FANOX
Safely protected

SIL-G

Feeder Relay



MODBUS PROTOCOL MANUAL

1. MODBUS PROTOCOL 3
1.1. Modbus RTU pachage format 4
1.2. Function Codes 5
1.3. Exceptions Responses 5
1.4. Data type 5
1.5. General Memory Map 7
1.5.1. States Map, FC03, 2 registers 8
1.5.2. States Map, FC03, 1 registry 25
1.5.3. States identifiers 28
1.5.4. Measurements Map 29
1.5.5. Fault reports Map 31
1.5.6. Settings Map 32
1.5.6.1. Change the “General - Settings Group” setting with 1 register 52
1.6. Counters 53
1.7. Command List 53
1.7.1. Option 1: Direct operate, FC16, 1 registry 53
1.7.2. Option 2: Direct operate, FC16, 2 registries 54
1.7.3. Option 3: Access Code + Direct operate, FC16, 2 registries 55
Setting-up the session: Password and access levels 56
1.8. Examples 57
1.8.1. Ask for each event of a fault report 57
1.8.2. Ask for the trip reason of a fault report 59
1.8.3. Example of Modbus Frames 60

1. MODBUS PROTOCOL

Communication parameters are:

Modbus RTU:
- Slave Address: 2 (by default)

Rear Serial COM:
- Baudrate: 19200 (by default)
- Serial Settings: 8-N-1 (by default)

Modbus TCP/IP:
- Slave Address: 2 (by default)
- Port: 502 (by default)

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	223.255.255.254	-	-	192.168.200.100
Subnet	255.0.0.0	255.255.255.252	-	-	255.255.255.0
Gateway	1.0.0.1	223.255.255.254	-	-	192.168.200.1
DNS – 1	0.0.0.0	255.255.255.255		-	0.0.0.0
DNS – 2	0.0.0.0	255.255.255.255		-	0.0.0.0

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

This document describes the steps to follow to read and write data on the SIL-G 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-G 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, fibre 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 pararmeters 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 pachage 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)
EVENTO2	11	Antiquity (UINT). Event (EVENT)
FH	5	*Year*(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).**

Number of registries: 2

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

FW M01.04.00 onwards:

Address	Description	Bit	Event NO	Status
600	SELF DIAGNOSIS	0	1	Model Error
		1	2	HW Error
		4	-	Slot 3 Empty
		5	-	Slot 4 Empty
		6	-	Slot 5 Empty
		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
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
		9	10	Thermal I. Reset
		11	11	HLT On
		12	12	HLT Off
		13	13	User Command 1
		14	14	User Command 2
		15	15	User Command 3
		16	16	User Command 4
		17	17	User Command 5
		18	18	User Command 6
		25	19	Set Counter
		27	20	Key Reset
		29	21	Activity
		30	22	Identification
		31	23	Test State

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
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
		9	10	Thermal I. 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

Address	Description	Bit	Event NO	Status
		25	-	Set Counter
		28	-	Activity
		29	-	Identification
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
		9	10	Thermal I. 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	-	Set Counter
		28	-	Activity
		29	-	Identification
622	MODBUS 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
		9	10	Thermal I. 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	-	Set Counter
		28	-	Activity
		29	-	Identification
624	DNP3 Serial	1	2	Open Breaker
		2	3	Close Breaker
		3	4	79 Block
		4	5	79 Unblock
		5	6	Local Control

Address	Description	Bit	Event NO	Status
		6	7	Remote Control
		7	8	Reset
		9	10	Thermal I. 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	-	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
		9	10	Thermal I. 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	-	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
		9	10	Thermal I. 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

Address	Description	Bit	Event NO	Status
		22	25	SettingsG. 2
		23	26	SettingsG. 3
		24	27	SettingsG. 4
		28	-	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
		9	10	Thermal I. 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	-	Activity
632	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

Address	Description	Bit	Event NO	Status
634	OUTPUTS	0	1	Output 1
		1	2	Output 2
		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	Output12 / Virtual Output12
		12	13	Output13 / Virtual Output13
		13	14	Output14 / Virtual Output14
		14	15	Output15 / Virtual Output15
		15	16	Output16 / Virtual Output16
		16	17	Output17 / Virtual Output17
		17	18	Output18 / Virtual Output18
		18	19	Virtual Output19
		19	20	Virtual Output20
		20	21	Virtual Output21
		21	22	Virtual Output22
		22	23	Virtual Output23
		23	24	Virtual Output24
		24	25	Virtual Output25
		25	26	Virtual Output26
		26	27	Virtual Output27
		27	28	Virtual Output28
		28	29	Virtual Output29
		29	30	Virtual Output30
		30	31	Virtual Output31
		31	32	Virtual Output32
636	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
		12	13	79N1 Start
		13	14	79N2 Start

Address	Description	Bit	Event NO	Status
		14	15	79N3 Start
		15	16	79N4 Start
		16	17	DFR Start
		17	18	50BF Start
		18	19	SOTF Start
		19	20	Thermal I. Reset
		20	21	74TCS Coil A
		21	22	74TCS Coil B
		22	23	Neutral Block
		23	24	Phase Block
		24	25	External Trip
		25	33	Reset
		26	34	Opening Blk
		27	35	Closing Blk
		29	26	PGC 1
		30	27	PGC 2
		31	28	PGC 3
638	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
640	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	-	Virtual Alarm 09
		9	-	Virtual Alarm 10
		10	-	Virtual Alarm 11
		11	-	Virtual Alarm 12
		12	-	Virtual Alarm 13
		13	-	Virtual Alarm 14
		14	-	Virtual Alarm 15
		15	-	Virtual Alarm 16
		16	-	Virtual Alarm 17
		17	-	Virtual Alarm 18
		18	-	Virtual Alarm 19
		19	-	Virtual Alarm 20
		20	-	Virtual Alarm 21
		21	-	Virtual Alarm 22
		22	-	Virtual Alarm 23

Address	Description	Bit	Event NO	Status
		23	-	Virtual Alarm 24
		24	-	Virtual Alarm 25
		25	-	Virtual Alarm 26
		26	-	Virtual Alarm 27
		27	-	Virtual Alarm 28
		28	-	Virtual Alarm 29
		29	-	Virtual Alarm 30
		30	-	Virtual Alarm 31
		31	-	Virtual Alarm 32
642	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
644	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
646	67/51-1	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
		16	9	Directionality A
		17	10	Directionality B
		18	11	Directionality C
		28	12	Directionality
648	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

Address	Description	Bit	Event NO	Status
		17	10	Directionality B
		18	11	Directionality C
		28	12	Directionality
650	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
652	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
		11	8	Phase Trip
		16	9	Directionality A
		17	10	Directionality B
		18	11	Directionality C
		28	12	Directionality
654	50G	4	1	Ground Pickup
		12	2	Ground Trip
656	50N	4	1	Neutral Pickup
		12	2	Neutral Trip
658	67G/51G-1	4	1	Ground Pickup
		12	2	Ground Trip
		19	3	Directionality
660	67G/51G-2	4	1	Ground Pickup
		12	2	Ground Trip
		19	3	Directionality
662	67N/51N-1	4	1	Neutral Pickup
		12	2	Neutral Trip
		19	3	Directionality
664	67N/51N-2	4	1	Neutral Pickup
		12	2	Neutral Trip
		19	3	Directionality
666	50BF	3	1	Pickup
		11	2	Alarm
668	46	3	1	Pickup

Address	Description	Bit	Event NO	Status
		11	2	Trip
670	46BC	3	1	Pickup
		11	2	Trip
672	49	3	1	Alarm
		11	2	Trip
674	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
		10	7	Phase C Trip
		11	8	Phase Trip
676	SHB	8	1	Phase A Block
		9	2	Phase B Block
		10	3	Phase C Block
		11	4	Phase Block
678	27-1	0	1	Phase A Pickup
		1	2	Phase B Pickup
		2	3	Phase C Pickup
		3	4	Phase Pickup
		5	5	AB Pickup
		6	6	BC Pickup
		7	7	CA Pickup
		8	8	Phase A Trip
		9	9	Phase B Trip
		10	10	Phase C Trip
		11	11	Phase Trip
		13	12	AB Trip
		14	13	BC Trip
		15	14	CA Trip
680	27-2	0	1	Phase A Pickup
		1	2	Phase B Pickup
		2	3	Phase C Pickup
		3	4	Phase Pickup
		5	5	AB Pickup
		6	6	BC Pickup
		7	7	CA Pickup
		8	8	Phase A Trip
		9	9	Phase B Trip
		10	10	Phase C Trip
		11	11	Phase Trip
		13	12	AB Trip
		14	13	BC Trip
		15	14	CA Trip
682	59-1	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
		5	5	AB Pickup
		6	6	BC Pickup
		7	7	CA Pickup
		8	8	Phase A Trip
		9	9	Phase B Trip
		10	10	Phase C Trip
		11	11	Phase Trip
		13	12	AB Trip
		14	13	BC Trip
		15	14	CA Trip
684	59-2	0	1	Phase A Pickup
		1	2	Phase B Pickup
		2	3	Phase C Pickup
		3	4	Phase Pickup
		5	5	AB Pickup
		6	6	BC Pickup
		7	7	CA Pickup
		8	8	Phase A Trip
		9	9	Phase B Trip
		10	10	Phase C Trip
		11	11	Phase Trip
		13	12	AB Trip
		14	13	BC Trip
		15	14	CA Trip
686	59N/G-1	4	1	Neutral Pickup
		12	2	Neutral Trip
688	59N/G-2	4	1	Neutral Pickup
		12	2	Neutral Trip
690	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
692	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

Address	Description	Bit	Event NO	Status
		11	8	Phase Trip
694	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
696	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
698	81-1	3	1	Pickup
		11	2	Trip
700	81-2	3	1	Pickup
		11	2	Trip
702	81-3	3	1	Pickup
		11	2	Trip
704	81-4	3	1	Pickup
		11	2	Trip
706	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
708	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

Address	Description	Bit	Event NO	Status
		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
710	74TCS	3	1	Pickup
		11	2	Alarm
712	60CTS	3	1	Pickup
		11	2	Alarm
714	60VTS	3	1	Phase Pickup
		8	2	Phase A Alarm
		9	3	Phase B Alarm
		10	4	Phase C Alarm
		11	5	Alarm
716	CLP	0	1	CLP Disable
		1	2	CB Closed
		2	3	CB Open
		3	4	CB Def.Open
		4	5	Close CLP
		5	6	Open CLP
		11	7	CLP
718	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
720	81R-1	3	1	Pickup
		11	2	Trip
722	81R-2	3	1	Pickup
		11	2	Trip
724	81R-3	3	1	Pickup
		11	2	Trip
726	81R-4	3	1	Pickup
		11	2	Trip
728	78	11	1	Trip
730	47	3	1	Pickup
		11	2	Trip
732	24-1	3	1	Pickup
		11	2	Trip
734	24-2	3	1	Pickup
		11	2	Trip

Address	Description	Bit	Event NO	Status
736	27V1	3	1	Pickup
		11	2	Trip
738	67GI	4	1	Ground Pickup
		12	2	Ground Trip
		19	3	Directionality
740	67NI	4	1	Neutral Pickup
		12	2	Neutral Trip
		19	3	Directionality
742	64REF	3	1	Pickup
		11	2	Trip
		19	3	IN SHB Block
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
		9	10	Thermal I. 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	-	Activity
746	IEC61850	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
		9	10	Thermal I. 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	-	Activity
748	GOOSE IN	0	1	Goose Ind. 1

Address	Description	Bit	Event NO	Status
		1	2	Goose Ind. 2
		2	3	Goose Ind. 3
		3	4	Goose Ind. 4
		4	5	Goose Ind. 5
		5	6	Goose Ind. 6
		6	7	Goose Ind. 7
		7	8	Goose Ind. 8
		8	9	Goose Ind. 9
		9	10	Goose Ind. 10
		10	11	Goose Ind. 11
		11	12	Goose Ind. 12
		12	13	Goose Ind. 13
		13	14	Goose Ind. 14
		14	15	Goose Ind. 15
		15	16	Goose Ind. 16
		16	17	Goose Ind. 17
		17	18	Goose Ind. 18
		18	19	Goose Ind. 19
		19	20	Goose Ind. 20
		20	21	Goose Ind. 21
		21	22	Goose Ind. 22
		22	23	Goose Ind. 23
		23	24	Goose Ind. 24
		24	25	Goose Ind. 25
		25	26	Goose Ind. 26
		26	27	Goose Ind. 27
		27	28	Goose Ind. 28
		28	29	Goose Ind. 29
		29	30	Goose Ind. 30
		30	31	Goose Ind. 31
		31	32	Goose Ind. 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	ARC FLASH DETECTION	0	1	Output 1
		1	2	Output 2
		2	3	Output 3

Address	Description	Bit	Event NO	Status
		3	4	Output 4
		8	5	Input 1
		9	6	Input 2
		10	7	Input 3
		11	8	Input 4
		16	9	Test OK 1
		17	10	Test OK 2
		18	11	Test OK 3
		19	12	Test OK 4
		20	13	Phase OC
		21	14	Neutral OC
		22	15	Overcurrent
762	21FL	0	1	Fault Locator
		1	2	Fault AG
		2	3	Fault BG
		3	4	Fault CG
		4	5	Fault ABG
		5	6	Fault BCG
		6	7	Fault CAG
		7	8	Fault AB
		8	9	Fault BC
		9	10	Fault CA
		10	11	Fault ABC
764	50INC	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
		13	9	50INCFLocator
		14	10	50INC Block
		15	11	50INC Reset
766	LMS	0	1	Standby
		1	2	Check PeakPeriod
		2	3	Check Peak Tap
		3	4	Peak Alarm
		4	5	Peak Interval
		5	6	Peak: 52 Open?
		6	7	Peak Close Time
		7	8	Peak Reset Time
		8	9	Lockout
		9	10	Check No Peak Tap
		10	11	No Peak Alarm
		11	12	No Peak Interval

Address	Description	Bit	Event NO	Status
		12	13	NoPeak: 52 Open?
		13	14	NoPeak CloseTime
		14	15	NoPeak Reset T.
		15	16	Peak period
		16	17	Pickup
		17	18	Trip
		18	19	Peak MaxAlarm
		19	20	NoPeak MaxAlarm
		20	21	LMS Bypass
768	DATE	0	1	Date/Time Set
		1	2	Need Sync.
		2	3	Summer Time
		3	4	IRIG-B Synchroni
		4	5	SNTP Synchroniza

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-G
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	Trip Block	
		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:Measurem.
		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-G
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
24-1	6177
24-2	6209
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
49	12545
50-1	12833
50-2	12865
52	13313
59-L	15106
59-1	15137
59-2	15169
60VTS	15361
67/51-1	17185
67/51-2	17217
67/51-3	17249
67/51-4	17281
74TCS	18945
78	19969
79	20225
81-1	20769
81-2	20801
81-3	20833
81-4	20865
27V1	32513
SOTF	37889
50G	38401
50N	38402
50BF	38913
59N/G-1	40737
59N/G-2	40769

CRITERIA	IDENTIFIER
64REF	41985
67GI	42755
67NI	42756
67G/51G-1	42785
67N/51N-1	42786
67G/51G-2	42817
67N/51N-2	42818
60CTS	44545
81R-1	46369
81R-2	46401
81R-3	46433
81R-4	46465
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
PGC	64001
CONTROL LEDS	64257
DFR	64513
INPUTS	64769
OUTPUTS	65025
MEASUREMENTS	65281
GOOSE IN	47361
AFD	50948
50INC	12804
FAULT LOCATOR	60930
LMS	60673

1.5.4. Measurements Map

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

Number of registries: 2.

Format: Float

Address	Description
800	Phase A current IA
802	Phase B current IB
804	Phase C current IC
806	Neutral current IN
808	Phase-Neutral V-A
810	Phase-Neutral V-B
812	Phase-Neutral V-C
814	Neutral Voltage V-R
816	Line Voltage V-L
818	Phase-Phase Voltage U-AB
820	Phase-Phase Voltage U-BC
822	Phase-Phase Voltage U-CA
824	Current $3I_0$
826	Positive Sequence current I-1
828	Negative Sequence current I-2
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	3V-0
840	V-1
842	V-2
844	V-MaX
846	Active Power P-3P
848	Reactive Power Q-3P
850	Apparent Power S-3P
852	Active Power P-A
854	Reactive Power Q-A
856	Apparent Power S-A
858	Active Power P-B
860	Reactive Power Q-B
862	Apparent Power S-B

Address	Description
864	Active Power P-C
866	Reactive Power Q-C
868	Apparent Power S-C
870	Bar Frequency f-Bar
872	Line Frequency f-Line
874	Df/dt
876	Ang I-A
878	Ang I-B
880	Ang I-C
882	Ang I-N
884	Ang 3I0
886	Ang V-A
888	Ang V-B
890	Ang V-C
892	Ang V-R
894	Ang 3V0
896	Ang UAB
898	Ang UBC
900	Ang UCA
902	Ang V-L
904	V/Hz
906	Thermal image
908	I2/I1
910	Neutral second harmonic current I-N2H
912	cosPhiA
914	cosPhiB
916	cosPhiC
918	cosPhi
920	THD I-A
922	THD I-B
924	THD I-C
926	Distance

Address	Description
928	I1 Angle
930	I2 Angle
932	THD VA
934	THD VB
936	THD VC
950	Fault Distance

1.5.5. Fault reports Map

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

Address	Description		Format	Number of registries	SILG
8334	Trip reason (with date and time)		ASCII	16	✓
8350	Fault report Phase A current IA		FLOAT INVERSE	2	✓
8352	Fault report Phase B current IB			2	✓
8354	Fault report Phase C current IC			2	✓
8356	Fault report Neutral current IN			2	✓
8358	Depending on VT setting	Va		2	✓
		Uab			
8360		Vb		2	✓
		Ubc			
8362		Vc		2	✓
		Uca			
8364		Vr		2	✓
8366	Fault report line phase B voltage, VLB			2	✓
8368	Fault report frequency			2	✓

There are multiple ways to obtain information from the fault report.

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	SIL-G
General settings / General	1000	Identification	TEXT16	-	✓
	1012	Language	ENUM4	00 → English 01 → Spanish 02 → Deutch 03 → French	✓
	1014	Active Setting Group	UINT32	01 → Set. Group 1 02 → Set. Group 2 03 → Set. Group 3 04 → Set. Group 4	✓
	1016	CB Opening time	FLOAT	0.001 – 300 s	✓
	1018	Min. Response T.	FLOAT	0.001 – 300 s	✓
	1020	Ph. Reset Time	FLOAT	0.001 – 500 s	✓
	1022	N. Reset Time	FLOAT	0.001 – 500 s	✓
General settings / Measurements	1024	Frequency	ENUM4	00 → 60 Hz 01 → 50 Hz	✓
	1026	P. Nominal current	ENUM4	00 → 5 A 01 → 1 A	✓
	1028	N. Nominal Current	ENUM4	00 → 5 A 01 → 1 A	✓
	1030	CT Phase Ratio	FLOAT INVERSE	1 - 3000	✓
	1032	CT Neutral ratio	FLOAT INVERSE	1 - 3000	✓
	1034	Current Presence	FLOAT INVERSE	0 – 0.5 In	✓
	1036	VT Connection	ENUM8	00 → 3P-N 01 →3P-N+R 02 →3P-P+R 03 →2P-P+R 04 →3P-P	✓
	1038	P-P Nominal V.	UINT32	50 - 480	✓
	1040	Neutral Nominal V.	UINT32	20 - 260	✓
	1042	VT Phase Ratio	FLOAT INVERSE	1 - 3000	✓
	1044	VT Neutral Ratio	FLOAT INVERSE	1 - 3000	✓

Settings	Address	Description	Format	Enumeration	SIL-G
	1046	Voltage Presence	FLOAT INVERSE	0 – 0.5	✓
General settings / USB COM	00 → 3P-N	00 → 3P-N	00 → 3P-N	00 → 3P-N	00 → 3P-N
WIFI COM	**1056**	WIFI Enable	ENUM4	-	✓
	1058	SSID	UINT32	-	✓
	1060	TCP Port	UINT32	-	✓
	1062	IP Address	IP	-	✓
	1064	Channel Number	UINT32	-	✓
	1066	Slave Address	UINT32	-	✓
General settings / Rear Serial COM	**1068**	Protocol	ENUM4	00 → Modbus RTU 01 → DNP3 serial 02 → IEC-103	✓
	1070	Baudrate	ENUM8	00 → 4800 01 → 9600 02 → 19200 03 → 38400 04 → 57600 05 → 115200	✓
	1072	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	✓
REAR TCP COM	**1074**	Protocol	ENUM4	00 → Modbus TCP 01 → DNP3 TCP 02 → IEC60870-104	✓
	1076	IP Address	IP	-	✓
	1078	Subnet	IP	-	✓
	1080	Gateway	IP	-	✓
	1082	DNS-1	IP	-	✓
	1084	DNS-2	IP	-	✓
General settings / MODBUS RTU	**1092**	Slave Address	UINT32	-	✓
MODBUS TCP	**1100**	Slave Address	UINT32	-	✓
	1102	TCP Port	UINT32	-	✓

Settings	Address	Description	Format	Enumeration	SIL-G
General settings / DNP3 SERIAL	1110	Slave Address	UINT32	0 - 65519	✓
	1112	DNP3 Master Address	UINT32	0 - 65519	✓
	1120	MultiMaster	ENUM4	00 → No 01 → Yes	✓
	1124	Unsolicited Retries	UINT32	1 - 255	✓
	1126	Unsolicited Timeout	FLOAT	0.02 – 300 s	✓
General settings / IEC-103	1158	Slave Address	UINT32	1 - 254	✓
DNP3 TCP	1134	Slave Address	UINT32	0 – 65519	✓
	1136	DNP3 Master Addss	UINT32	0 - 65519	✓
	1138	Port	UINT32	1 - 65535	✓
	1144	MultiMaster	ENUM4	00 → No 01 → Yes	✓
	1148	Unsolicet Retries	UINT32	1 – 255	✓
	1150	Unsolicet TimeOut	FLOAT INVERSE	0.02 – 300 s	✓
IEC60870-104	1166	OutStation Adddr.	UINT32	1 - 65534	✓
	1168	TCP Port	UINT32	1 - 65535	✓
	1170	T0 Timeout	FLOAT	1 - 255	✓
	1172	T1 Timeout	FLOAT	1 - 255	✓
	1174	T2 Timeout	FLOAT	1 - 255	✓
	1176	T3 Timeout	FLOAT	1 - 255	✓
	1178	K parameter	UINT32	1 - 32767	✓
	1180	W parameter	UINT32	1 - 32767	✓
	1182	CYC Period	FLOAT	0 – 300 s	✓
	1184	Back Period	FLOAT	0 – 300 s	✓
	1186	Spontaneous Ena.	ENUM44	00 → No 01 → Yes	✓
	1188	Buffering Time	FLOAT	0.01 – 0.5 s	✓
	1190	Max Commnd Delay	FLOAT	0.01 – 300 s	✓
	1192	Select Timeout	FLOAT	0 – 300 s	✓
	1194	IP Adress 1	IP		✓
	1196	IP Adress 2	IP		✓
	1198	Clk Sync Enabled	ENUM4	00 → No 01 → Yes	✓
Inputs	1208	Debounce Time	UINT32	5 - 255	✓
DFR	1210	Num. Of Records	ENUM4	00 → 5 x 300 cycles 01 → 25 x 60 cycles 02 → 50 x 30 cycles 03 → 100 x 15 cycles	✓
	1212	Cycles Prefault	UINT32	1 - 8	✓

Settings	Address	Description	Format	Enumeration	SIL-G
LDP	1214	Current Level	FLOAT INVERSE	0.01 – 2 In	✓
	1216	Interval Time	UINT32	1 – 60 min	✓
CLP	1218	Function Enable	ENUM4	00 → No 01 → Yes	✓
	1220	Settings Group	UINT32	1 - 4	✓
	1222	No Load Time	FLOAT INVERSE	0.02 – 300 s	✓
	1224	Cold Load Time	FLOAT INVERSE	0.02 - 300	✓
52	1226	Max Number of Openings	UINT32	1 - 100000	✓
	1228	Max Accumulated Amperes	UINT32	1 – 100000 MA2)	✓
	1230	Excessive Repetitive Openings	UINT32	1 - 100000	✓
	1232	Repetitive Openings/Time	UINT32	1 - 300	✓
	1234	Opening Time	FLOAT INVERSE	0.02 – 300 s	✓
	1236	Closing Time	FLOAT INVERSE	0.02 – 300 s	✓
50-1	1242	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip 03 → SHB Trip	✓
	1244	Current Tap	FLOAT INVERSE	0.05 – 30 In	✓
	1246	Time Delay	FLOAT INVERSE	0 – 300 s	✓
50-2	1248	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip 03 → SHB Trip	✓
	1250	Current Tap	FLOAT INVERSE	0.05 – 30 In	✓
	1252	Time Delay	FLOAT INVERSE	0 – 300 s	✓
67-1	1254	Function Enable	ENUM4	0 → Disable 01 → Alarm 02 → Trip 03 → SHB Trip	✓
	1256	Curve Type	ENUM16	0 → Defined Time 01 → IEC Long Time Inverse 02 → IEC Inverse 03 → IEC Very Inverse 04 → IEC Extremely Inverse	✓

Settings	Address	Description	Format	Enumeration	SIL-G
				05 → IEC Short Time Inverse Inverse 06 → IEEE Inverse 07 → IEEE Very Inverse 08 → IEEE Extremely	
	1258	Time Dial (TMS)	FLOAT INVERSE	0.01 – 25	✓
	1260	Current Tap	FLOAT INVERSE	0.01 – 20 In	✓
	1262	Time Delay	FLOAT INVERSE	0 – 300 s	✓
	1264	Directionality	FLOAT INVERSE	0 → No 01 → Forward 02 → Reverse	✓
	1266	Polarization V	FLOAT INVERSE	0.08 – 2 Un	✓
	1268	Operating angle	UINT32	0 – 359 º	✓
	1270	Halfcone Angle	UINT32	10 – 170 º	✓
67-2	**1272**	Function Enable	ENUM4	0 → Disable 01 → Alarm 02 → Trip 03 → SHB Trip	✓
	1274	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	✓
	1276	Time Dial (TMS)	FLOAT INVERSE	0.01 – 25	✓
	1278	Current Tap	FLOAT INVERSE	0.01 – 20 In	✓
	1280	Time Delay	FLOAT INVERSE	0 – 300 s	✓
	1282	Directionality	FLOAT INVERSE	0 → No	✓

Settings	Address	Description	Format	Enumeration	SIL-G
				01 → Forward 02 → Reverse	
	1284	Polarization V	FLOAT INVERSE	0.08 – 2 Un	✓
	1286	Operating angle	UINT32	0 – 359 °	✓
	1288	Halfcone Angle	UINT32	10 – 170 °	✓
67-3	**1290**	Function Enable	ENUM4	0 → Disable 01 → Alarm 02 → Trip 03 → SHB Trip	✓
	1292	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	✓
	1294	Time Dial (TMS)	FLOAT INVERSE	0.01 – 25	✓
	1296	Current Tap	FLOAT INVERSE	0.01 – 20 In	✓
	1298	Time Delay	FLOAT INVERSE	0 – 300 s	✓
	1300	Directionality	FLOAT INVERSE	0 → No 01 → Forward 02 → Reverse	✓
	1302	Polarization V	FLOAT INVERSE	0.08 – 2 Un	✓
	1304	Operating angle	UINT32	0 – 359 °	✓
	1306	Halfcone Angle	UINT32	10 – 170 °	✓
67-4	**1308**	Function Enable	ENUM4	0 → Disable 01 → Alarm 02 → Trip 03 → SHB Trip	✓
	1310	Curve Type	ENUM16	0 → Defined Time	✓

Settings	Address	Description	Format	Enumeration	SIL-G
				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	
	1312	Time Dial (TMS)	FLOAT INVERSE	0.01 – 25	✓
	1314	Current Tap	FLOAT INVERSE	0.01 – 20 In	✓
	1316	Time Delay	FLOAT INVERSE	0 – 300 s	✓
	1318	Directionality	FLOAT INVERSE	0 → No 01 → Forward 02 → Reverse	✓
	1320	Polarization V	FLOAT INVERSE	0.08 – 2 Un	✓
	1322	Operating angle	UINT32	0 – 359 °	✓
	1324	Halfcone Angle	UINT32	10 – 170 °	✓
50G	**1326**	Function Enable	ENUM4	0 → Disable 01 → Alarm 02 → Trip 03 → SHB Trip	✓
	1328	Current Tap	FLOAT INVERSE	0.01 – 30 In	✓
	1330	Time Delay	FLOAT INVERSE	0 – 300 s	✓
50N	**1332**	Function Enable	ENUM4	0 → Disable 01 → Alarm 02 → Trip 03 → SHB Trip	✓
	1334	Current Tap	FLOAT INVERSE	0.05 – 30 In	✓
	1336	Time Delay	FLOAT INVERSE	0 – 300 s	✓
67G-1	**1338**	Function Enable	ENUM4	0 → Disable 01 → Alarm 02 → Trip	✓

Settings	Address	Description	Format	Enumeration	SIL-G
				03 → SHB Trip	
	1340	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	✓
	1342	Time Dial (TMS)	FLOAT INVERSE	0.01 - 25	✓
	1344	Current Tap	FLOAT INVERSE	0.01 – 20 In	✓
	1346	Time Delay	FLOAT INVERSE	0 – 300 s	✓
	1348	Directionality	ENUM4	0 → No 01 → Forward 02 → Reverse	✓
	1350	Polarization V	FLOAT INVERSE	0.08 – 2 Vn	✓
	1352	Operating angle	UINT32	0 – 359 º	✓
	1354	Halfcone Angle	UINT32	10 – 170 º	✓
67G-2	**1356**	Function Enable	ENUM4	0 → Disable 01 → Alarm 02 → Trip 03 → SHB Trip	✓
	1358	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	✓

Settings	Address	Description	Format	Enumeration	SIL-G
				06 → IEEE Inverse 07 → IEEE Very Inverse 08 → IEEE Extremely	
	1360	Time Dial (TMS)	FLOAT INVERSE	0.01 - 25	✓
	1362	Current Tap	FLOAT INVERSE	0.01 – 20 In	✓
	1364	Time Delay	FLOAT INVERSE	0 – 300 s	✓
	1366	Directionality	ENUM4	0 → No 01 → Forward 02 → Reverse	✓
	1368	Polarization V	FLOAT INVERSE	0.08 – 2 Vn	✓
	1370	Operating angle	UINT32	0 – 359 °	✓
	1372	Halfcone Angle	UINT32	10 – 170 °	✓
67N-1	**1374**	Function Enable	ENUM4	0 → Disable 01 → Alarm 02 → Trip 03 → SHB Trip	✓
	1376	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	✓
	1378	Time Dial (TMS)	FLOAT INVERSE	0.01 - 25	✓
	1380	Current Tap	FLOAT INVERSE	0.05 – 20 In	✓
	1382	Time Delay	FLOAT INVERSE	0 – 300 s	✓
	1384	Directionality	ENUM4	0 → No 01 → Forward 02 → Reverse	✓

Settings	Address	Description	Format	Enumeration	SIL-G
	1386	Polarization V	FLOAT INVERSE	0.08 – 2 Un	✓
	1388	Operating angle	UINT32	0 – 359 º	✓
	1390	Halfcone Angle	UINT32	10 – 170 º	✓
67N-2	**1392**	Function Enable	ENUM4	0 → Disable 01 → Alarm 02 → Trip 03 → SHB Trip	✓
	1394	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	✓
	1396	Time Dial (TMS)	FLOAT INVERSE	0.01 - 25	✓
	1398	Current Tap	FLOAT INVERSE	0.05 – 20 In	✓
	1400	Time Delay	FLOAT INVERSE	0 – 300 s	✓
	1402	Directionality	ENUM4	0 → No 01 → Forward 02 → Reverse	✓
	1404	Polarization V	FLOAT INVERSE	0.08 – 2 Un	✓
	1406	Operating angle	UINT32	0 – 359 º	✓
	1408	Halfcone Angle	UINT32	10 – 170 º	✓
50BF	**1410**	Function Enable	ENUM4	00 → No 01 → Yes	✓
	1412	Time Delay	FLOAT INVERSE	0.02 – 1 s	✓
46	**1414**	Function Enable	ENUM4	0 → Disable 01 → Alarm 02 → Trip 03 → SHB Trip	✓

Settings	Address	Description	Format	Enumeration	SIL-G
	1416	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	✓
	1418	Time Dial (TMS)	FLOAT INVERSE	0.01 - 25	✓
	1420	Current Tap	FLOAT INVERSE	0.05 – 20 In	✓
	1422	Time Delay	FLOAT INVERSE	0 – 300 s	✓
49	**1424**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓
	1426	Current Tap	FLOAT INVERSE	0.1 – 2.4 In	✓
	1428	Heating Constatnt	UINT32	3 - 600	**1428**
	1430	Cooling Constant	UINT32	1 - 6	✓
	1432	Alarm Level	UINT32	20 – 99	✓
SHB	**1442**	Function Enable	ENUM4	00 → No 01 → Yes	✓
	1444	Current Tap	UINT32	5 – 50 %	✓
	1446	Reset Time	FLOAT INVERSE	0 – 300 s	✓
	1448	Block Threshold	FLOAT INVERSE	0.01 – 30 In	✓
27-1	**1450**	Function Enable	ENUM4	00 → Disable 01 → Alarm 01 → Trip	✓
	1452	Voltage Tap	FLOAT INVERSE	0.08 – 2 Un	✓
	1454	Minimum Level	FLOAT INVERSE	0 – 1 Un	✓
	1456	Time delay	FLOAT INVERSE	0.06 – 300 s	✓

Settings	Address	Description	Format	Enumeration	SIL-G
	1458	Reset Time	FLOAT INVERSE	0.02 – 300 s	✓
27-2	**1460**	Function Enable	ENUM4	00 → Disable 01 → Alarm 01 → Trip	✓
	1462	Voltage Tap	FLOAT INVERSE	0.08 – 2 Un	✓
	1464	Minimum Level	FLOAT INVERSE	0 – 1 Un	✓
	1466	Time delay	FLOAT INVERSE	0.06 – 300 s	✓
	1468	Reset Time	FLOAT INVERSE	0.02 – 300 s	✓
59-1	**1470**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓
	1472	Voltage Tap	FLOAT INVERSE	0.08 – 2 Un	✓
	1474	Time delay	FLOAT INVERSE	0.045 – 300 s	✓
	1476	Reset Time	FLOAT INVERSE	0.02 – 300 s	✓
59-2	**1478**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓
	1480	Voltage Tap	FLOAT INVERSE	0.08 – 2 Un	✓
	1482	Time delay	FLOAT INVERSE	0.045 – 300 s	✓
	1484	Reset Time	FLOAT INVERSE	0.02 – 300 s	✓
59N-1	**1486**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓
	1488	Voltage Tap	FLOAT INVERSE	0.08 – 2 Vn	✓
	1490	Time delay	FLOAT INVERSE	0.045 – 300 s	✓
	1492	Reset Time	FLOAT INVERSE	0.02 – 300 s	✓
59N-2	**1494**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓
	1496	Voltage Tap	FLOAT INVERSE	0.08 – 2 Vn	✓
	1498	Time delay	FLOAT INVERSE	0.045 – 300 s	✓
	1500	Reset Time	FLOAT INVERSE	0.02 – 300 s	✓
32-1	**1502**	Function Enable	ENUM4	00 → Disable	✓

Settings	Address	Description	Format	Enumeration	SIL-G
				01 → Alarm 02 → Trip	
	1504	Activation level	FLOAT INVERSE	0.02 – 2 Sn	✓
	1506	Operating angle	UINT32	0 – 359 °	✓
	1508	Time delay	FLOAT INVERSE	0.02 – 300 s	✓
32-2	**1510**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓
	1512	Activation level	FLOAT INVERSE	0.02 – 2 Sn	✓
	1514	Operating angle	UINT32	0 – 359 °	✓
	1516	Time delay	FLOAT INVERSE	0.02 – 300 s	✓
32-3	**1518**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓
	1520	Activation level	FLOAT INVERSE	0.02 – 2 Sn	✓
	1522	Operating angle	UINT32	0 – 359 °	✓
	1524	Time delay	FLOAT INVERSE	0.02 – 300 s	✓
32-4	**1526**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓
	1528	Activation level	FLOAT INVERSE	0.02 – 2 Sn	✓
	1530	Operating angle	UINT32	0 – 359 °	✓
	1532	Time delay	FLOAT INVERSE	0.02 – 300 s	✓
81-1	**1534**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓
	1536	Type	ENUM4	00 → Over 01 → Under	✓
	1538	Activation Level	FLOAT INVERSE	45 – 65 Hz	✓
	1540	Time Delay	FLOAT INVERSE	0.02 – 300 s	✓
	1542	Reset Time	FLOAT INVERSE	0.02 – 300 s	✓
81-2	**1544**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓
	1546	Type	ENUM4	00 → Over 01 → Under	✓

Settings	Address	Description	Format	Enumeration	SIL-G
	1548	Activation Level	FLOAT INVERSE	45 – 65 Hz	✓
	1550	Time Delay	FLOAT INVERSE	0.02 – 300 s	✓
	1552	Reset Time	FLOAT INVERSE	0.02 – 300 s	✓
81-3	**1554**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓
	1556	Type	ENUM4	00 → Over 01 → Under	✓
	1558	Activation Level	FLOAT INVERSE	45 – 65 Hz	✓
	1560	Time Delay	FLOAT INVERSE	0.02 – 300 s	✓
	1562	Reset Time	FLOAT INVERSE	0.02 – 300 s	✓
81-4	**1564**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓
	1566	Type	ENUM4	00 → Over 01 → Under	✓
	1568	Activation Level	FLOAT INVERSE	45 – 65 Hz	✓
	1570	Time Delay	FLOAT INVERSE	0.02 – 300 s	✓
	1572	Reset Time	FLOAT INVERSE	0.02 – 300 s	✓
79	**1574**	Reclose Number	UINT32	0 - 4	✓
	1576	Reset Time	FLOAT INVERSE	0.02 – 2000 s	✓
	1578	Reclose 1 Time	FLOAT INVERSE	0.02 – 2000 s	✓
	1580	Reclose 2 Time	FLOAT INVERSE	0.02 – 2000 s	✓
	1582	Reclose 3 Time	FLOAT INVERSE	0.02 – 2000 s	✓
	1584	Reclose 4 Time	FLOAT INVERSE	0.02 – 2000 s	✓
	1586	Hold Enable	ENUM4	00 → No 01 → Yes 02 → No Time	✓
	1588	Hold Time	FLOAT INVERSE	0.02 – 2000 s	✓
	1590	Safe Time	FLOAT INVERSE	0.02 – 2000 s	✓
74TCS	**1592**	Function Enable	ENUM4	00 → No 01 → Yes	✓
	1594	Time Delay	FLOAT INVERSE	0.02 – 300 s	✓
60CTS	**1596**	Function Enable	ENUM4	00 → No	✓

Settings	Address	Description	Format	Enumeration	SIL-G
				01 → Yes	
	1598	Time Delay	FLOAT INVERSE	0.02 – 300 s	✓
60VTS	**1600**	Function Enable	ENUM4	00 → No 01 → Yes	✓
	1602	Time Delay	FLOAT INVERSE	0.02 – 300 S	✓
	1604	V1 Tap	FLOAT INVERSE	0.08 – 2 Un	✓
	1606	V2 Tap	FLOAT INVERSE	0.08 – 2 Un	✓
	1608	VP Tap	FLOAT INVERSE	0.08 – 2 Un	✓
	1610	I1 Tap	FLOAT INVERSE	0.01 – 20 In	✓
	1612	I2 Tap	FLOAT INVERSE	0.01 – 20 In	✓
	1614	I30 Tap	FLOAT INVERSE	0.01 – 20 In	✓
25	**1616**	Dead Tap	FLOAT INVERSE	0.08 – 2 Un	✓
	1618	Live Tap	FLOAT INVERSE	0.08 – 2 Un	✓
	1620	V. Supervis. Time	FLOAT INVERSE	0.06 – 300 s	✓
	1622	Voltage Diff	FLOAT INVERSE	0.05 – 2 Un	✓
	1624	Phase Diff.	UINT32	2 – 90 º	✓
	1626	Frequency Diff.	FLOAT INVERSE	0.06 – 10 Hz	✓
	1628	Syncrocheck Time	FLOAT INVERSE	0.02 – 300 s	
81R-1	**1630**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓
	1632	Type	ENUM4	00 → Increase 01 → Decrease	✓
	1634	Activation Level	FLOAT INVERSE	0.1 – 5 Hz/s	✓
	1636	Time Delay	FLOAT INVERSE	0.06 – 40 s	✓
	1638	Reset Time	FLOAT INVERSE	0.02 – 300 s	✓
81R-2	**1640**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓
	1642	Type	ENUM4	00 → Increase 01 → Decrease	✓

Settings	Address	Description	Format	Enumeration	SIL-G
	1644	Activation Level	FLOAT INVERSE	0.1 – 5 Hz/s	✓
	1646	Time Delay	FLOAT INVERSE	0.06 – 40 s	✓
	1648	Reset Time	FLOAT INVERSE	0.02 – 300 s	✓
81R-3	**1650**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓
	1652	Type	ENUM4	00 → Increase 01 → Decrease	✓
	1654	Activation Level	FLOAT INVERSE	0.1 – 5 Hz/s	✓
	1656	Time Delay	FLOAT INVERSE	0.06 – 40 s	✓
	1658	Reset Time	FLOAT INVERSE	0.02 – 300 s	✓
81R-4	**1660**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓
	1662	Type	ENUM4	00 → Increase 01 → Decrease	✓
	1664	Activation Level	FLOAT INVERSE	0.1 – 5 Hz/s	✓
	1666	Time Delay	FLOAT INVERSE	0.06 – 40 s	✓
	1668	Reset Time	FLOAT INVERSE	0.02 – 300 s	✓
78	**1670**	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip	✓
	1672	Activation Level	FLOAT INVERSE	1 – 25 º	✓
	1674	Reset Time	FLOAT INVERSE	0.02 – 300 s	✓
47	**1676**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓
	1678	Voltage Tap	FLOAT INVERSE	0.08 – 2 Un	✓
	1680	Time delay	FLOAT INVERSE	0.045 – 300 s	✓
	1682	Reset Time	FLOAT INVERSE	0.02 – 300 s	✓
27V1	**1684**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓

Settings	Address	Description	Format	Enumeration	SIL-G
	1686	Voltage Tap	FLOAT INVERSE	0.15 – 2 Un	✓
	1688	Minimum Level	FLOAT INVERSE	0 – 1 Un	✓
	1690	Time delay	FLOAT INVERSE	0.06 – 300 s	✓
	1692	Reset Time	FLOAT INVERSE	0.02 – 300 s	✓
27L	**1694**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓
	1696	Voltage Tap	FLOAT INVERSE	0.08 – 2 Un	✓
	1698	Minimum Level	FLOAT INVERSE	0 – 1 Un	✓
	1700	Time delay	FLOAT INVERSE	0.06 – 300 s	✓
	1702	Reset Time	FLOAT INVERSE	0.02 – 300 s	✓
59-L	**1704**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓
	1706	Voltage Tap	FLOAT INVERSE	0.08 – 2 Un	✓
	1708	Time delay	FLOAT INVERSE	0.045 – 300 s	✓
	1710	Reset Time	FLOAT INVERSE	0.02 – 300 s	✓
46BC	**1712**	Function Enable	ENUM4	00 → Disable 01 → Alarm 02 → Trip	✓
	1714	Current Tap	UINT32	15 – 100 %	✓
	1716	Time Delay	FLOAT INVERSE	0.03 – 300 s	✓
24-1	**1718**	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip	✓
	1720	Curve Type	ENUM4	00 → Def. Time 01 → Inverse A 02 → Inverse B 03 → Inverse C	✓
	1722	Time Dial (TMS)	FLOAT INVERSE	0.05 - 300	✓
	1724	Activation Level	FLOAT INVERSE	0.5 – 2 xVn/fn	✓
	1726	Time Delay	FLOAT INVERSE	0.02 – 300 s	✓

Settings	Address	Description	Format	Enumeration	SIL-G
	1728	Reset Time	FLOAT INVERSE	0 – 300 s	✓
24-2	**1730**	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip	✓
	1732	Curve Type	ENUM4	00 → Def. Time 01 → Inverse A 02 → Inverse B 03 → Inverse C	✓
	1734	Time Dial (TMS)	FLOAT INVERSE	0.05 - 300	✓
	1736	Activation Level	FLOAT INVERSE	0.5 – 2 xVn/fn	✓
	1738	Time Delay	FLOAT INVERSE	0.02 – 300 s	✓
	1740	Reset Time	FLOAT INVERSE	0 – 300 s	✓
SOTF	**1748**	Function Enable	ENUM4	0 → Disable 01 → Alarm 02 → Trip 03 → SHB Trip	✓
	1750	Current Tap	FLOAT INVERSE	0.01 – 30 In	✓
	1752	Time Delay	FLOAT INVERSE	0 – 295 s	✓
	1754	Safe Time	FLOAT INVERSE	0.02 – 300 s	✓
64REF	**1756**	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip 03 → SHB Trip	✓
	1758	Current Tap	FLOAT INVERSE	0.05 – 20 In	✓
	1760	Time delay	FLOAT INVERSE	0.02 – 300 s	✓
	1762	IN SHB Tap	FLOAT INVERSE	5 – 50 %	✓
67GI	**1764**	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip 03 → SHB Trip	✓
	1766	Directionality	ENUM4	00 → No 01 → Forward 02 → Reverse	✓
	1768	Low Current Tap	FLOAT INVERSE	0.01 – 30 In	✓

Settings	Address	Description	Format	Enumeration	SIL-G
	1770	Low Voltage Tap	FLOAT INVERSE	0.08 – 2 Vn	✓
	1772	High Current Tap	FLOAT INVERSE	0.01 – 30 In	✓
	1774	High Voltage Tap	FLOAT INVERSE	0.08 – 2 Vn	✓
	1776	Time Delay	FLOAT INVERSE	0 – 300 s	✓
	1778	Operating Angle	UINT32	0 – 359 º	✓
	1780	Halfcone Angle	UINT32	10 – 170 º	✓
67NI	**1782**	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip 03 → SHB Trip	✓
	1784	Directionality	ENUM4	00 → No 01 → Forward 02 → Reverse	✓
	1786	Low Current Tap	FLOAT INVERSE	0.05 – 30 In	✓
	1788	Low Voltage Tap	FLOAT INVERSE	0.08 – 2 Vn	✓
	1790	High Current Tap	FLOAT INVERSE	0.05 – 30 In	✓
	1792	High Voltage Tap	FLOAT INVERSE	0.08 – 2 Vn	✓
	1794	Time Delay	FLOAT INVERSE	0 – 300 s	✓
	1796	Operating Angle	UINT32	0 – 359 º	✓
	1798	Halfcone Angle	UINT32	10 – 70ª	✓
21FL	**1804**	Function Enable	ENUM4	00 → No 01 → Yes	✓
	1806	Line Length	FLOAT INVERSE	1 – 100 Km	✓
	1808	Z1 Line Magnitude	FLOAT INVERSE	0.001 – 5 Ohm/Kms	✓
	1810	Z1 Line Angle	FLOAT INVERSE	0 – 90 º	✓
	1812	Z0 Line Magnitude	FLOAT INVERSE	0.001 – 5 Ohm/kms.	✓
	1814	Z0 Line Angle	FLOAT INVERSE	0 – 90 º	✓
50INC	**1816**	Function Enable	ENUM4	00 → No 01 → Alarm 02 → Trip	✓
	1818	Phase Current Tap	FLOAT INVERSE	0.5 – 30 In	✓
	1820	Pickup Peaks Number	FLOAT INVERSE	1 - 20	✓
	1822	Trip Peaks Number	FLOAT INVERSE	1 - 20	✓
	1824	50INC Block	BOOLSTATE,	-	✓
	1826	50INC Reset	BOOLSTATE	-	✓
LMS	**1828**	Function Enable	ENUM4	00 → No 01 → Yes	✓
	1830	Peak Period Mode	ENUM4	00 → TRIP 01 → ALARM	✓
	1832	No Peak Mode	ENUM4	00 → TRIP 01 → ALARM	✓

Settings	Address	Description	Format	Enumeration	SIL-G
	1834	Starting Month	ENUM16	01 – January 02 – February 03 – March 04 – April 05 – May 06 – June 07 – July 08 – August 09 – September 10 – October 11 – November 12 - December	✓
	1836	Starting Day	FLOAT INVERSE	1 - 31	✓
	1838	Ending Month	ENUM16	01 – January 02 – February 03 – March 04 – April 05 – May 06 – June 07 – July 08 – August 09 – September 10 – October 11 – November 12 - December	✓
	1840	Ending Day	FLOAT INVERSE	1 - 31	✓
	1842	Starting hour	FLOAT INVERSE	0 - 23	✓
	1844	Starting Minute	FLOAT INVERSE	0 - 59	✓
	1846	Ending Hour	FLOAT INVERSE	0 - 23	✓
	1848	Ending Minute	FLOAT INVERSE	0 - 59	✓
	1850	Starting Day Week	ENUM4	1 – Monday 2 – Tuesday 3 – Wednesday 4 – Thursday 5 – Friday 6 – Saturday 7 - Sunday	✓
	1852	Ending Day of Week	ENUM4	1 – Monday 2 – Tuesday 3 – Wednesday 4 – Thursday 5 – Friday 6 – Saturday 7 - Sunday	✓
	1854	Reset Time	FLOAT INVERSE	0 – 18000 s	✓
	1856	Peak Period Tap	FLOAT INVERSE	0.01 – 30 In	✓
	1858	Peak Trip T1	FLOAT INVERSE	0 – 18000 s	✓
	1860	Peak Trip T2	FLOAT INVERSE	0 – 18000 s	✓
	1862	Peak Trip T3	FLOAT INVERSE	0 – 18000 s	✓
	1864	Peak Trip T4+	FLOAT INVERSE	0 – 18000 s	✓
	1866	Peak Reclosings	FLOAT INVERSE	0 - 247	✓
	1868	Peak Interval 1	FLOAT INVERSE	0 – 18000 s	✓
	1870	Peak Interval 2	FLOAT INVERSE	0 – 18000 s	✓
	1872	Peak Interval 3	FLOAT INVERSE	0 – 18000 s	✓
	1874	Peak Interval 4+	FLOAT INVERSE	0 – 18000 s	✓
	1876	No Peak Tap	FLOAT INVERSE	0.01 – 30 In	✓
	1878	No Peak Trip T1	FLOAT INVERSE	0 – 18000 s	✓
	1880	No Peak Trip T2	FLOAT INVERSE	0 – 18000 s	✓

Settings	Address	Description	Format	Enumeration	SIL-G
	1882	No Peak Trip T3	FLOAT INVERSE	0 – 18000 s	✓
	1884	No Peak Trip T4+	FLOAT INVERSE	0 – 18000 s	✓
	1886	NoPeak reclosing	FLOAT INVERSE	0 - 247	✓
	1888	NoPeak Interval1	FLOAT INVERSE	0 – 18000 s	✓
	1890	NoPeak Interval2	FLOAT INVERSE	0 – 18000 s	✓
	1892	NoPeak Interval3	FLOAT INVERSE	0 – 18000 s	✓
	1894	NoPeak Interval4+	FLOAT INVERSE	0 – 18000 s	✓
	1896	LMS Bypass	BOOL STATE	-	✓

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	1013	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 198

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

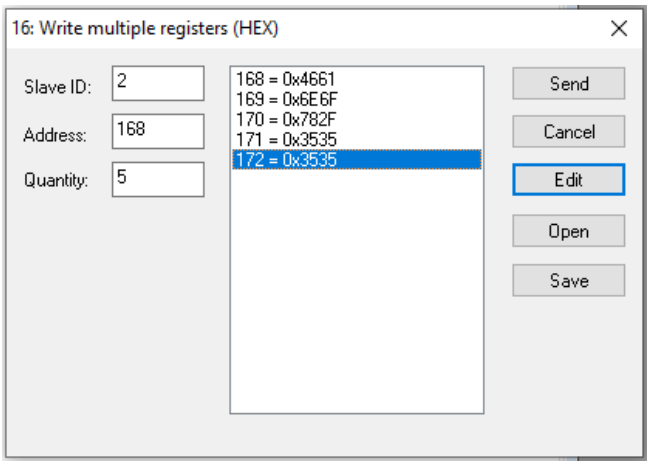
Four passwords and their associated levels of access are set up when the relay is configured using the SIcom program. The password must be made up of 4 characters (passwords with more or less characters will not be accepted). By default, the relay is programmed with the following passwords and their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

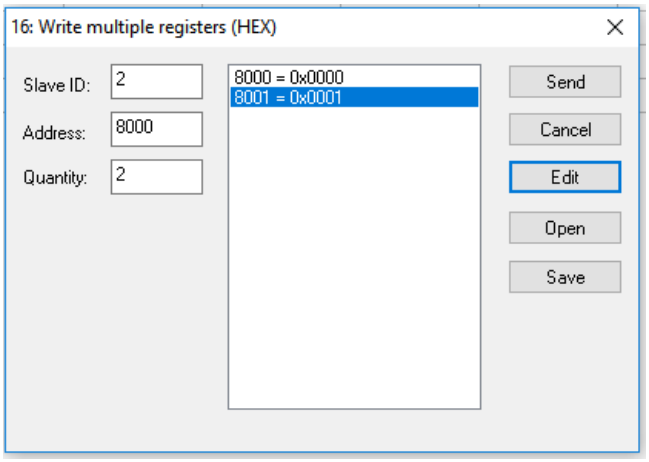
1.8. Examples

1.8.1. Ask for each event of a fault report

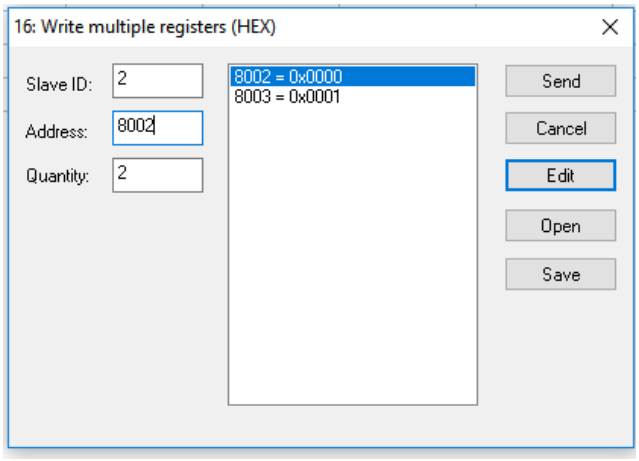
First start the session using the function 16 (write multiple registers) for entering the password at address 168. Default password “Fanox/5555” entered in HEX, as in the image:



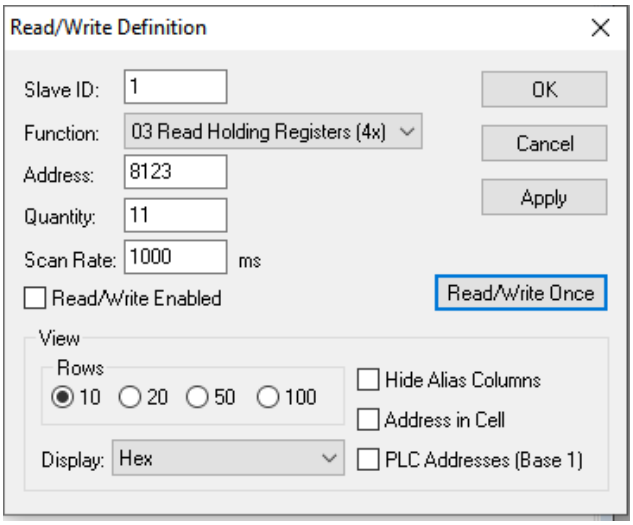
Next, write the fault report index you want to read on the 8000 address. The newest fault report has the index number one, so for reading the last fault report:



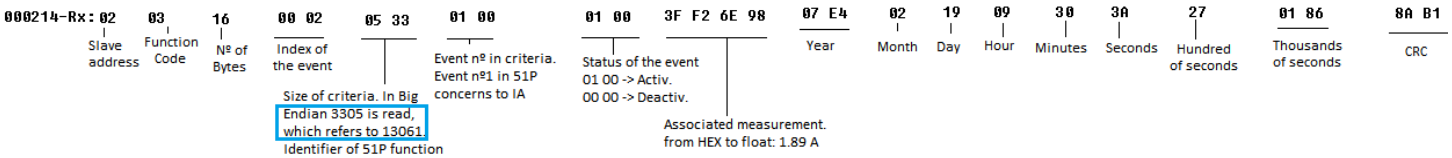
Then write the event index from which you want to start reading on the 8002 address. For reading the first event:



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



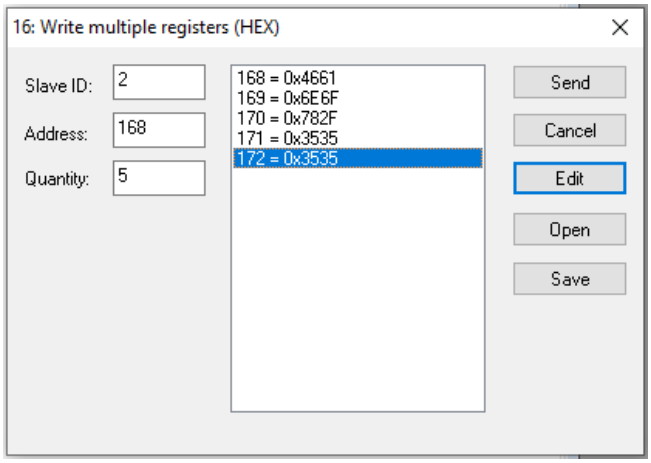
The response includes the identifier of the criteria, number of the event in that criteria (info available on the status map), status of the event (active/desactivate) and associated measurement and date:



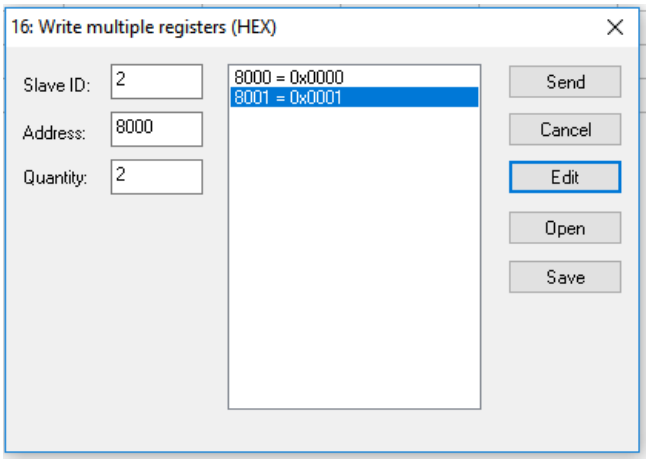
Continue reading in same 8123 direction for obtaining the nexts events of the report.

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:



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:



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 8E 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 00 A2 8D
```

Slave Address | Function Code | Nº of bytes | Year | Month | Day | Hour | Minutes | Seconds | Thousand of seconds | Trip Reason | CRC

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 SILG 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



Bizkaia Technology Park

Building, 604

Derio, 48160 Bizkaia SPAIN

T. +34 94 471 14 09

fanox@fanox.com

www.fanox.com

www.fanox.com