “D”)
Software version	The number of the CPU card delivered with the Modbus protocol
CPU card number	The serial number of the CPU card

3.4. Interface configuration

This section describes the communication parameters required to configure REC 523 in order to be able to communicate using the Modbus protocol over a given link.

These parameters can be uploaded, reviewed and modified using the Relay Setting Tool from the CAP 501/505 package by choosing the Communication library and the General, Link Handler or the Modbus pages.

3.4.1. Communication start-up procedure

Before the start-up of the Modbus based communication with REC 523, the parameters of the link and the protocol should be verified using the Relay Setting Tool from the CAP 501/505 package. To properly configure the interface of REC 523, it is necessary to know the setup of the master and the characteristics of

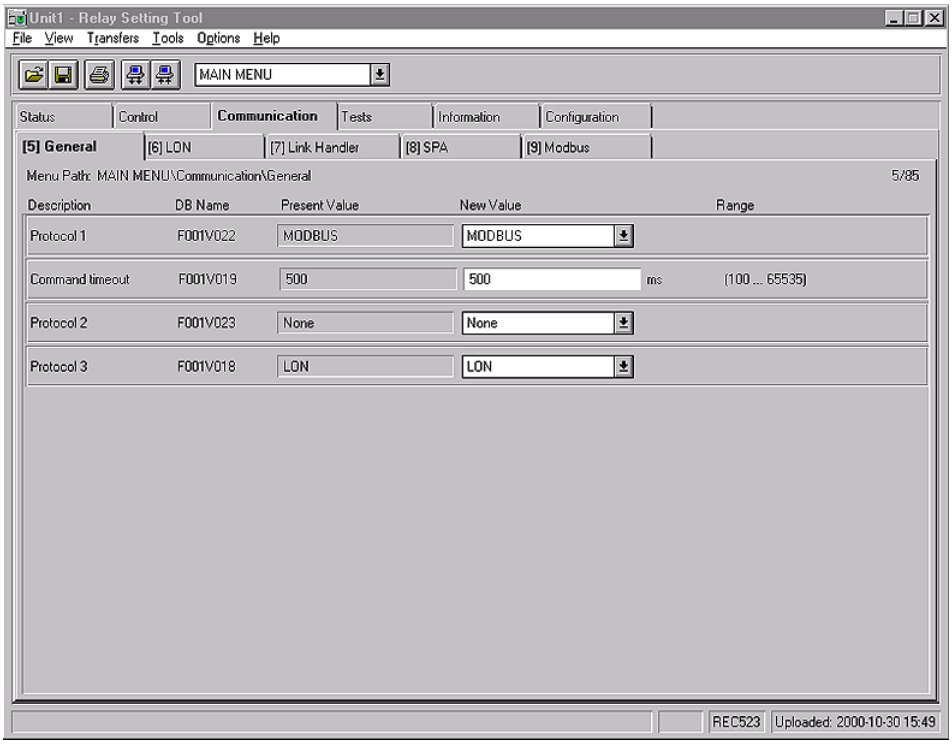
the utilized communication channel. At the end of the configuration process, the tool should enforce storing of updated parameters in the non-volatile memory and reset the REC 523 unit to activate new parameters. In some cases it may also be required to modify the application mapping in the POD table using the Protocol Editing Tool.

3.4.2. Port assignment

There are three communication ports in REC 523: two RS 232 and one RS 485. The Modbus can be assigned to each one of them (but only one at the time). The port assignment to the protocol can be done by choosing the Communication library and the General pages in the Relay Setting Tool. The default values for REC 523 ports are as follows:

Port X5.1	Modbus
Port X5.2	None
Port X5.3	LON

In Relay Setting Tool, parameter `Protocol1` refers to REC 523 port X5.1, `Protocol2` to port X5.2, and `Protocol 3` to port X5.3.



general

Fig. 3.4.2.-1 General pages

Note that the port assignments for protocols are revision dependent. This product supports only the following protocols: Modbus, SPA and LON. Refer to the Technical Reference Manual for a revision history.

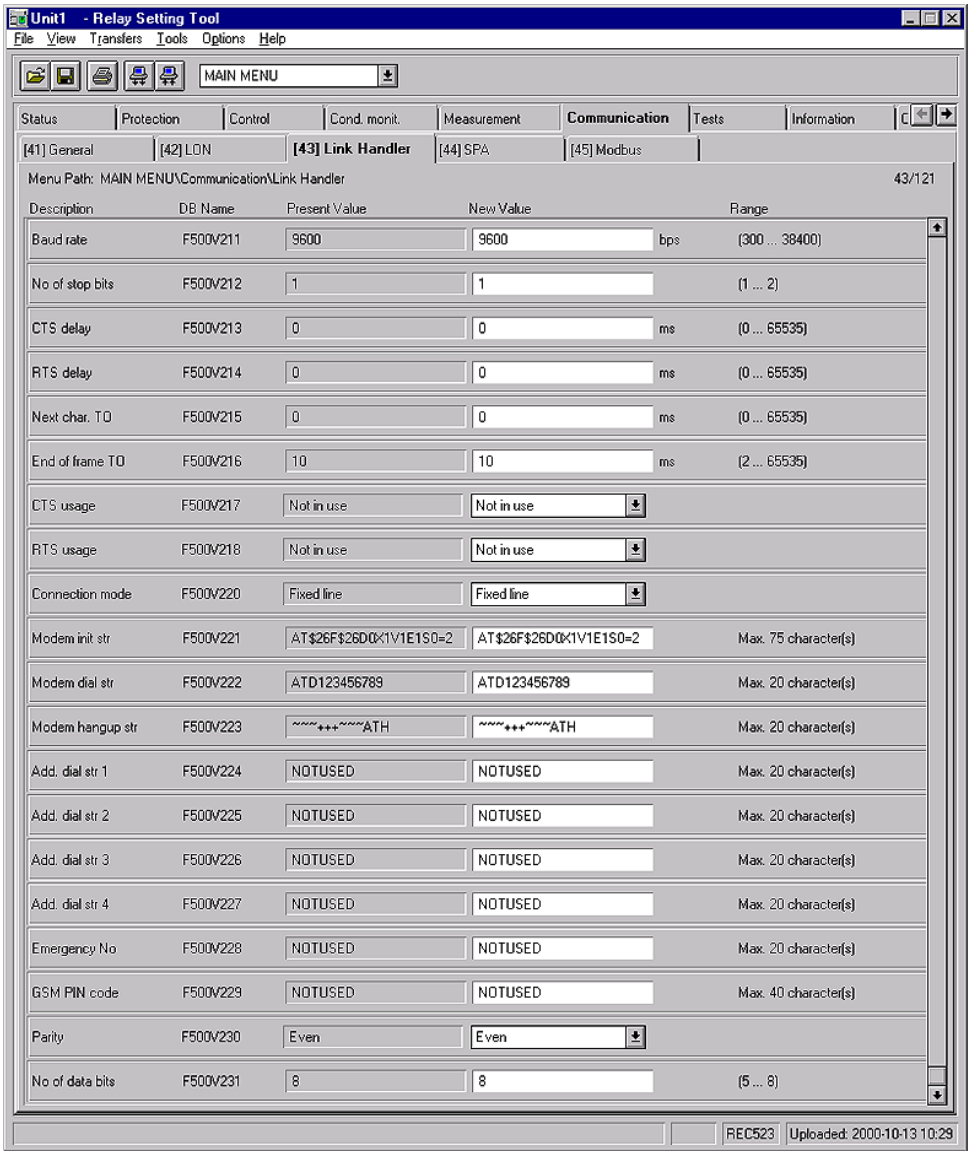
3.4.3. Link parameters

The link parameters of REC 523 can be accessed by choosing the Communication library and the Link Handler pages in the Relay Setting Tool.

Group description	Object name	Description	Notes
Transmission settings	F500V220	Connection mode 0 – fixed line 1 – dial-up	0 - in case of a fixed line or leased line connection (with preconfigured modems) 1 – in case of a dial-up connection (modem controlled by REC 523)
	F500V211	Communication speed (in bps) Baud rate	The same configuration as in the master (fixed line) or in the modem (dial-up).
	F500V212	The number of stop bits	The same configuration as in the master (fixed line) or in the modem (dial-up).
	F500V230	Parity 0 – no parity 1 – odd parity 2 – even parity (standard)	The same configuration as in the master (normally even parity for the RTU mode and odd parity for the ASCII mode, however, some modems require no parity).
	F500V231	The number of data bits	7 – The ASCII mode 8 – The RTU mode
Timeout settings (frame transmission delays)	F500V215	The next character timeout (in ms): the maximum allowed time gap between received characters of the same frame; 0 – not in use.	Can be tuned according to the link characteristics. According to the RTU mode in the Modbus protocol, the next character timeout is 1.5 x character time.
	F500V216	The end of the frame timeout (in ms): the minimum idle time following the frame transmission to REC 523	Must be tuned according to the link characteristics. Recommended minimum in the ASCII mode: longer than the character transmission time. In the RTU mode 3.5 x character time.
Handshaking settings (connection to the DCE)	F500V217	CTS usage 0 – not used 1 – in use	In use if required by the DCE (modem in the half duplex mode) and supported by the connection cable.
	F500V218	RTS usage 0 – not used 1 – in use	In use if required by the DCE (modem in the half duplex mode) and supported by the connection cable.
	F500V219	DCD usage 0 – not used 1 – in use	Not used – not supported by REC 523 hardware.
	F500V213	CTS delay value (in ms)	In REC 523 controlled by hardware, set to 0.
	F500V214	RTS delay value (in ms)	In REC 523 controlled by hardware, set to 0.

Group description (Continued)	Object name	Description	Notes
Modem settings (for use only in the dial-up connection mode)	F500V221	The modem initialization string (max. 75 characters)	According to the modem type (refer to the modem manual).
	F500V222	The modem dialing string (max. 20 characters) **Note:** This parameter will be used only if REC 523 is permitted to activate the dial-up connection with the master (unsolicited reporting of events will be allowed).	According to the type of modem (refer to the modem manual).
Modem settings (for use only in the dial-up connection mode)	F500V223	The modem hang-up string (max. 20 characters). **Note:** This parameter will be used in case of enforced interface restart or unknown modem state.	According to the type of modem (refer to the modem manual).
	F500V224	The 1st spare modem dialing string (max. 20 characters). **Note:** This parameter will be used only if REC 523 is permitted to activate the dial-up connection with the master (unsolicited reporting of events will be allowed). Add dial str 1	According to the type of modem (refer to the modem manual). Set to “NOTUSED” if not in use.
	F500V225	The 2nd spare modem dialing string (max. 20 characters). **Note:** This parameter will be used only if REC 523 is permitted to activate the dial-up connection with the master (unsolicited reporting of events will be allowed). Add dial str 2	According to the type of modem (refer to the modem manual). Set to “NOTUSED” if not in use.

Group description (Continued)	Object name	Description	Notes
	F500V226	The 3rd spare modem dialing string (max. 20 characters). **Note:** This parameter will be used only if REC 523 is permitted to activate the dial-up connection with the master (unsolicited reporting of events will be allowed). Add dial str 3	According to the type of modem (refer to the modem manual). Set to “NOTUSED” if not in use.
	F500V227	The 4th spare modem dialing string (max. 20 characters). **Note:** This parameter will be used only if REC 523 is permitted to activate the dial-up connection with the master (unsolicited reporting of events will be allowed). Add dial str 4	According to the type of modem (refer to the modem manual). Set to “NOTUSED” if not in use.
	F500V228	Emergency dialing string (max. 20 characters). **Note:** This parameter will be used only if REC 523 is permitted to activate the dial-up connection with the master (unsolicited reporting of events will be allowed).	According to the type of modem (refer to the modem manual). Set to “NOTUSED” if not in use.
	F500V229	The PIN code string (max. 40 characters). **Note:** This parameter is used only with GSM modems.	According to the type of modem (refer to the modem manual). Set to “NOTUSED” if not in use.



Linkhandler1

Fig. 3.4.3.-1 Link Handler

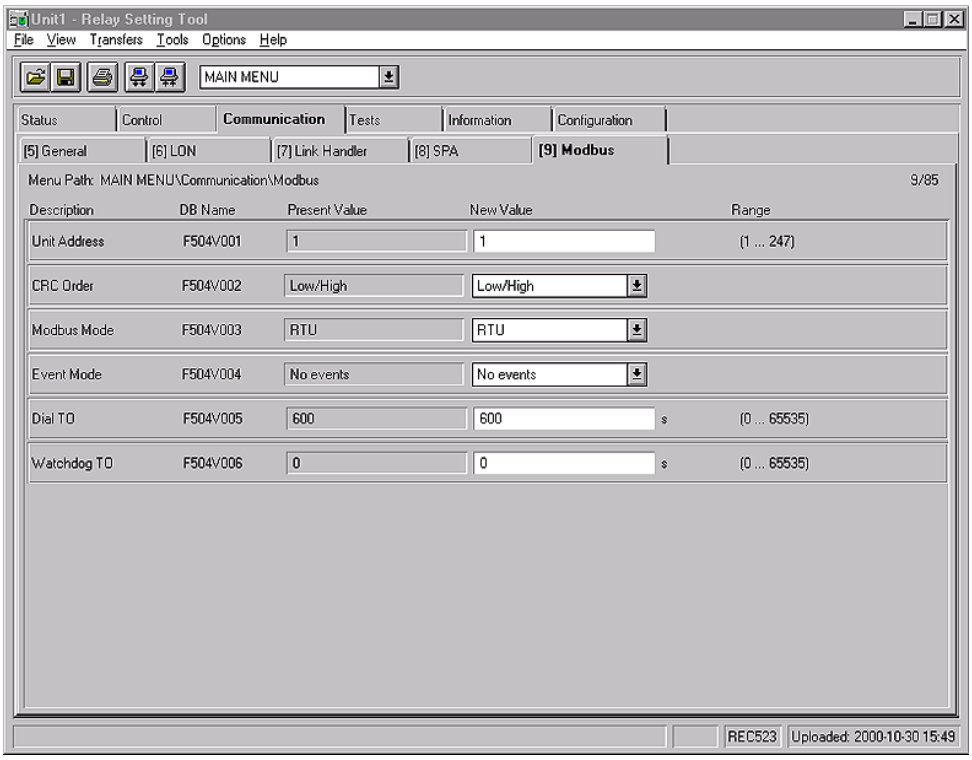
3.4.4. Protocol parameters

The protocol parameters of REC 523 can be accessed by choosing the Communication library and the Modbus pages in the Relay Setting Tool.

Object name	Description	Notes
F504V001	Unit address 1...247	The same configuration as in the master.
F504V002	CRC order	Irrelevant in the ASCI mode. In the RTU mode the same configuration as in the master.
F504V003	Mode	The same configuration as in the master.
F504V004	Event reporting mode	Apply the same method as used by the master.

Object name	Description	Notes
F504V005	Dial timeout	Can be set to 0 when fixed line configuration is used. In the dial-up environment this timeout is activated after the event has been received. After the timeout has expired, the channel will be openedto indicate that the event buffers are not empty.
F504V006	Channel idle watchdog timeout	The time in seconds after which the protocol will close the communication channel if there is no communication with the controlling device. 0 – not used

Note: The event mask 1 in the function block parameters should be used to select events to be reported via the Modbus protocol.



MBparams

Fig. 3.4.4.-1 Relay Setting Tool with Modbus parameters

3.4.4.1. Recommendations for parameter tuning due to specific medium or link characteristics

Fixed line (RS-232) 1 to 1 or bus topology connection:

In this case there is no need to set the dial timeout. The fixed line connection mode is used. It is irrelevant to set the modem parameters. The rest of the parameters must match the master’s configuration.

Fixed line (modem) 1 to 1 or bus topology connection:

For communication over a leased line the connection mode needs to be set to fixed line. The utilized modem must be set up using the terminal program. For this type of communication the end of the frame timeout needs to be set according to the channel characteristics.

Dial up connection – requesting a connection to the master not allowed:

In this case only the master can initiate the connection (that is, dial the number). The dial timeout should be set to 0.

Dial up connection – requesting a connection to the master station allowed:

In this case unsolicited reporting can be switched on. The reconnection timeout can be used to choose the time after which REC 523 will try to connect after it has received an event.

Note: For communication in the dial-up connection mode the utilized modem is configured by REC 523. E0 command should be included in the modem initialization string to prevent sending an echo of the received commands. The modem initialization string must not include any command that establishes a connection with the remote modem. For this purpose only the dialing string should be used.

3.4.4.2. Communication in the dial-up environment

Establishing a modem connection through the PSN (Public Switched Network) requires the use of string parameters. There can be a maximum of one default and four spare dialing strings. The dialing string contains the phone number of the designated master (with mandatory ATD prefix). The REC 523 unit will open the channel only if communication with the designated master is necessary and the channel has been closed. If the default master can not answer the call, the spare dialing numbers will be used. If all attempts to connect fail, the emergency number will be dialed and REC 523 will hung up immediately after a connection has been established. This number can be the operator's GSM number, for instance. This feature allows informing the operator that all attempts to connect to all configured numbers have failed and that the system therefore has to be reconfigured. After this REC 523 will only accept incoming calls. The dialing feature of the Modbus interface will be reactivated only after REC 523 has been reset.

To configure REC 523 so that the dial-up connection can be used, the following parameters must be set:

- The parameter `Connection mode` must be set to dial-up
- The parameter `Modem init str` must be set to parameterize the modem (according to the manual of the used modem)
- The use of the GSM modem requires that also the `GSM PIN code` parameter be set accordingly

Each modem operation is started by hanging-up any active connection. This includes also the procedure of establishing the connection between the REC 523 and SCADA system.

The modem configuration/initialization will be done every time the link initialization is performed (this does not apply to entering the GSM modem PIN-code).

The use of the GSM modem requires two levels of modem initialization:

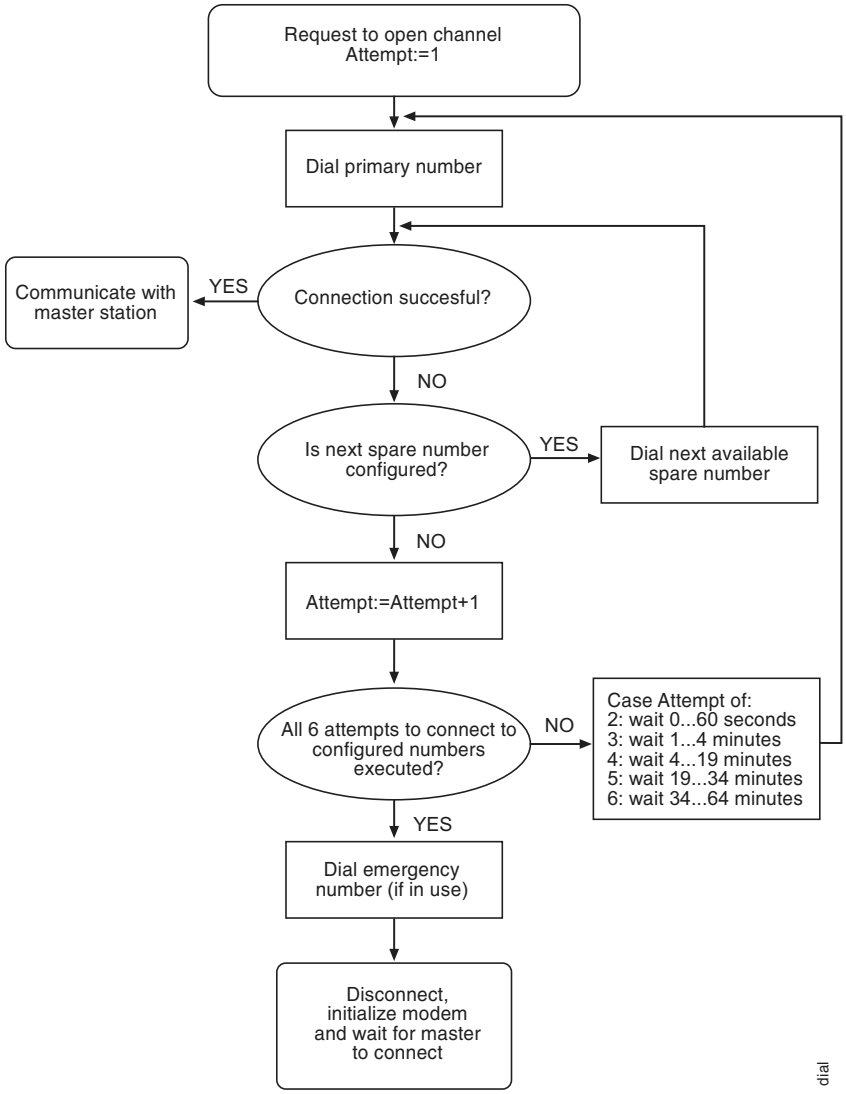
- Hard initialization after the device start-up - this includes the entering of the PIN-code and common modem configuration
- Soft initialization that includes only modem reconfiguration

To be able to establish a connection to the master at least the “Modem dial str” needs to be set to dial the master’s number (note that this string must include the ATD prefix).

The communication channel will be opened only at the request of the protocol software. The algorithm of this operation assumes a predefined number of six attempts made at random and increasing intervals (the intervals are presented below). It is possible to define more than one telephone number of the SCADA system by using separate dialing strings as link handler parameters (one primary number, up to four spare numbers). During each attempt to establish a connection all configured dialing numbers on the list will be used (without delays).

It is also possible to define an emergency number to be used only when no connection to any of the configured numbers (primary and spare numbers) can be established. The emergency number can be the number of the operator, for instance. The idea of using this number is to inform the operator about traffic problems in the telephone switching network. No action is expected from the operator after it has received such a call – after a connection has been established, the link will notify the protocol about the channel error. As a result of this, the protocol will initialize the link (and hang up the connection) and wait for the master to connect (that is, it will not try to open the channel by itself).

The detailed behavior of the dialing algorithm is shown below:



When the master dials the number of the REC 523 unit and successfully manages to connect between the dialing attempts made by REC 523, the same procedure will be followed as though REC 523 would successfully connect.

REC 523 is responsible for closing the communication channel when there is no communication with the master for a predefined time (no valid frame is received, including also the frames addressed to other units). A watchdog function supervising the incoming valid frames has been added to the protocol software. The watchdog timeout is defined by the configurable parameter `Watchdog TO` in the protocol parameter group.

3.4.4.3. Application mapping review

In most of the system configurations the application mapping defined by the default POD should be acceptable. However, a modification of the visible POD table is necessary in the following cases:

- When a different addressing concept is used in the system because of the master's requirements or limitations in the protocol data addressing (that is, the mapped application objects are readdressed)
- To eliminate obsolete data and events from active function blocks (data items not required or not processed by the master station)

The visible POD table can be uploaded, reviewed, and modified using the dedicated Protocol Editing Tool. In the default POD the mapped function blocks occupy the assigned ranges of addresses. Therefore, for a downloaded application the overall addressing of the data will not be continuous. Some masters, however, may accept only a continuous address map. In this case the addresses of the data items will have to be changed.

A detailed description of the contents of the visible POD and examples of mapping are given in section 3.1.3.

After the contents of the visible POD have been changed, the table can be downloaded to REC 523. After this the tool enforces storing of the data in the non-volatile memory followed by the device reset. The updated table will be used to generate the operational POD.

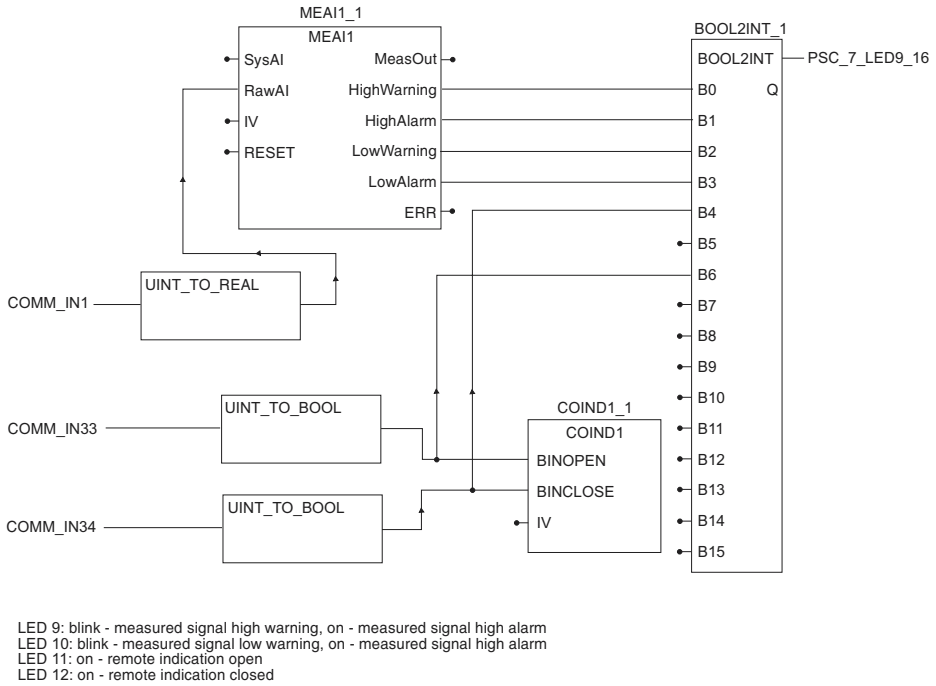
3.4.4.4. MODBUS/LON gateway function

It is possible to use REC 523 as a Modbus/LON gateway. There are 32 analogue inputs, 32 analogue outputs, 32 binary inputs and 32 binary outputs (from the Modbus point of view) that represent the LON network variables. A change of any input network variable (by the Modbus seen as an analogue or a binary input) will be reported as a change event on the Modbus side. Setting a new value to the binary or the analogue output will result in sending an appropriate output network variable update message on the LON side.

The Modbus/LON gateway function can be used in two ways:

- Directly - by using the LON network variables as data points (data from channels 25 and 26)
- As a remote I/O - by connecting the LON network variables to inputs and outputs of the function blocks in the application

Below an example of the Modbus/LON used as a remote I/O:



LED 9: blink - measured signal high warning, on - measured signal high alarm
LED 10: blink - measured signal low warning, on - measured signal high alarm
LED 11: on - remote indication open
LED 12: on - remote indication closed

Remote

Note:

- The LON interface must be properly configured in order to be able to use the Modbus/LON gateway function
- The time stamps of the LON events are assigned by REC 523 software, not by the LON devices providing updates of network variables to REC 523. The time stamp contains the time when a network variable update has been received.

4. Appendix A: Profile checklist

Modbus DEVICE PROFILE DOCUMENT
Vendor Name: ABB Oy Distribution Automation
Device Name: REC 523 rev. E
Device Function: Slave
Modes:
☒ RTU
☒ ASCII

Supported function codes

Code (HEX)	Function	Supported
01	Read coil Status	Yes
02	Read Input Status	Yes
03	Read Holding Register	Yes
04	Read Input Registers	Yes
05	Force Single Coil	Yes
06	Preset Single Register	Yes
07	Read Exception Status	No
08	Diagnostics	Yes
0B	Fetch Comm Event Counter	No
0C	Fetch Comm Event Log	No
0F	Force Multiple Coils	Yes
10	Preset Multiple Registers	Yes
11	Report Slave ID	No
14	Read General Reference	No
15	Write General Reference	No
16	Mask Write 4x Register	No
17	Read/Write 4x Registers	No
18	Read FIFO queue	Yes

Supported diagnostic subfunction codes

Code (HEX)	Name	Supported
00	Return Query Data	Yes
01	Restart Communication Option	Yes
02	Return Diagnostic Register	Yes
03	Change ASCII Delimiter	No
04	Force Listen Only Mode	Yes
0A	Clear Counters and Diagnostics Register	Yes
0B	Return Bus Message Count	Yes

Code (HEX)	Name	Supported
0C	Return Bus Communication Error Count	Yes
0D	Return Bus Exception Error Count	Yes
0E	Return Slave Message Count	Yes
0F	Return Slave No Response Count	Yes
10	Return Slave NAK Count	No
11	Return Slave Busy Count	No
12	Return Bus Character Overrun Count	No
13	Return IOP Overrun Count	No
14	Clear Overrun Counter Counter and Flag	No
15	Get / Clear Modbus Plus Statisctics	No

Supported exception responses

Code	Name	Supported
01	ILLEGAL FUNCTION	Yes
02	ILLEGAL DATA ADDRESS	Yes
03	ILLEGAL DATA VALUE	Yes
04	SLAVE DEVICE FAILURE	No
05	ACKNOWLEDGE	No
06	SLAVE DEVICE BUSY	No
07	NEGATIVE ACKNOWLEDGE	No
08	MEMORY PARITY ERROR	No

Supported data types

Name	Supported
Digital input	Yes
Coil	Yes
Input register	Yes
Holding register	Yes
General reference	No
Digital event[a]	Yes
Analog event[a]	Yes

a. Extension of the protocol specification

Supported event reporting methods

Name	Supported
SACE with a short time stamp	Yes
SACE with a full time stamp	Yes
MicroScada	Yes
MicroScada with a full time stamp	Yes
Modicon FIFO read method with a short time stamp	Yes
Modicon FIFO read method with a full time stamp	Yes

5. Appendix B: List of used abbreviations

ASCII	American Standard Code for Information Interchange
CRC	Cyclic redundancy check
CTS	Clear to send
DCD	Data carrier detect
FIFO	First in first out
LRC	Longitudinal redundancy check
PLC	Programmable logic controller
RTS	Request to send
RTU	Remote terminal unit

ABB Oy
Distribution Automation
P.O. Box 699
FI-65101 Vaasa
FINLAND
Tel. +358 10 22 11
Fax. +358 10 224 1094
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