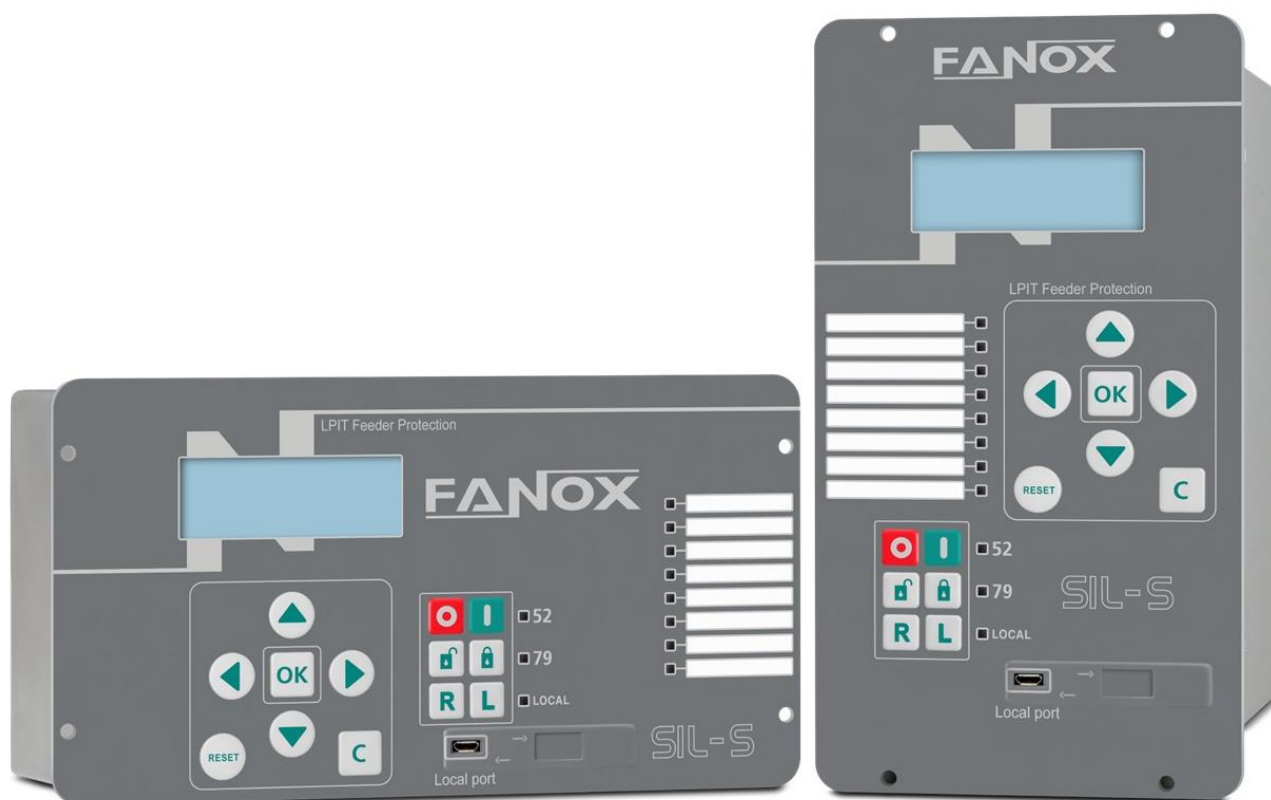


SIL-S

Feeder Protection Relay



MODBUS PROTOCOL MANUAL

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1. MODBUS PROTOCOL

Communication parameters are:

Description	Minimun	Maximun	Step	Unit	Default
Modbus RTU					
Slave address	1	247	1	-	2

Description	Minimun	Maximun	Step	Unit	Default
Rear Serial Communications					
Protocol	-	-	Modbus RTU, IEC 60870-5-103 or DNP3.0		Modbus RTU
Baud rate	4800	115200	4800, 9600, 19200, 38400, 57600 or 115200	bauds	19200
Parity	-	-	8-N-1, 8-E-1, 8-O-1, 9-N-1, 8-N-2, 8-E-2, 8-O-2 or 9-N-2	-	8-N-1

Description	Minimun	Maximun	Step	Unit	Default
Modbus TCP					
Slave address	1	247	1	-	2
Modbus Port	1	65535	1	-	502

Description	Minimun	Maximun	Step	Unit	Default
Rear TCP Communications					
Protocol	-	-	Modbus TCP, IEC 60870-5-104 or DNP3.0 TCP	-	Modbus TCP
IP Address	1.0.0.1	255.255.255.252	-	-	192.168.200.100
Subnet	1.0.0.1	255.255.255.252	-	-	255.255.255.0
Gateway	1.0.0.1	255.255.255.252	-	-	192.168.200.1
DNS – 1	0.0.0.0	255.255.255.252	-	-	0.0.0.0
DNS-2	0.0.0.0	255.255.255.252	-	-	0.0.0.0
SNTP	-	-	-	-	0.es.pool.ntp.org

Note: Retries number =10, confirmation time = 2000 ms

This document describes the steps to follow to read and write data on the SIL-S relay, as per the Modbus protocol. This memory map is only valid for one piece of equipment and one version of the memory. The positions of existing objects in the memory remain fixed from one version to the next, but new objects will naturally have new addresses which will, in turn, remain fixed in future versions. The memory map is described further on.

The standard Modbus protocol is used, so any program or PC can communicate easily with the equipment.

The SIL-S always acts as a slave, which means that it never initiates communications. The master is always responsible for initiating communications.

Only a subset of the Modbus functions is implemented:

- Reading function 3.
- Writing function 16.

The MODBUS/RTU protocol is independent from the hardware. Therefore, the physical layer can exist in different hardware configurations: RS232, RS485, fiber optic or Ethernet.

Specifically, the relay has a front RS232 port and, as an option, a rear RS485 port. The data stream in any of the configurations is “half-duplex”.er

Each byte of data is transmitted asynchronously and is made up of: 1 start bit, 8 data bits, 1 stop bit and 1 parity bit, if this is how it is programmed. Therefore, the data has 10 or 11 bits, depending on whether it includes parity.

If the relay only offers with Modbus on the front port, the address (1 to 247) is configurable but the rest of the parameters are fixed and equal to: baudrate 19200, No parity and stop bit 1.

If the relay offers RS485 Modbus protocol, the address (1 to 247), baudrate (4800, 9600, 19200, 38400, 57600 or 115200) and the serial setting (8-N-1, 8-E-1, 8-O-1, 9-N-1, 8-N-2, 8-E-2, 8-O-2 or 9-N-2) can be changed by the user.

The master must know the address of the slave that it is going to communicate with. No unit will act on requests from the master if the message is not addressed to them. The exception is when the 0 address, or “broadcast” address, is used, in which case the relay will act but will not send an answer of any type.

Communications are made in packages or frames, which are groups of data that are sent asynchronously. The master transmits a frame to the slave, and the slave then replies with another frame (except in the case of “broadcast” messages).

The end of the frame is marked by a dead time or silence time in the communication medium. The length of this time of silence varies depending on the transmission speed, as it is equivalent to 3 characters.

The following table shows the generic package format that is valid for transmission and reception. However, each function has its own peculiarities, as will be described further on.

1.1. Modbus RTU package format

CUSTOMER ADDRESS	1 byte	Each device on a communication bus must have a unique address, otherwise two different units could reply simultaneously to the same request. All ports of the relay will use this address which can be set a value between 1 and 247. When the master transmits a frame with the slave address to 0 indicates a Broadcast. All the slaves in the communications bus will carry out the requested action, but no one will reply to the master. The Broadcast will only be accepted to write, as it makes no sense to make a read request in the Broadcast, as no one will reply this request.
FUNCTION CODE	1 byte	This is one of the function codes supported by the equipment. In this case, the only function codes supported are 3 to read and 16 to write. When the slave has to reply with an exception one of these frames, it is indicated by putting 1 in the most important bit of the correspondent function. Thus, an exception for the function 3, will be indicated with a 83 as a function code; and an exception for the function code 16 or 0x10 in hexadecimal, will be indicated with an 0x90.
DATA	N bytes	This part consists of a variable number of bytes, depending on the function code. It may include addresses, data lengths, settings, commands or exception codes sent by the user.
CRC	2 bytes	Control code of two bytes. The ModBus/RTU includes a 16-bit CRC in each frame, to detect errors. If the slave detects an erroneous frame, based on a CRC that is not correct, it won't take any action, nor will reply anything to the master. The management of the CRC is LSB-MSB.
DEAD TIME	Necessary time to transmit 3,5 Bytes	A frame is terminated when nothing is received for a period of 3,5 bytes. It means: 15 ms at 2400 bps 2 ms at 19200 bps ...etc.

1.2. Function Codes

HEX DEC CODE	MODBUS NAME	DEFINITION	COMMENT
0x03 3	Read Holding Registers	Reading of Any Value	This function allows the master to read 1 or more consecutive addresses of a relay. The registers always are of 16 bits, with the most important byte at first. The maximum number of registers to be read in a package are 60.
HEX DEC CODE	MODBUS NAME	DEFINITION	COMMENT
0x10 16	Preset Multiple Registers	Script	This function allows to write one or more registers that represent one or more settings. The registers are values of 2 bytes of length, transmitted with the most important byte at first. The maximum number of registers to be written in a package is 60.

1.3. Exceptions Responses

The error codes defined by the ModBus protocol are as follows:

01	ILLEGAL FUNCTION	The slave does not support any function with the function code received in this message.
02	ILLEGAL DATA ADDRESS	The master is trying to do an operation in a wrong address.
03	ILLEGAL DATA VALUE	The slave has detected that the value sent by the master is not valid.
04	SLAVE DEVICE FAILURE	Indicates an error occurred in the slave while trying to execute the request of the master.
05	ACKNOWLEDGE	Generic recognition.
06	SLAVE DEVICE BUSY	The slave is busy and unable to perform the required operation.
07	NEGATIVE ACKNOWLEDGE	Generic non-recognition.

When the data format takes up more than one BYTE, the most important BYTE is sent through the communications first, and the least important BYTE is sent last.

1.4. Data type

TYPE	LENGTH (Registers)	DESCRIPTION
ASCIIxx	xx/2	String: In length variable character chain. Final of String marked with '\0'. E. g.: "ABC" 0x41x42x43x00....
ASCII88	44	88 string character chain
ENUM	-	Each of the possible values of the integer will have a correspondence in the auxiliary list of the database. This list is the correspondence chain which must be shown for each of the values. Memory will only receive an integer value. E. g.: 0, 1 Correspondence to "CLOSED", "OPEN"
ENUM4	2	4 option ENUM (0-3)
ENUM8	2	8 option ENUM (0-7)
ENUM16	2	16 option ENUM (0-15)
ENUM80	2	80 option ENUM (0-79)
EVENT	9	Criteria Directory (UINT16). Event Identifier (UINT16). Value (UINT16). Associated Measure (FLOAT).Date and Time(FH)
EVENT02	11	Antiquity (UINT). Event (EVENT)
FH	5	<i>Year</i> (UINT16).month(UCHAR).day(UCHAR).hour(UCHAR).minutes(UCHAR).seconds(UCHAR).hundredth(UCHAR).thousandth(UINT16)
FLOAT INVERSE	2	Number in FLOAT INVERSEing decimal point "FLOAT INVERSE" of 4 bytes
IP	2	Unsigned Integer of 32 bit, in decimal point format.
TAP	2	Number in FLOAT INVERSE type with restrictions on the accepted values. See the user manual for more information in each specific case.
TEXT10	5	10 Character string
TEXT16	8	16 Character string
UINT16	1	Integer without sign of 16 bytes
UINT32	2	Integer without sign of 16 bytes

When the data format takes up more than one BYTE, the most important BYTE is sent through the communications first, and the least important BYTE is sent last.

1.5. General Memory Map

The function code implemented to **reading is 0x03 (Read Holding Registers)**.

The function code implemented to **writing is 0x16 (Write Holding Registers)**.

Function	Description	Start address	Number of registries	Format	Reference
16	Write event index	1	2	UINT32	
03 & 16	Load data Profiling	2	1		
16	Write the selected setting group	6	2	UINT	
03	Read of Model and Version	100	44	ASCII88	
16	Write access code	168	5	UCHAR4	See Passwords and Access Levels
03 & 16	Date and Time	170	5	FH	
16	Direct operate command	See Commands map	1	UINT	See Commands map
03	Serial number	252	2	LONG	
03	Equipment identifier	1000	8	TEXT16	
03	Read and Delete the oldest Event	400	11	EVENTO2	See States map (Event Number)
03	One event reading	410	11	EVENTO2	See States map (Event Number)
16	Delete All Events	420	2	dummy	
16	Write fault report index	8000	2		
16	Write event index from a fault report	8002	2		
03	Read event from a fault report	8123	11	EVENTO2	
16	Delete All DFR	8200	2		
03	Read a complete fault report	8400	54		

1.5.1. States Map, FC03, 2 registers

The function code implemented to **State reading is 0x03 (Read Holding Registers)**.

The states and events in the table may vary depending on the relay model.

Number of registries: 2

Type: Bit string 32 bits, Most significant bit first (MSB-LSB)

Address	Description	Bit	Event NO	Status
600	SELF DIAGNOSIS	0	1	Model Error
		1	2	HW Error
		12	4	COM Loading
		13	3	Test State
		14	5	Default Settings
		15	6	Error:Settings
		16	7	Default Config
		17	8	Error:Config
		18	9	Error: Curves
		20	10	ENVM Full
602	MEASUREMENTS	0	1	Error:Measurem.
		1	2	Net Freq.50Hz
		2	3	Blocked FreqLine
		3	4	Blocked Freq Bar
		4	5	Simulation
604	DFR	-	1	DFR Deleted
608	HMI	1	2	Open Breaker
		2	3	Close Breaker
		3	4	79 Block
		4	5	79 Unblock
		5	6	Local Control
		6	7	Remote Control
		7	8	Reset
		11	16	HLT On
		12	17	HLT Off
		13	18	User Command 1
		14	19	User Command 2
		15	20	User Command 3
		16	21	User Command 4
		17	22	User Command 5
		18	23	User Command 6
		25	15	Set Counter
		27	11	Key Reset
		29	12	Activity
		30	13	Identification
		31	14	Test State

Address	Description	Bit	Event NO	Status
610	GENERAL	0	1	Trip
		1	2	Ready
		2	3	Wrong Password
		4	5	Local
		5	6	Error: SER
		6	7	SER Deleted
		7	8	Wrong Access
		8	9	Settings Change
		10	11	SER Overflow
		11	12	Config Change
		13	14	LDP Deleted
		14	15	New DFR
		15	16	Phase Trip
		16	17	Trip Block
		17	18	Pickup
		18	19	Phase A Pickup
		19	20	Phase B Pickup
		20	21	Phase C Pickup
		21	22	Neutral Pickup
		22	23	Phase A Trip
		23	24	Phase B Trip
		24	25	Phase C Trip
		25	26	Neutral Trip
		26	27	SettingsG. 1
		27	28	SettingsG. 2
		28	29	SettingsG. 3
		29	30	SettingsG. 4
		30	-	Set to FALSE
		31	-	Set to TRUE
612	USB COM	1	2	Open Breaker
		2	3	Close Breaker
		3	4	79 Block
		4	5	79 Unblock
		5	6	Local Control
		6	7	Remote Control
		7	8	Reset
		11	16	HLT On
		12	17	HLT Off
		13	18	User Command 1
		14	19	User Command 2
		15	20	User Command 3
		16	21	User Command 4

Address	Description	Bit	Event NO	Status
		17	22	User Command 5
		18	23	User Command 6
		25	15	Set Counter
		28	12	Activity
		29	13	Identification
614	WIFI COM	1	2	Open Breaker
		2	3	Close Breaker
		3	4	79 Block
		4	5	79 Unblock
		5	6	Local Control
		6	7	Remote Control
		7	8	Reset
		11	16	HLT On
		12	17	HLT Off
		13	18	User Command 1
		14	19	User Command 2
		15	20	User Command 3
		16	21	User Command 4
		17	22	User Command 5
		18	23	User Command 6
		25	15	Set Counter
		27	11	Link
		28	12	Activity
		29	13	Identification
		31	14	WIFI Enabled
620	MODBUS RTU	1	2	Open Breaker
		2	3	Close Breaker
		3	4	79 Block
		4	5	79 Unblock
		5	6	Local Control
		6	7	Remote Control
		7	8	Reset
		11	16	HLT On
		12	17	HLT Off
		13	18	User Command 1
		14	19	User Command 2
		15	20	User Command 3
		16	21	User Command 4
		17	22	User Command 5
		18	23	User Command 6
		25	15	Set Counter
		28	12	Activity

Address	Description	Bit	Event NO	Status
622	MODBUS TCP	29	13	Identification
		1	2	Open Breaker
		2	3	Close Breaker
		3	4	79 Block
		4	5	79 Unblock
		5	6	Local Control
		6	7	Remote Control
		7	8	Reset
		11	16	HLT On
		12	17	HLT Off
		13	18	User Command 1
		14	19	User Command 2
		15	20	User Command 3
		16	21	User Command 4
		17	22	User Command 5
		18	23	User Command 6
		25	15	Set Counter
		28	12	Activity
		29	13	Identification
624	DNP3 Serial	1	2	Open Breaker
		2	3	Close Breaker
		3	4	79 Block
		4	5	79 Unblock
		5	6	Local Control
		6	7	Remote Control
		7	8	Reset
		11	16	HLT On
		12	17	HLT Off
		13	18	User Command 1
		14	19	User Command 2
		15	20	User Command 3
		16	21	User Command 4
		17	22	User Command 5
		18	23	User Command 6
		28	12	Activity
626	DNP3 TCP	1	2	Open Breaker
		2	3	Close Breaker
		3	4	79 Block
		4	5	79 Unblock
		5	6	Local Control
		6	7	Remote Control
		7	8	Reset

Address	Description	Bit	Event NO	Status
		11	16	HLT On
		12	17	HLT Off
		13	18	User Command 1
		14	19	User Command 2
		15	20	User Command 3
		16	21	User Command 4
		17	22	User Command 5
		18	23	User Command 6
		28	12	Activity
628	IEC60870-5-103	1	2	Open Breaker
		2	3	Close Breaker
		3	4	79 Block
		4	5	79 Unblock
		5	6	Local Control
		6	7	Remote Control
		7	8	Reset
		11	16	HLT On
		12	17	HLT Off
		13	18	User Command 1
		14	19	User Command 2
		15	20	User Command 3
		16	21	User Command 4
		17	22	User Command 5
		18	23	User Command 6
		21	24	SettingsG. 1
		22	25	SettingsG. 2
		23	26	SettingsG. 3
		24	27	SettingsG. 4
		28	12	Activity
630	IEC60870-5-104	1	2	Open Breaker
		2	3	Close Breaker
		3	4	79 Block
		4	5	79 Unblock
		5	6	Local Control
		6	7	Remote Control
		7	8	Reset
		11	16	HLT On
		12	17	HLT Off
		13	18	User Command 1
		14	19	User Command 2
		15	20	User Command 3
		16	21	User Command 4

Address	Description	Bit	Event NO	Status
		17	22	User Command 5
		18	23	User Command 6
		28	12	Activity
632	DATE	0	1	Date/Time Set
		1	2	Need Sync.
		2	3	Summer Time
		3	4	IRIG-B Synchronization
		4	5	SNTP Synchronization
634	INPUTS	0	1	Input 1
		1	2	Input 2
		2	3	Input 3
		3	4	Input 4
		4	5	Input 5
		5	6	Input 6
		6	7	Input 7
		7	8	Input 8
		8	9	Input 9
		9	10	Input 10
		10	11	Input 11
		11	12	Input 12
		12	13	Input 13
		13	14	Input 14
		14	15	Input 15
		15	16	Input 16
		16	17	Input 17
		17	18	Input 18
		18	19	Input 19
		19	20	Input 20
		20	21	Input 21
		21	22	Input 22
		22	23	Input 23
		23	24	Input 24
		24	25	Input 25
		25	26	Input 26
		26	27	Input 27
		27	28	Input 28
		28	29	Input 29
		29	30	Input 30
		30	31	Input 31
		31	32	Input 32
636	OUTPUTS	0	1	Output 1
		1	2	Output 2

Address	Description	Bit	Event NO	Status
		2	3	Output 3
		3	4	Output 4
		4	5	Output 5
		5	6	Output 6
		6	7	Output 7
		7	8	Output 8
		8	9	Output 9
		9	10	Output 10
		10	11	Output 11
		11	12	Output 12
		12	13	Output 13
		13	14	Output 14
		14	15	Output 15
		15	16	Output 16
		16	17	Output 17
		17	18	Output 18
		18	19	Output 19
		19	20	Output 20
		20	21	Output 21
		21	22	Output 22
		22	23	Output 23
		23	24	Output 24
		24	25	Output 25
		25	26	Output 26
		26	27	Output 27
		27	28	Output 28
		28	29	Output 29
		29	30	Output 30
		30	31	Output 31
		31	32	Output 32
638	PGC	0	1	Open Breaker
		1	2	Close Breaker
		2	3	79 Block
		3	4	79 Unblock
		4	5	Local Control
		5	6	Remote Control
		6	7	52a
		7	8	52b
		8	9	SettingsG. x1
		9	10	SettingsG. x2
		10	11	Hot Line Tag
		11	12	79 Enable

Address	Description	Bit	Event NO	Status
		12	13	79N1 Start
		13	14	79N2 Start
		14	15	79N3 Start
		15	16	79N4 Start
		16	17	DFR Start
		17	18	50BF Start
		18	19	SOTF Start
		19	20	SZM Start
		20	21	74TCS Coil A
		21	22	74TCS Coil B
		22	23	Neutral Block
		23	24	Phase Block
		24	25	External Trip
		25	26	Reset
		26	27	Opening Blk
		27	28	Closing Blk
		28	29	WIFI ON
		29	30	PGC 1
		30	31	PGC 2
		31	32	PGC 3
640	CONTROL LEDS	0	1	Led Local
		1	2	Led 79
		2	3	Led 52
		3	4	Virtual Led-1
		4	5	Virtual Led-2
		5	-	Virtual Led-3
642	ALARM LEDS	0		Alarm 1
		1		Alarm 2
		2		Alarm 3
		3		Alarm 4
		4		Alarm 5
		5		Alarm 6
		6		Alarm 7
		7		Alarm 8
		8		Alarm 9
		9		Alarm 10
		10		Alarm 11
		11		Alarm 12
		12		Alarm 13
		13		Alarm 14
		14		Alarm 15
		15		Alarm 16

Address	Description	Bit	Event NO	Status
		16		Alarm 17
		17		Alarm 18
		18		Alarm 19
		19		Alarm 20
		20		Alarm 21
		21		Alarm 22
		22		Alarm 23
		23		Alarm 24
		24		Alarm 25
		25		Alarm 26
		26		Alarm 27
		27		Alarm 28
		28		Alarm 29
		29		Alarm 30
		30		Alarm 31
		31		Alarm 32
644	50-1	0	1	Phase A Pickup
		1	2	Phase B Pickup
		2	3	Phase C Pickup
		3	4	Phase Pickup
		8	5	Phase A Trip
		9	6	Phase B Trip
		10	7	Phase C Trip
		11	8	Phase Trip
646	50-2	0	1	Phase A Pickup
		1	2	Phase B Pickup
		2	3	Phase C Pickup
		3	4	Phase Pickup
		8	5	Phase A Trip
		9	6	Phase B Trip
		10	7	Phase C Trip
		11	8	Phase Trip
648	SOTF	0	1	Phase A Pickup
		1	2	Phase B Pickup
		2	3	Phase C Pickup
		3	4	Phase Pickup
		8	5	Phase A Trip
		9	6	Phase B Trip
		10	7	Phase C Trip
		11	8	Phase Trip
		16	9	SOTF
650	67/51-1	0	1	Phase A Pickup

Address	Description	Bit	Event NO	Status
		1	2	Phase B Pickup
		2	3	Phase C Pickup
		3	4	Phase Pickup
		8	5	Phase A Trip
		9	6	Phase B Trip
		10	7	Phase C Trip
		11	8	Phase Trip
		16	9	Directionality A
		17	10	Directionality B
		18	11	Directionality C
		28	12	Directionality
652	67/51-2	0	1	Phase A Pickup
		1	2	Phase B Pickup
		2	3	Phase C Pickup
		3	4	Phase Pickup
		8	5	Phase A Trip
		9	6	Phase B Trip
		10	7	Phase C Trip
		11	8	Phase Trip
		16	9	Directionality A
		17	10	Directionality B
		18	11	Directionality C
		28	12	Directionality
654	67/51-3	0	1	Phase A Pickup
		1	2	Phase B Pickup
		2	3	Phase C Pickup
		3	4	Phase Pickup
		8	5	Phase A Trip
		9	6	Phase B Trip
		10	7	Phase C Trip
		11	8	Phase Trip
		16	9	Directionality A
		17	10	Directionality B
		18	11	Directionality C
		28	12	Directionality
656	67/51-4	0	1	Phase A Pickup
		1	2	Phase B Pickup
		2	3	Phase C Pickup
		3	4	Phase Pickup
		8	5	Phase A Trip
		9	6	Phase B Trip
		10	7	Phase C Trip

Address	Description	Bit	Event NO	Status
		11	8	Phase Trip
		16	9	Directionality A
		17	10	Directionality B
		18	11	Directionality C
		28	12	Directionality
658	50G	4	1	Ground Pickup
		12	2	Ground Trip
660	50N	4	1	Neutral Pickup
		12	2	Neutral Trip
662	67G/51G-1	4	1	Ground Pickup
		12	2	Ground Trip
		19	3	Directionality
664	67G/51G-2	4	1	Ground Pickup
		12	2	Ground Trip
		19	3	Directionality
666	67N/51N-1	4	1	Neutral Pickup
		12	2	Neutral Trip
		19	3	Directionality
668	67N/51N-2	4	1	Neutral Pickup
		12	2	Neutral Trip
		19	3	Directionality
670	67GI	4	1	Ground Pickup
		12	2	Ground Trip
		19	3	Directionality
672	67NI	4	1	Neutral Pickup
		12	2	Neutral Trip
		19	3	Directionality
674	64REF	3	1	Pickup
		11	2	Trip
		19	3	IN SHB Block
676	50BF	3	1	Pickup
		11	2	Alarm
678	46	3	1	Pickup
		11	2	Trip
680	46BC	3	1	Pickup
		11	2	Trip
682	37	0	1	Phase A Pickup
		1	2	Phase B Pickup
		2	3	Phase C Pickup
		3	4	Phase Pickup
		8	5	Phase A Trip
		9	6	Phase B Trip

Address	Description	Bit	Event NO	Status
		10	7	Phase C Trip
		11	8	Phase Trip
684	SHB	8	1	Phase A Block
		9	2	Phase B Block
		10	3	Phase C Block
		11	4	Phase Block
686	27-1	0	1	Phase A Pickup
		1	2	Phase B Pickup
		2	3	Phase C Pickup
		3	4	Phase Pickup
		8	8	Phase A Trip
		9	9	Phase B Trip
		10	10	Phase C Trip
		11	11	Phase Trip
688	27-2	0	1	Phase A Pickup
		1	2	Phase B Pickup
		2	3	Phase C Pickup
		3	4	Phase Pickup
		8	8	Phase A Trip
		9	9	Phase B Trip
		10	10	Phase C Trip
		11	11	Phase Trip
690	27V1	3	1	Pickup
		11	2	Trip
692	59-1	0	1	Phase A Pickup
		1	2	Phase B Pickup
		2	3	Phase C Pickup
		3	4	Phase Pickup
		8	8	Phase A Trip
		9	9	Phase B Trip
		10	10	Phase C Trip
		11	11	Phase Trip
694	59-2	0	1	Phase A Pickup
		1	2	Phase B Pickup
		2	3	Phase C Pickup
		3	4	Phase Pickup
		8	8	Phase A Trip
		9	9	Phase B Trip
		10	10	Phase C Trip
		11	11	Phase Trip
696	59N-1	4	1	Neutral Pickup
		12	2	Neutral Trip

Address	Description	Bit	Event NO	Status
698	59N-2	4	1	Neutral Pickup
		12	2	Neutral Trip
700	47	3	1	Pickup
		11	2	Trip
702	32-1	0	1	Phase A Pickup
		1	2	Phase B Pickup
		2	3	Phase C Pickup
		3	4	Phase Pickup
		8	5	Phase A Trip
		9	6	Phase B Trip
		10	7	Phase C Trip
		11	8	Phase Trip
704	32-2	0	1	Phase A Pickup
		1	2	Phase B Pickup
		2	3	Phase C Pickup
		3	4	Phase Pickup
		8	5	Phase A Trip
		9	6	Phase B Trip
		10	7	Phase C Trip
		11	8	Phase Trip
706	32-3	0	1	Phase A Pickup
		1	2	Phase B Pickup
		2	3	Phase C Pickup
		3	4	Phase Pickup
		8	5	Phase A Trip
		9	6	Phase B Trip
		10	7	Phase C Trip
		11	8	Phase Trip
708	32-4	0	1	Phase A Pickup
		1	2	Phase B Pickup
		2	3	Phase C Pickup
		3	4	Phase Pickup
		8	5	Phase A Trip
		9	6	Phase B Trip
		10	7	Phase C Trip
		11	8	Phase Trip
710	81-1	3	1	Pickup
		11	2	Trip
712	81-2	3	1	Pickup
		11	2	Trip
714	81-3	3	1	Pickup
		11	2	Trip

Address	Description	Bit	Event NO	Status
716	81-4	3	1	Pickup
		11	2	Trip
718	81R-1	3	1	Pickup
		11	2	Trip
720	81R-2	3	1	Pickup
		11	2	Trip
722	81R-3	3	1	Pickup
		11	2	Trip
724	81R-4	3	1	Pickup
		11	2	Trip
726	78	11	1	Trip
728	52	0	1	Startup
		1	2	Error
		2	3	Open
		3	4	Opening Time
		4	5	Opening Error
		5	6	Closed
		6	7	Closing Time
		7	8	Closing Error
		8	9	Openings Alarm
		9	10	I2t Alarm
		10	11	Openings/T Alarm
		11	-	52B contact
		12	-	52A contact
730	79	0	1	Standby
		1	2	Reclose Time
		2	3	Is 52 Open?
		3	4	Hold Time
		4	5	Closing Time
		5	6	Reset Time
		6	7	Lockout
		7	8	Safe Time
		8	9	79 Blocked
		9	10	Reclose N1
		10	11	Reclose N2
		11	12	Reclose N3
		12	13	Reclose N4
		13	14	79 In Progress
732	SCM	0	1	Standby
		1	2	Wait to Open
		2	3	Lockout
		3	4	Wait to 79

Address	Description	Bit	Event NO	Status
		4	5	Reset Time
734	SZM	0	1	Standby
		1	2	Wait to Open
		2	3	Wait to Close
		3	4	Reset Time
		4	5	Open
		5	6	Lockout
736	74TCS	3	1	Pickup
		11	2	Alarm
738	CSS	3	1	Pickup
		11	2	Alarm
740	VSS	3	1	Phase Pickup
		8	2	Phase A Alarm
		9	3	Phase B Alarm
		10	4	Phase C Alarm
		11	5	Alarm
742	CLP	0	2	CLP Disable
		1	3	CB Closed
		2	4	CB Open
		3	5	CB Def.Open
		4	6	Close CLP
		5	7	Open CLP
		11	1	CLP
744	WEB SERVER	1	2	Open Breaker
		2	3	Close Breaker
		3	4	79 Block
		4	5	79 Unblock
		5	6	Local Control
		6	7	Remote Control
		7	8	Reset
		11	16	HLT On
		12	17	HLT Off
		13	18	User Command 1
		14	19	User Command 2
		15	20	User Command 3
		16	21	User Command 4
		17	22	User Command 5
		18	23	User Command 6
		28	12	Activity
746	IEC61850	1	2	Open Breaker
		2	3	Close Breaker
		3	4	79 Block

Address	Description	Bit	Event NO	Status
		4	5	79 Unblock
		5	6	Local Control
		6	7	Remote Control
		7	8	Reset
		11	16	HLT On
		12	17	HLT Off
		13	18	User Command 1
		14	19	User Command 2
		15	20	User Command 3
		16	21	User Command 4
		17	22	User Command 5
		18	23	User Command 6
		28	12	Activity
748	GOOSE IN	0	1	GOOSE I. 1
		1	2	GOOSE I. 2
		2	3	GOOSE I. 3
		3	4	GOOSE I. 4
		4	5	GOOSE I. 5
		5	6	GOOSE I. 6
		6	7	GOOSE I. 7
		7	8	GOOSE I. 8
		8	9	GOOSE I. 9
		9	10	GOOSE I. 10
		10	11	GOOSE I. 11
		11	12	GOOSE I. 12
		12	13	GOOSE I. 13
		13	14	GOOSE I. 14
		14	15	GOOSE I. 15
		15	16	GOOSE I. 16
		16	17	GOOSE I. 17
		17	18	GOOSE I. 18
		18	19	GOOSE I. 19
		19	20	GOOSE I. 20
		20	21	GOOSE I. 21
		21	22	GOOSE I. 22
		22	23	GOOSE I. 23
		23	24	GOOSE I. 24
		24	25	GOOSE I. 25
		25	26	GOOSE I. 26
		26	27	GOOSE I. 27
		27	28	GOOSE I. 28
		28	29	GOOSE I. 29

Address	Description	Bit	Event NO	Status
		29	30	GOOSE I. 30
		30	31	GOOSE I. 31
		31	32	GOOSE I. 32
750	25	0	1	Synchrocheck
		1	2	Dead L & Dead B
		2	3	Dead L & Live B
		3	4	Live L & Dead B
		4	5	Live L & Live B
		5	6	Voltage Diff.
		6	7	Frequency Diff
		7	8	Phase Diff.
752	27-L	3	1	Phase Pickup
		11	2	Phase Trip
754	59-L	3	1	Phase Pickup
		11	2	Phase Trip
756	AFD	0	1	AFD Output 1
		1	2	AFD Output 2
		2	3	AFD Output 3
		3	4	AFD Output 4
		8	5	AFD Input 1
		9	6	AFD Input 2
		10	7	AFD Input 3
		11	8	AFD Input 4
		16	9	AFD TestOK 1
		17	10	AFD TestOK 2
		18	11	AFD TestOK 3
		19	12	AFD TestOK 4
		20	13	AFD Phase OC
		21	14	AFD Neutral OC
		22	15	AFD Overcurrent

1.5.2. States Map, FC03, 1 registry

The function code to **State reading is 0x03 (Read Holding Registers)** admits request of **1 registry** also.

Number of registries: 1

Type: Bit string 16 bits, Most significant bit first (MSB-LSB)

2 examples are shown on how to ask the state map in 1 registry:

“General” in 2 registries:

Address	Description	Bit	Event NO	Status
610	GENERAL	0	1	Trip
		1	2	Ready
		2	3	Wrong Password
		3	4	Date/Time Set
		4	5	Local
		5	6	Error: SER
		6	7	SER Deleted
		7	8	Wrong Access
		8	9	Settings Change
		10	11	SER Overflow
		11	12	Config Change
		13	14	LDP Deleted
		14	15	New DFR
		15	16	Phase Trip
		16	17	Trip Block
		17	18	Pickup
		18	19	Phase A Pickup
		19	20	Phase B Pickup
		20	21	Phase C Pickup
		21	22	Neutral Pickup
		22	23	Phase A Trip
		23	24	Phase B Trip
		24	25	Phase C Trip
		25	26	Neutral Trip
		26	27	SettingsG. 1
		27	28	SettingsG. 2
		28	29	SettingsG. 3
		29	30	SettingsG. 4
		30	-	Set to FALSE
		31	-	Set to TRUE

“General” in 1 register:

Address	Description	Bit	Status	SIL-S
611	General	00	Trip	✓
		01	Ready	
		02	Wrong Password	
		03	Set date/time	
		04	Local Control	
		05	SER error	
		06	SER deleted	
		07	Wrong Access	
		08	Settings Change	
		10	SER Overflow	
		11	Configuration Changed	
		13	LDP Deleted	
		14	New DFR	
		15	Phase Trip	
		610	00	
01			General Pickup	
02			Phase A Pickup	
03			Phase B Pickup	
04			Phase C Pickup	
05			Neutral Pickup	
06			Phase A Trip	
07			Phase B Trip	
08			Phase C Trip	
09			Neutral Trip	
10			Settings Group 1	
11			Settings Group 2	
12			Settings Group 3	
13			Settings Group 4	
14			Set to FALSE	
15		Set to TRUE		

“Measurements” in 2 registries:

Address	Description	Bit	Event NO	Status
602	MEASUREMENTS	0	1	Error:Measur.
		1	2	Net Freq.50Hz
		2	3	Blocked FreqLine
		3	4	Blocked Freq Bar
		4	5	Simulation

“Measurements” in 1 register:

Address	Description	Bit	Status	SIL-S
603	Measurements	00	Measurement Error	✓
		01	Net Frequency 50 Hz	
		02	Line Frequency blocked	
		03	Bar Frequency Blocked	

1.5.3. States identifiers

CRITERIA	IDENTIFIER
25	6401
27-L	6914
27-1	6945
27-2	6977
32-1	8225
32-2	8257
32-3	8289
32-4	8321
37	9473
46	11777
46BC	11778
47	12033
50-1	12833
50-2	12865
52	13313
59-L	15106
59-1	15137
59-2	15169
VSS	15361
67/51-1	17185
67/51-2	17217
67/51-3	17249
67/51-4	17281
74TCS	18945
78	19969
79	20225
SCM	20481
81-1	20769
81-2	20801
81-3	20833
81-4	20865
SZM	20993
27V1	32513
SOTF	37889
50G	38401
50N	38402
50BF	38913
59N-1	40737
59N-2	40769
64REF	41985

CRITERIA	IDENTIFIER
67GI	42755
67NI	42756
67G/51G-1	42785
67N/51N-1	42786
67G/51G-2	42817
67N/51N-2	42818
CSS	44545
81R-1	46369
81R-2	46401
81R-3	46433
81R-4	46465
GOOSE IN	47361
AFD	50948
GENERAL	51201
SELF DIAGNOSIS	51457
SHB	51714
CLP	51969
HMI	52481
DATE	52737
ALARM LEDS	53505
LDP	61185
IEC60870-5-103	61442
IEC60870-5-104	61444
DNP3 Serial	61698
DNP3 TCP	61700
IEC61850	61956
Rear TCP COM	63233
Rear Serial COM	63489
USB COM	63745
MODBUS RTU	63746
MODBUS TCP	63748
WEB SERVER	63750
WIFI COM	63751
PGC	64001
CONTROL LEDS	64257
DFR	64513
INPUTS	64769
OUTPUTS	65025
MEASUREMENTS	65281

1.5.4. Measurements Map

The function code implemented to **State reading is 0x03 (Read Holding Registers)**.

Number of registries: 2.

Format: Float

The states and events in the table may vary depending on the relay model

Address	Description
800	Phase A current I _A
802	Phase B current I _B
804	Phase C current I _C
806	Neutral current I _N
808	Phase-Neutral V-A
810	Phase-Neutral V-B
812	Phase-Neutral V-C
814	Line Voltage V-L
816	Phase-Phase Voltage U-AB
818	Phase-Phase Voltage U-BC
820	Phase-Phase Voltage U-CA
822	Current 3I ₀
824	Positive Sequence current I-1
826	Negative Sequence current I-2
828	I ₂ /I ₁
830	Maximum current I-Max
832	Phase A second harmonic current I-A2H
834	Phase B second harmonic current I-B2H
836	Phase C second harmonic current I-C2H
838	Neutral second harmonic current I-N2H
840	3V-0
842	V-1
844	V-2
846	V-MaX
848	Active Power P-3P
850	Reactive Power Q-3P
852	Apparent Power S-3P
854	Active Power P-A
856	Reactive Power Q-A
858	Apparent Power S-A
860	Active Power P-B
862	Reactive Power Q-B
864	Apparent Power S-B

Address	Description
866	Active Power P-C
868	Reactive Power Q-C
870	Apparent Power S-C
872	Bar Frequency f-Bar
874	Line Frequency f-Line
876	Df/dt
878	Ang I-A
880	Ang I-B
882	Ang I-C
884	Ang I-N
886	Ang 3I ₀
888	Ang V-A
890	Ang V-B
892	Ang V-C
894	Ang V-L
896	Ang 3V ₀
898	Ang UAB
900	Ang UBC
902	Ang UCA
904	cosPhiA
906	cosPhiB
908	cosPhiC
910	cosPhi
912	THD I-A
914	THD I-B
916	THD I-C
918	THD V-A
920	THD V-B
922	THD V-C
924	Temp A
926	Temp B
928	Temp C
930	Temp LB

1.5.5. Fault reports Map

The function code implemented to **State reading is 0x03 (Read Holding Registers)**.

Address	Fault report information	Format	Number of registries	SIL-S
8334	Trip reason (with date and time)	ASCII	16	✓
8350	Phase A current IA	FLOAT INVERSE	2	✓
8352	Phase B current IB		2	✓
8354	Phase C current IC		2	✓
8356	Neutral current IN		2	✓
8358	Phase-Neutral V-A		2	✓
8360	Phase-Neutral V-B		2	✓
8362	Phase-Neutral V-C		2	✓
8364	Line Voltage V-L		2	✓
8366	Phase-Phase Voltage U-AB		2	✓
8368	Phase-Phase Voltage U-BC		2	✓
8370	Phase-Phase Voltage U-CA		2	✓
8372	Current 3I ₀		2	✓
8374	Positive Sequence current I-1		2	✓
8376	Negative Sequence current I-2		2	✓
8378	I2/I1		2	✓
8380	Maximum current I-Max		2	✓

1.5.6. Settings Map

The function code implemented to **State writing is 0x16 (Write Holding Registers)**.

Number of registries: 2.

Settings	Address	Description	Format	Enumeration
25	1648	Dead Tap	TAP	-
	1650	Live Tap	TAP	-
	1652	V. Supervis. Time	FLOAT	-
	1654	Voltage Diff.	TAP	-
	1656	Phase Diff.	NUM	-
	1658	Frequency Diff	FLOAT	-
	1660	Synchrocheck Time	FLOAT	-
27-L	1726	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1728	Voltage Tap	TAP	-
	1730	Minimum Level	TAP	-
	1732	Time Delay	FLOAT	-
	1734	Reset Time	FLOAT	-
27-1	1482	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1484	Voltage Tap	TAP	-
	1486	Minimum Level	TAP	-
	1488	Time Delay	FLOAT	-
	1490	Reset Time	FLOAT	-
27-2	1492	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1494	Voltage Tap	TAP	-
	1496	Minimum Level	TAP	-
	1498	Time Delay	FLOAT	-
	1500	Reset Time	FLOAT	-
32-1	1534	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1536	Activation Level	TAP	-
	1538	Operating Angle	NUM	-
	1540	Time Delay	FLOAT	-
32-2	1542	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1544	Activation Level	TAP	-

Settings	Address	Description	Format	Enumeration
	1546	Operating Angle	NUM	-
	1548	Time Delay	FLOAT	-
32-3	1550	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1552	Activation Level	TAP	-
	1554	Operating Angle	NUM	-
	1556	Time Delay	FLOAT	-
32-4	1558	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1560	Activation Level	TAP	-
	1562	Operating Angle	NUM	-
	1564	Time Delay	FLOAT	-
37	1466	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1468	Current Tap	TAP	-
	1470	Minimum Level	TAP	-
	1472	Time Delay	FLOAT	-
46	1456	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip 03 → SHB Trip
	1458	Curve type	ENUM16	0 → Defined Time 01 → IEC Long Time Inverse 02 → IEC Inverse 03 → IEC Very Inverse 04 → IEC Extremely Inverse 05 → IEC Short Time Inverse Inverse 06 → IEEE Inverse 07 → IEEE Very Inverse 08 → IEEE Extremely
	1460	Time Dial (TMS)	FLOAT	-
	1462	Current Tap	TAP	-
	1464	Time Delay	FLOAT	-
46BC	1744	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1746	Current Tap	NUM	-
	1748	Time Delay	FLOAT	-
47	1708	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip

Settings	Address	Description	Format	Enumeration
	1710	Voltage Tap	TAP	-
	1712	Time Delay	FLOAT	-
	1714	Reset Time	FLOAT	-
50-1	1284	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip 03 → SHB Trip
	1286	Current Tap	TAP	-
	1288	Time Delay	FLOAT	-
50-2	1290	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip 03 → SHB Trip
	1292	Current Tap	TAP	-
	1294	Time Delay	FLOAT	-
52	1264	Max NO. Openings	NUM	-
	1266	Max Accumulated A.	NUM	-
	1268	Rep. Openings	NUM	-
	1270	Rep. Openings/Time	NUM	-
	1272	Max Open Time	FLOAT	-
	1274	Max Close Time	FLOAT	-
59-L	1736	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1738	Voltage Tap	TAP	-
	1740	Time Delay	FLOAT	-
	1742	Reset Time	FLOAT	-
59-1	1502	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1504	Voltage Tap	TAP	-
	1506	Time Delay	FLOAT	-
	1508	Reset Time	FLOAT	-
59-2	1510	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1512	Voltage Tap	TAP	-
	1514	Time Delay	FLOAT	-
	1516	Reset Time	FLOAT	-
VSS	1632	Function Enable	ENUM4	00 → No 01 → Yes
	1634	Time Delay	FLOAT	-
	1636	V1 Tap	TAP	-

Settings	Address	Description	Format	Enumeration
	1638	V2 Tap	TAP	-
	1640	VP Tap	TAP	-
	1642	I1 Tap	TAP	-
	1644	I2 Tap	TAP	-
	1646	3I0 Tap	TAP	-
67/51-1	1296	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip 03 → SHB Trip
	1298	Curve type	ENUM16	0 → Defined Time 01 → IEC Long Time Inverse 02 → IEC Inverse 03 → IEC Very Inverse 04 → IEC Extremely Inverse 05 → IEC Short Time Inverse Inverse 06 → IEEE Inverse 07 → IEEE Very Inverse 08 → IEEE Extremely
	1300	Time Dial (TMS)	FLOAT	-
	1302	Current Tap	TAP	-
	1304	Time Delay	FLOAT	-
	1306	Directionality	ENUM4	00 → No 01 → Forward 02 → Reverse
	1308	Polarization V	TAP	-
	1310	Operating Angle	NUM	-
	1312	Halfcone Angle	NUM	-
67/51-2	1314	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip 03 → SHB Trip
	1316	Curve type	ENUM16	0 → Defined Time 01 → IEC Long Time Inverse 02 → IEC Inverse 03 → IEC Very Inverse 04 → IEC Extremely Inverse 05 → IEC Short Time Inverse Inverse 06 → IEEE Inverse 07 → IEEE Very Inverse 08 → IEEE Extremely
	1318	Time Dial (TMS)	FLOAT	-
	1320	Current Tap	TAP	-
	1322	Time Delay	FLOAT	-

Settings	Address	Description	Format	Enumeration
	1324	Directionality	ENUM4	00 → No 01 → Forward 02 → Reverse
	1326	Polarization V	TAP	-
	1328	Operating Angle	NUM	-
	1330	Halfcone Angle	NUM	-
67/51-3	1332	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip 03 → SHB Trip
	1334	Curve type	ENUM16	0 → Defined Time 01 → IEC Long Time Inverse 02 → IEC Inverse 03 → IEC Very Inverse 04 → IEC Extremely Inverse 05 → IEC Short Time Inverse Inverse 06 → IEEE Inverse 07 → IEEE Very Inverse 08 → IEEE Extremely
	1336	Time Dial (TMS)	FLOAT	-
	1338	Current Tap	TAP	-
	1340	Time Delay	FLOAT	-
	1342	Directionality	ENUM4	00 → No 01 → Forward 02 → Reverse
	1344	Polarization V	TAP	-
	1346	Operating Angle	NUM	-
	1348	Halfcone Angle	NUM	-
67/51-4	1350	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip 03 → SHB Trip
	1352	Curve type	ENUM16	0 → Defined Time 01 → IEC Long Time Inverse 02 → IEC Inverse 03 → IEC Very Inverse 04 → IEC Extremely Inverse 05 → IEC Short Time Inverse Inverse 06 → IEEE Inverse 07 → IEEE Very Inverse 08 → IEEE Extremely
	1354	Time Dial (TMS)	FLOAT	-
	1356	Current Tap	TAP	-
	1358	Time Delay	FLOAT	-

Settings	Address	Description	Format	Enumeration
	1360	Directionality	ENUM4	00 → No 01 → Forward 02 → Reverse
	1362	Polarization V	TAP	-
	1364	Operating Angle	NUM	-
	1366	Halfcone Angle	NUM	-
74TCS	1624	Function Enable	ENUM4	00 → No 01 → Yes
	1626	Time Delay	FLOAT	-
78	1702	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1704	Activation Level	NUM	-
	1706	Reset Time	FLOAT	-
79	1606	Recloses Number	ENUM8	00 → 0 01 → 1 02 → 2 03 → 3 04 → 4
	1608	Reset Time	FLOAT	-
	1610	Reclose 1 Time	FLOAT	-
	1612	Reclose 2 Time	FLOAT	-
	1614	Reclose 3 Time	FLOAT	-
	1616	Reclose 4 Time	FLOAT	-
	1618	Hold Enable	ENUM4	00 → No 01 → Yes 02 → No time
	1620	Hold Time	FLOAT	-
	1622	Safe Time	FLOAT	-
SCM	1808	Recloses Number	ENUM8	00 → 0 01 → 1 02 → 2 03 → 3 04 → 4
	1810	Reset Time	FLOAT	-
81-1	1566	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1568	Type	ENUM4	00 → Over 01 → Under
	1570	Activation Level	FLOAT	-
	1572	Time Delay	FLOAT	-
	1574	Reset Time	FLOAT	-

Settings	Address	Description	Format	Enumeration
81-2	1576	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1578	Type	ENUM4	00 → Over 01 → Under
	1580	Activation Level	FLOAT	-
	1582	Time Delay	FLOAT	-
	1584	Reset Time	FLOAT	-
81-3	1586	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1588	Type	ENUM4	00 → Over 01 → Under
	1590	Activation Level	FLOAT	-
	1592	Time Delay	FLOAT	-
	1594	Reset Time	FLOAT	-
81-4	1596	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1598	Type	ENUM4	00 → Over 01 → Under
	1600	Activation Level	FLOAT	-
	1602	Time Delay	FLOAT	-
	1604	Reset Time	FLOAT	-
SZM	1812	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1814	Recloses Number	ENUM8	00 → 0 01 → 1 02 → 2 03 → 3 04 → 4
	1816	Reset Time	FLOAT	-
	1818	Max. Open Time	FLOAT	-
	1820	Max. Close Time	FLOAT	-
	1822	Current Tap	TAP	-
	1824	Neutral Tap	TAP	-
	1826	V. Supervis. Time	FLOAT	-
	1828	Dead Tap	TAP	-
27V1	1716	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1718	Voltage Tap	TAP	-
	1720	Minimum Level	TAP	-

Settings	Address	Description	Format	Enumeration
	1722	Time Delay	FLOAT	-
	1724	Reset Time	FLOAT	-
SOTF	1756	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip 03 → SHB Trip
	1758	Current Tap	TAP	-
	1760	Time Delay	FLOAT	-
	1762	Safe Time	FLOAT	-
50G	1368	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip 03 → SHB Trip
	1370	Current Tap	TAP	-
	1372	Time Delay	FLOAT	-
50N	1374	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip 03 → SHB Trip
	1376	Current Tap	TAP	-
	1378	Time Delay	FLOAT	-
50BF	1452	Function Enable	ENUM4	00 → No 01 → Yes
	1454	Time Delay	FLOAT	-
59N-1	1518	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1520	Voltage Tap	TAP	-
	1522	Time Delay	FLOAT	-
	1524	Reset Time	FLOAT	-
59N-2	1526	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1528	Voltage Tap	TAP	-
	1530	Time Delay	FLOAT	-
	1532	Reset Time	FLOAT	-
64REF	1764	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip 03 → SHB Trip
	1766	Current Tap	TAP	-
	1768	Time Delay	FLOAT	-
	1770	IN SHB Tap	NUM	-

Settings	Address	Description	Format	Enumeration
67GI	1772	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip 03 → SHB Trip
	1774	Directionality	ENUM4	00 → No 01 → Forward 02 → Reverse
	1776	Low Current Tap	TAP	-
	1778	Low Voltage Tap	TAP	-
	1780	High Current Tap	TAP	-
	1782	High Voltage Tap	TAP	-
	1784	Time Delay	FLOAT	-
	1786	Operating Angle	NUM	-
	1788	Halfcone Angle	NUM	-
67NI	1790	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip 03 → SHB Trip
	1792	Directionality	ENUM4	00 → No 01 → Forward 02 → Reverse
	1794	Low Current Tap	TAP	-
	1796	Low Voltage Tap	TAP	-
	1798	High Current Tap	TAP	-
	1800	High Voltage Tap	TAP	-
	1802	Time Delay	FLOAT	-
	1804	Operating Angle	NUM	-
	1806	Halfcone Angle	NUM	-
67G/51G-1	1380	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip 03 → SHB Trip
	1382	Curve type	ENUM16	0 → Defined Time 01 → IEC Long Time Inverse 02 → IEC Inverse 03 → IEC Very Inverse 04 → IEC Extremely Inverse 05 → IEC Short Time Inverse Inverse 06 → IEEE Inverse 07 → IEEE Very Inverse 08 → IEEE Extremely
	1384	Time Dial (TMS)	FLOAT	-
	1386	Current Tap	TAP	-
	1388	Time Delay	FLOAT	-

Settings	Address	Description	Format	Enumeration
	1390	Directionality	ENUM4	00 → No 01 → Forward 02 → Reverse
	1392	Polarization V	TAP	-
	1394	Operating Angle	NUM	-
	1396	Halfcone Angle	NUM	-
67N/51N-1	1416	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip 03 → SHB Trip
	1418	Curve type	ENUM16	0 → Defined Time 01 → IEC Long Time Inverse 02 → IEC Inverse 03 → IEC Very Inverse 04 → IEC Extremely Inverse 05 → IEC Short Time Inverse Inverse 06 → IEEE Inverse 07 → IEEE Very Inverse 08 → IEEE Extremely
	1420	Time Dial (TMS)	FLOAT	-
	1422	Current Tap	TAP	-
	1424	Time Delay	FLOAT	-
	1426	Directionality	ENUM4	00 → No 01 → Forward 02 → Reverse
	1428	Polarization V	TAP	-
	1430	Operating Angle	NUM	-
	1432	Halfcone Angle	NUM	-
67G/51G-2	1398	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip 03 → SHB Trip
	1400	Curve type	ENUM16	0 → Defined Time 01 → IEC Long Time Inverse 02 → IEC Inverse 03 → IEC Very Inverse 04 → IEC Extremely Inverse 05 → IEC Short Time Inverse Inverse 06 → IEEE Inverse 07 → IEEE Very Inverse 08 → IEEE Extremely
	1402	Time Dial (TMS)	FLOAT	-
	1404	Current Tap	TAP	-
	1406	Time Delay	FLOAT	-

Settings	Address	Description	Format	Enumeration
	1408	Directionality	ENUM4	00 → No 01 → Forward 02 → Reverse
	1410	Polarization V	TAP	-
	1412	Operating Angle	NUM	-
	1414	Halfcone Angle	NUM	-
67N/51N-2	1434	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip 03 → SHB Trip
	1436	Curve type	ENUM16	0 → Defined Time 01 → IEC Long Time Inverse 02 → IEC Inverse 03 → IEC Very Inverse 04 → IEC Extremely Inverse 05 → IEC Short Time Inverse Inverse 06 → IEEE Inverse 07 → IEEE Very Inverse 08 → IEEE Extremely
	1438	Time Dial (TMS)	FLOAT	-
	1440	Current Tap	TAP	-
	1442	Time Delay	FLOAT	-
	1444	Directionality	ENUM4	00 → No 01 → Forward 02 → Reverse
	1446	Polarization V	TAP	-
	1448	Operating Angle	NUM	-
	1450	Halfcone Angle	NUM	-
CSS	1628	Function Enable	ENUM4	00 → No 01 → Yes
	1630	Time Delay	FLOAT	-
81R-1	1662	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1664	Type	ENUM4	00 → Increase 01 → Decrease
	1666	Activation Level	FLOAT	-
	1668	Time Delay	FLOAT	-
	1670	Reset Time	FLOAT	-
81R-2	1672	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1674	Type	ENUM4	00 → Increase 01 → Decrease

Settings	Address	Description	Format	Enumeration
	1676	Activation Level	FLOAT	-
	1678	Time Delay	FLOAT	-
	1680	Reset Time	FLOAT	-
81R-3	1682	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1684	Type	ENUM4	00 → Increase 01 → Decrease
	1686	Activation Level	FLOAT	-
	1688	Time Delay	FLOAT	-
	1690	Reset Time	FLOAT	-
81R-4	1692	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1694	Type	ENUM4	00 → Increase 01 → Decrease
	1696	Activation Level	FLOAT	-
	1698	Time Delay	FLOAT	-
	1700	Reset Time	FLOAT	-
AFD	1750	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip
	1752	Current Tap	NUM	-
	1754	Time Delay	NUM	-
GENERAL	1000	Identification	TEXT16	-
	1010	Language	ENUM4	00 → English 01 → Spanish 02 → German 03 → French 04 → Turkish 05 → Russian 06 → Portuguese
	1012	Settings Group	NUM	-
	1014	Ph. Reset Time	FLOAT	-
	1016	N. Reset Time	FLOAT	-
SHB	1474	Function Enable	ENUM4	00 → No 01 → Yes
	1476	Current Tap	NUM	-
	1478	Reset Time	FLOAT	-
	1480	Block Threshold	TAP	-
CLP	1256	Function Enable	ENUM4	00 → No 01 → Yes
	1258	Settings Group	NUM	-
	1260	No Load Time	FLOAT	-

Settings	Address	Description	Format	Enumeration
	1262	Cold Load Time	FLOAT	-
DATE	1242	Sync. Time	NUM	-
	1244	GMT	SNUM	-
LDP	1252	Current Level	TAP	-
	1254	Interval Time	NUM	-
IEC60870-5-103	1194	Slave Address	NUM	-
IEC60870-5-104	1202	OutStation Addr.	NUM	-
	1204	TCP Port	NUM	-
	1206	T0 timeout	FLOAT	-
	1208	T1 timeout	FLOAT	-
	1210	T2 timeout	FLOAT	-
	1212	T3 timeout	FLOAT	-
	1214	k parameter	NUM	-
	1216	w parameter	NUM	-
	1218	CYC Period	FLOAT	-
	1220	Back Period	FLOAT	-
	1222	Spontaneous Ena.	ENUM4	00 → No 01 → Yes
	1224	BufferingTime	FLOAT	-
	1226	Max Commnd Delay	FLOAT	-
	1228	Select Timeout	FLOAT	-
	1230	IP Address 1	IP	-
	1232	IP Address 2	IP	-
	1234	Clk Sync Enabled	ENUM4	00 → No 01 → Yes
DNP3 Serial	1146	Slave Address	NUM	-
	1148	DNP3 Master Addss	NUM	-
	1156	MultiMaster	ENUM4	00 → No 01 → Yes
	1160	Unsolic. Retries	NUM	-
	1162	Unsolic. TimeOut	FLOAT	-
DNP3 TCP	1170	Slave Address	NUM	-
	1172	DNP3 Master Addss	NUM	-
	1174	TCP Port	NUM	-
	1180	MultiMaster	ENUM4	00 → No 01 → Yes
	1184	Unsolic. Retries	NUM	-
	1186	Unsolic. TimeOut	FLOAT	-
Rear TCP COM	1110	Protocol	ENUM4	00 → Modbus TCP 01 → DNP3 TCP 02 → IEC60870-104 03 → IEC61850
	1112	IP Address	IP	-

Settings	Address	Description	Format	Enumeration
	1114	Subnet	IP	-
	1116	Gateway	IP	-
	1118	DNS-1	IP	-
	1120	DNS-2	IP	-
Rear Serial COM	1104	Protocol	ENUM4	00 → Modbus RTU 01 → DNP3 Serial 02 → IEC60870-5-103
	1106	BaudRate	ENUM8	00 → 4800 01 → 9600 02 → 19200 03 → 38400 04 → 57600 05 → 115200
	1108	Serial Setting	ENUM4	00 → 8-N-1 01 → 8-E-1 02 → 8-O-1 03 → 9-N-1 04 → 8-N-2 05 → 8-E-2 06 → 8-O-2 07 → 9-N-1
USB COM	1090	Slave Address	NUM	-
MODBUS RTU	1128	Slave Address	NUM	-
MODBUS TCP	1136	Slave Address	NUM	-
	1138	TCP Port	NUM	-
WIFI COM	1092	WIFI Enable	ENUM4	00 → No 01 → Yes
	1094	SSID Hidden	ENUM4	00 → No 01 → Yes
	1096	TCP Port	NUM	-
	1098	IP Address	IP	-
	1100	Channel NO.	NUM	-
	1102	Slave Address	NUM	-
DFR	1248	Num. Of Records	ENUM4	00 → 5 x 300 cycles 01 → 25 x 60 cycles 02 → 50 x 30 cycles 03 → 100 x 15 cycles
	1250	Cycles Prefault	NUM	-
INPUTS	1246	Debounce Time	NUM	-
MEASUREMENTS	1018	Frequency	ENUM4	00 → 60 Hz 01 → 50 Hz
	1020	P. Nominal Current	FLOAT	-
	1022	N. Nominal Current	FLOAT	-
	1024	P.Sensor Iprimary	FLOAT	-

Settings	Address	Description	Format	Enumeration
	1026	N.Sensor Iprimary	FLOAT	-
	1028	P. Current Range	ENUM4	00 → 16 x Ratio 01 → 64 x Ratio 02 → 256 x Ratio
	1030	Sensor Type	ENUM4	00 → Rogowski 01 → LPCT
	1032	Nominal V. P-P	NUM	-
	1034	BusBar Volt. Ratio	FLOAT	-
	1036	Line Volt. Ratio	FLOAT	-
	1038	I-A RCF	FLOAT	-
	1040	I-B RCF	FLOAT	-
	1042	I-C RCF	FLOAT	-
	1044	I-N RCF	FLOAT	-
	1046	Freq RCF Phase	FLOAT	-
	1048	Freq RCF Neutral	FLOAT	-
	1050	V-A RCF	FLOAT	-
	1052	V-B RCF	FLOAT	-
	1054	V-C RCF	FLOAT	-
	1056	VL-B RCF	FLOAT	-
	1058	IA A. Correction	FLOAT	-
	1060	IB A. Correction	FLOAT	-
	1062	IC A. Correction	FLOAT	-
	1064	IN A. Correction	FLOAT	-
	1066	F.A.Corr.Phase	FLOAT	-
	1068	F.A.Corr.Neutral	FLOAT	-
	1070	VA A. Correction	FLOAT	-
	1072	VB A. Correction	FLOAT	-
	1074	VC A. Correction	FLOAT	-
	1076	VLB A. Correction	FLOAT	-
	1078	Temp. CF Enable	ENUM4	00 → No 01 → Yes
	1080	Temp. CF M	NUM	-
	1082	Temp. CF B	NUM	-

1.5.6.1. Change the “General - Settings Group” setting with 1 register

There are two options:

Option 1: Send the number of the desired table to an address

Function	Description	Start address	Number of registries	Format	Info
16	Change “Settings Group” setting	1012	1	UINT	1 → Settings Group 1 2 → Settings Group 2 3 → Settings Group 3 4 → Settings Group 4

Option 2: Each table has its address

Function	Description	Start address	Number of registries	Format	Value
16	Settings Group 1	212	1	UINT	1
16	Settings Group 2	214	1	UINT	1
16	Settings Group 3	216	1	UINT	1
16	Settings Group 4	218	1	UINT	1

1.6. Counters

The function code implemented to **State reading** is **0x03 (Read Holding Registers)**.

The function code implemented to **State writing** is **0x16 (Write Holding Registers)**.

Number of registries: 2.

Function	Description	Units	Start address	Number of registries	Format
03 & 16	Openings Number	-	500	2	FLOAT INVERSE
03 & 16	Recloses Number	-	502	2	
03 & 16	Accumulated Amps	k(A2)	504	2	
03 & 16	AE+	Wh	508	2	
03 & 16	AE-	Wh	510	2	
03 & 16	RE+	VArh	512	2	
03 & 16	RE-	VArh	514	2	

1.7. Command List

There are different options to execute commands. With different number of registers and with and without identification.

1.7.1. Option 1: Direct operate, FC16, 1 registry

Writing the following values (1 or 0) on each address:

Address	Description	Number of registries	Enumeration	Format
220	Open Breaker	1	1	UINT16
	Close Breaker	1	0	UINT16
222	79 Block	1	1	UINT16
	79 Unblock	1	0	UINT16
224	Local Control	1	1	UINT16
	Remote Control	1	0	UINT16
226	Reset	1	1	UINT16
228	Reset Thermal Image	1	1	UINT16
212	Setting group 1	1	1	UINT16
214	Setting group 2	1	1	UINT16
216	Setting group 3	1	1	UINT16
218	Setting group 4	1	1	UINT16

There is no need to start the session, these are direct operated commands.

The function code implemented to **State writing** is **0x16 (Write Holding Registers)**.

Number of registries: 1.

1.7.2. Option 2: Direct operate, FC16, 2 registries

Writing the following values in address 182

Function	Description	Start address	Number of registries	Format	Reference
16	Direct operate command	182	2	UINT	See Commands below

DEC Value	COMMAND
1	Open Breaker
2	Close Breaker
3	79 Block
4	79 Unblock
5	Local Control
6	Remote Control
7	Reset
9	Reset Thermal Image
11	Hot Line Tag ON
12	Hot Line Tag OFF
13	User Command 1
14	User Command 2
15	User Command 3
16	User Command 4
17	User Command 5
18	User Command 6
32	Setting group 1
33	Setting group 2
34	Setting group 3
35	Setting group 4

There is no need to start the session, these are direct operated commands.

The function code implemented to **State writing is 0x16 (Write Holding Registers)**.

Number of registries: 2.

1.7.3. Option 3: Access Code + Direct operate, FC16, 2 registries

Start session and write the following values in address 198:

Function	Description	Start address	Number of registries	Format	Reference
16	Write Access Code	168	5	UCHAR4	See Passwords and Access Levels
16	Direct operate command	198	2	UINT	See Commands below

DEC Value	COMMAND
1	Open Breaker
2	Close Breaker
3	79 Block
4	79 Unblock
5	Local Control
6	Remote Control
7	Reset
9	Reset Thermal Image
11	Hot Line Tag ON
12	Hot Line Tag OFF
13	User Command 1
14	User Command 2
15	User Command 3
16	User Command 4
17	User Command 5
18	User Command 6
32	Setting group 1
33	Setting group 2
34	Setting group 3
35	Setting group 4

It is needed to start the session.

The function code implemented to **State writing is 0x16 (Write Holding Registers)**.

Setting-up the session: Password and access levels

The relay is provided with different passwords associated to access levels allowing the user to carry out different actions depending on the selected password:

ACCESS LEVEL	PASSWORD	Read-only permission: Status and measurements Settings Configuration Events/DFR	Permission to: Change settings	Permission to: Execute Commands Set Counters Delete Events Delete DFR	Permission to: Change user's Configuration	Permission to: Upgrade the FW (flashing process)	Permission to: Read and change access levels	Permission to: Change manufacturer's Configuration
0	Fanox/0000	YES	NO	NO	NO	NO	NO	NO
1	Fanox/1111 Fanox/2222 Fanox/3333 Fanox/6666 Fanox/7777 Fanox/8888	YES	YES	NO	NO	NO	NO	NO
2	Fanox/4444	YES	YES	YES	NO	NO	NO	NO
3	Fanox/5555 Fanox/9999	YES	YES	YES	YES	YES	YES	NO

Four passwords and their associated levels of access are set up when the relay is configured using the Slcom program. The password must be made up of 4 characters (passwords with more or less characters will not be accepted). By default, the relay is programmed with the following passwords and their associated levels:

PASSWORD	ACCESS LEVEL
Fanox/0000	0
Fanox/1111 Fanox/2222 Fanox/3333 Fanox/6666 Fanox/7777 Fanox/8888	1
Fanox/4444	2
Fanox/555 Fanox/9999	3

1.8. Examples

1.8.1. Ask for each event of a fault report

First start the session using the function 16 (write multiple registers) for entering the password at address 168. Default password “Fanox/5555” entered in HEX, as in the image:

16: Write multiple registers (HEX)

Slave ID: 2

Address: 168

Quantity: 5

168 = 0x4661
169 = 0x6E6F
170 = 0x782F
171 = 0x3535
172 = 0x3535

Buttons: Send, Cancel, Edit, Open, Save

Next, write the fault report index you want to read on the 8000 address. The newest fault report has the index number one, so for reading the last fault report:

16: Write multiple registers (HEX)

Slave ID: 2

Address: 8000

Quantity: 2

8000 = 0x0000
8001 = 0x0001

Buttons: Send, Cancel, Edit, Open, Save

Then write the event index from which you want to start reading on the 8002 address. For reading the first event:

16: Write multiple registers (HEX)

Slave ID: 2

Address: 8002

Quantity: 2

8002 = 0x0000
8003 = 0x0001

Send
Cancel
Edit
Open
Save

To conclude, read the selected event with function 3 (read holding register) on address 8123 and 11 registers:

Read/Write Definition

Slave ID: 1

Function: 03 Read Holding Registers (4x)

Address: 8123

Quantity: 11

Scan Rate: 1000 ms

☐ Read/Write Enabled

OK
Cancel
Apply
Read/Write Once

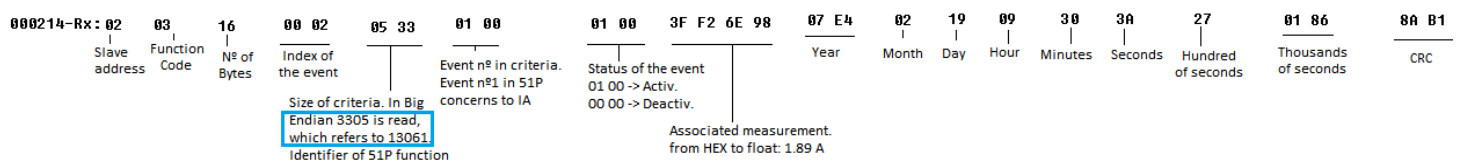
View

Rows
☒ 10 ☐ 20 ☐ 50 ☐ 100

Display: Hex

☐ Hide Alias Columns
☐ Address in Cell
☐ PLC Addresses (Base 1)

The response includes the identifier of the criteria, number of the event in that criteria (info available on the status map), status of the event (active/deactivate) and associated measurement and date:



Continue reading in same 8123 direction for obtaining the nexts events of the report.

1.8.2. Ask for the trip reason of a fault report

First start the session using the function 16 (write multiple registers) for entering the password at address 168. Default password “Fanox/5555” should be entered in HEX, as in the image:

16: Write multiple registers (HEX) X

Slave ID: 2

Address: 168

Quantity: 5

168 = 0x4661
 169 = 0x6E6F
 170 = 0x782F
 171 = 0x3535
 172 = 0x3535

Send
 Cancel
 Edit
 Open
 Save

Next, write the fault report index you want to read on the 8000 address. The newest fault report has the index number one, so for reading the last fault report:

16: Write multiple registers (HEX) X

Slave ID: 2

Address: 8000

Quantity: 2

8000 = 0x0000
8001 = 0x0001

Send
Cancel
Edit
Open
Save

And finally read 16 registers starting on address 8334. On the response the trip reason is given on ASCII format:

000004-Tx:						02	03	20	0E	00	10	2F	DE																												
000005-Rx:						02	03	20	07	E4	00	0B	00	0B	00	09	00	23	00	07	00	31	01	EB	47	45	4E	45	52	41	4C	00	00	00	00	00	00	00	00	A2	8D
									Year	Month	Day	Hour	Minutes	Seconds					Thousand of seconds				Trip Reason										CRC								
						Slave Address	Nº of bytes																																		
						Function Code																																			

1.8.3. Example of Modbus Frames

Writing the access password “Fanox/5555” to equipment address no. 2

Address	Function	H Pickup Address	L Pickup Address	Number of H Registers	Number of L Registers	Number of Bytes	Password	Checksum H	Checksum L
0x02	0x10	0x00	0xA8	0x00	0x05	0x0A	0x4661 0x6E6F 0x782F 0x3535 0x3535	0x30	0xF4

And the SIL-S will reply OK:

Address	Function	H Pickup Address	L Pickup Address	Number of H Registers	Number of L Registers	Checksum H	Checksum L
0x02	0x10	0x00	0xA8	0x00	0x05	0x81	0xD9



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