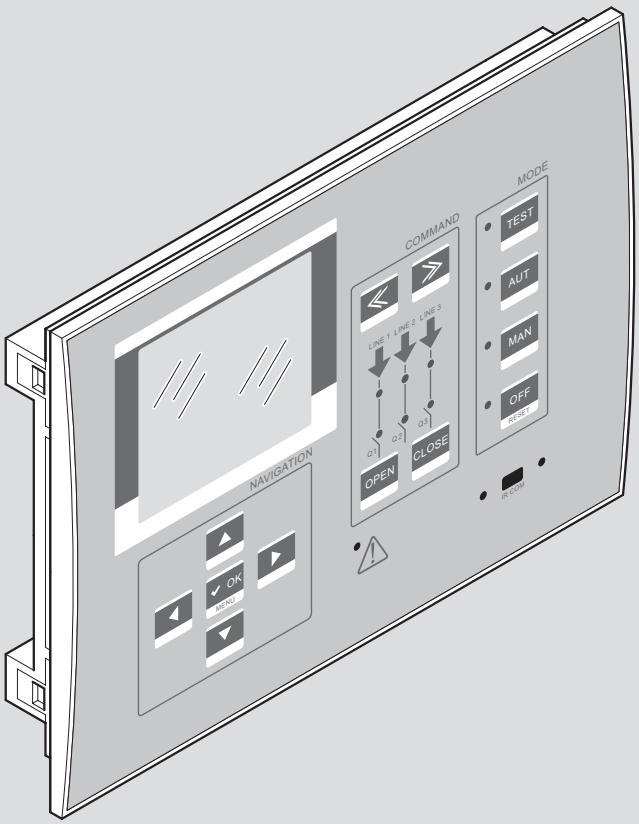
Three-Sources Management System (T.S.M.S.)

Modbus instruction manual



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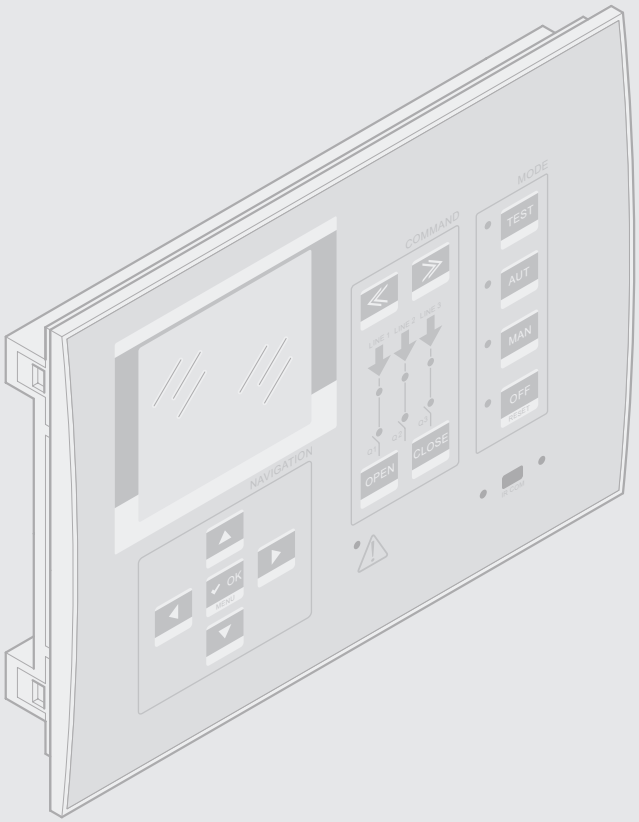

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1. Modbus® protocol

The Legrand 4 226 84 three sources management system supports the communication protocols Modbus RTU® and Modbus ASCII®.
Using this function, it is possible to read the device status and to control the units through Legrand Webservers offer, third-party supervision software (SCADA) or through other intelligent devices supporting Modbus®, like PLCs.

2. Parameters setting

To configure the Modbus® protocol, enter SETUP MENU and choose the M10 menu to configure communication port.

MENU M10 – COMMUNICATION
Serial communication.

PAR	FUNCTION	DEFAULT	RANGE
P10.1.01	Node address	01	01-255
P10.1.02	Serial port speed	19200	1200 2400 4800 9600 19200 38400 57600 115200
P10.1.03	Data format	8 bit – n	8 bit –no par. 8 bit, odd 8 bit, even 7 bit, odd 7 bit, even
P10.1.04	Stop bits	1	1-2
P10.1.05	Protocol	Modbus RTU	Modbus RTU Modbus ASCII

3. Modbus® RTU protocol

If one selects the Modbus® RTU protocol, the communication message has the following structure:

T1T2T3	Address (8 bit)	Function (8 bit)	Data (N x 8 bit)	CRC (16 bit)	T1T2T3

- The Address field holds the serial address of the slave destination device.
- The Function field holds the code of the function that must be executed by the slave.
- The Data field contains data sent to the slave or data received from the slave in response to a query.
- The maximum length for the data field is 80 16-bit registers (160 bytes)
- The CRC field allows the master and slave devices to check the message integrity. If a message has been corrupted by electrical noise or interference, the CRC field allows the devices to recognize the error and thereby to ignore the message.
- The T1 T2 T3 sequence corresponds to a time in which data must not be exchanged on the communication bus to allow the connected devices to recognize the end of one message and the beginning of another. This time must be at least 3.5 times the time required to send one character.

The device measures the time that elapses from the reception of one character and the following. If this time exceeds the time necessary to send 3.5 characters at the selected baud rate, then the next character will be considered as the first of a new message.

4. Modbus® functions

The available functions are:

03 = Read input register	Allows to read the device measures.
04 = Read input register	Allows to read the device measures.
06 = Preset single register	Allows writing parameters
07 = Read exception	Allows to read the device status
10 = Preset multiple register	Allows writing several parameters
17 = Report slave ID	Allows to read information about the device.

For instance, to read the number number of switching alarms of breaker 1, which resides at location 58 (3Ah), from the DEVICE with serial address 01, the message to send is the following:

01	04	00	39	00	02	A1	C6

Where:
01= slave address
04 = Modbus® function 'Read input register'
00 39 = Address of the required register (number of switching alarms of breaker 1) decreased by one
00 02 = Number of registers to be read beginning from address 22
A1 C6 = CRC Checksum

The DEVICE answer is the following:

01	04	04	00	00	00	0A	7B	83

Where:
01 = DEVICE address (Slave 01)
04 = Function requested by the master
04 = Number of bytes sent by the DEVICE
00 00 00 0A = Hex value of number of switching alarms of breaker 1 = 10
7B 83 = CRC checksum

4.1 Function 04: read input register

The Modbus® function 04 allows to read one or more consecutive registers from the slave memory. The address of each measure is given in the table "Measures". As for Modbus® standard, the address in the query message must be decreased by one from the effective address reported in the table.
If the measure address is not included in the table or the number of requested registers exceeds the acceptable max number, the DEVICE will return an error code (see error table).

Master query:

Slave address	08h
Function	04h
MSB address	00h
LSB address	0Fh
MSB register number	00h
LSB register number	08h
LSB CRC	C1h
MSB CRC	56h

In the above example, slave 08 is requested for 8 consecutive registers beginning with address 10h. Thus, registers from 10h to 17h will be returned. As usual, the message ends with the CRC checksum.

Slave response:

Slave address	08h
Function	04h
Byte number	10h
MSB register 10h	00h
LSB register 10h	00h
----------	----
MSB register 17h	00h
LSB register 17h	00h
LSB CRC	8Ah
MSB CRC	B1h

The response is always composed of the slave address, the function code requested by the master and the contents of the requested registers. The answer ends with the CRC.

4.2 Function 06: preset single register

This function allows to write in the registers. It can be used only with registers with address higher than 1000h. For instance, it is possible to change setup parameters. If the value is not in the correct range, the DEVICE will answer with an error message. In the same way, if the parameter address is not recognised, the DEVICE will send an error response.
The address and the valid range for each parameter are indicated in Table "Commands".

Master message:

Slave address	08h
Function	06h
MSB address	2Fh
LSB address	0Fh
MSB register number	00h
LSB register number	0Ah
LSB CRC	31h
MSB CRC	83h

Slave response:
The slave response is an echo to the query, that is the slave sends back to the master the address and the new value of the variable.

4. Modbus® functions

4.3 Function 07: read exception status

This function allows to read the status of the automatic transfer switch.

Master query:

Slave address	08h
Function	07h
LSB CRC	47h
MSB CRC	B2h

Following table explains meaning of the answer bye sent by device:

BIT	MEANING
0	Operative mode OFF / Reset
1	Operative mode MAN
2	Operative mode AUT
3	Operative mode TEST
4	On error
5	AC power supply ok
6	DC power supply ok
7	Global alarm on

4.4 Function 16: preset multiple register

This function allows to modify multiple parameters with a single message, or to preset a value longer than one register.

Master message: Slave response:

Slave address	08h
Function	10h
MSB register address	20h
LSB register address	01h
MSB register number	00h
LSB register number	02h
Number of byte ((it is the double of the above)	04h
MSB data	00h
LSB data	00h
MSB data	00h
LSB data	00h
LSB CRC	85h
MSB CRC	3Eh

Slave address	08h
Function	10h
MSB register address	20h
LSB register address	01h
MSB byte number	00h
LSB byte number	02h
LSB CRC	1Bh
MSB CRC	51h

4.5 Function 17: report slave ID

This function allows to identify the device type.

Master query:

Slave address	08h
Function	11h
LSB CRC	C6h
MSB CRC	7Ch

Slave response:

Slave address	08h
Function	11h
Bytes counter	08h
Data 01 (Type) ❶	76h
Dato 02 (software revision)	01h
Dato 03 (hardware revision)	00h
Dato 04 (parameters revision)	01h
Data 05 (product type) ❷	04h
Dato 06 (reserved)	00h
Dato 07 (reserved)	00h
Dato 08 (reserved)	00h
LSB CRC	B0h
MSB CRC	2Ah

❶ 118 - 76h = 4 226 84
❷ 4 – 04h= TSMS series

4.6 Errors

In case the slave receives an incorrect message, it answers with a massage composed by the queried function ORed with 80h, followed by an error code byte. In the following table are reported the error codes sent by the slave to the master:

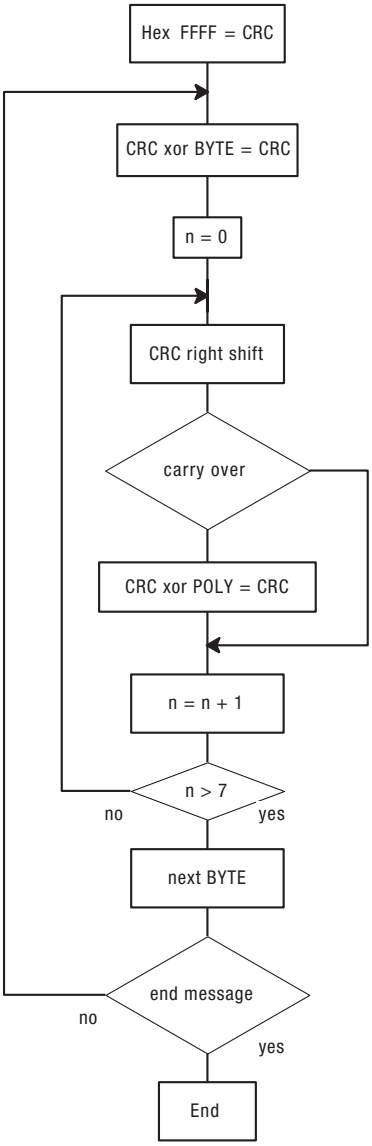
CODE	ERROR
01	Invalid function
02	Invalid address
03	Parameter out of range
04	Function execution impossible
06	Slave busy, function momentarily not available

4. Modbus® functions

4.7 CRC calculation (CHECKSUM for RTU)

Example of CRC calculation:
Frame = 0207h

CRC initialization	**1111**	**1111**	**1111**	**1111**
Load the first byte	0000	0010		
Execute xor with the first Byte of the frame	1111	1111	1111	1101
Execute 1st right shift	0111	1111	1111	1110 **1**
Carry=1, load polynomial	1010	0000	0000	0001
Execute xor with the polynomial	1101	1111	1111	1111
Execute 2nd right shift	0110	1111	1111	1111 **1**
Carry=1, load polynomial	1010	0000	0000	0001
Execute xor with the polynomial	1100	1111	1111	1110
Execute 3rd right shift	0110	0111	1111	1111 **0**
Execute 4th right shift	0011	0011	1111	1111 **1**
Carry=1, load polynomial	1010	0000	0000	0001
Execute xor with the polynomial	1001	0011	1111	1110
Execute 5th right shift	0100	1001	1111	1111 **0**
Execute 6th right shift	0010	0100	1111	1111 **1**
Carry=1, load polynomial	1010	0000	0000	0001
Execute xor with the polynomial	1000	0100	1111	1110
Execute 7th right shift	0100	0010	0111	1111 **0**
Execute 8th right shift	0010	0001	0011	1111 **1**
Carry=1, load polynomial	1010	0000	0000	0001
Load the second byte of the frame	0000	0111		
Execute xor with the second byte of the frame	1000	0001	0011	1001
Execute 1st right shift	0100	0000	1001	1100 **1**
Carry=1, load polynomial	1010	0000	0000	0001
Execute xor with the polynomial	1110	0000	1001	1101
Execute 2nd right shift	0111	0000	0100	1110 **1**
Carry=1, load polynomial	1010	0000	0000	0001
Execute xor with the polynomial	1101	0000	0100	1111
Execute 3rd right shift	0110	1000	0010	0111 **1**
Carry=1, load polynomial	1010	0000	0000	0001
Execute xor with the polynomial	1100	1000	0010	0110
Execute 4th right shift	0110	0100	0001	0011 **0**
Execute 5th right shift	0010	0100	0000	1001 **1**
Carry=1, load polynomial	1010	0000	0000	0001
Execute xor with the polynomial	1001	0010	0000	1000
Execute 6th right shift	0100	1001	0000	0100 **0**
Execute 7th right shift	0010	0100	1000	0010 **0**
Execute 8th right shift	0001	0010	0100	0001 **0**
CRC Result	**0001 0100 12h**	**0010 0001 41h**		



Note: The byte 41h is sent first(even if it is the LSB), then12h is sent.

5. Modbus® ASCII protocol

The Modbus® ASCII protocol is normally used in application that require to communicate through a couple of modems. The functions and addresses available are the same as for the RTU version, but the transmitted characters are in ASCII and the message end is delimited by Carriage return/ Line Feed instead of a transmission pause.
If one selects the parameter P10.n.05 as Modbus® ASCII protocol, the communication message on the correspondent communication port has the following structure:

:	Address (2 chars)	Function (2 chars)	Dates (N chars)	LRC (2 chars)	CR LF

- The Address field holds the serial address of the slave destination device.
- The Function field holds the code of the function that must be executed by the slave.
- The Data field contains data sent to the slave or data received from the slave in response to a query.
- The LRC field allows the master and slave devices to check the message integrity. If a message has been corrupted by electrical noise or interference, the LRC field allows the devices to recognize the error and thereby ignore the message.
- The message terminates always with CRLF control character (0D 0A).

5.1 LRC calculation (CHECKSUM for ASCII)

Example of LRC calculation:

Address	01	00000001
Function	04	00000100
Start address hi.	00	00000000
Start address lo.	00	00000000
Number of registers	08	00001000
	Sum	00001101
	1. complement	11110010
	+ 1	00000001
	2. complement	11110101

LRC result **F5**

(continued)

6. Measures supplied by serial communication protocol

To be used with functions 03 and 04.

ADDRESS	WORDS	MEASURE	UNIT	FORMAT
02h	2	Voltage of line 1 L1-N	V	Unsigned long
04h	2	Voltage of line 1 L2-N	V	Unsigned long
06h	2	Voltage of line 1 L3-N	V	Unsigned long
08h	2	Voltage of line 1 L1-L2	V	Unsigned long
0Ah	2	Voltage of line 1 L2-L3	V	Unsigned long
0Ch	2	Voltage of line 1 L3-L1	V	Unsigned long
0Eh	2	Voltage of line 2 L1-N	V	Unsigned long
10h	2	Voltage of line 2 L2-N	V	Unsigned long
12h	2	Voltage of line 2 L3-N	V	Unsigned long
14h	2	Voltage of line 2 L1-L2	V	Unsigned long
16h	2	Voltage of line 2 L2-L3	V	Unsigned long
18h	2	Voltage of line 2 L3-L1	V	Unsigned long
1Ah	2	Frequency of line 1	Hz/10	Unsigned long
1Ch	2	Frequency of line 2	Hz/10	Unsigned long
1Eh	2	Battery voltage (DC power supply)	VDC / 10	Unsigned long
20h	2	Total operation time	s	Unsigned long
22h	2	Line 1 ok total time	s	Unsigned long
24h	2	Line 2 ok total time	s	Unsigned long
26h	2	Line 1 not ok total time	s	Unsigned long
28h	2	Line 2 not ok total time	s	Unsigned long
2Ah	2	Line 1 breaker closed total time	s	Unsigned long
2Ch	2	Line 2 breaker closed total time	s	Unsigned long
2Eh	2	Breaker opened total time	s	Unsigned long
30h	2	(not used)	--	Unsigned long
32h	2	Number of operations of line 1 breaker in AUT	nr	Unsigned long
34h	2	Number of operations of line 2 breaker in AUT	nr	Unsigned long
36h	2	Number of operations of line 1 breaker in MAN	nr	Unsigned long
38h	2	Number of operations of line 2 breaker in MAN	nr	Unsigned long
3Ah	2	Number of switching alarms of breaker 1	nr	Unsigned long
3Ch	2	Number of switching alarms of breaker 2	nr	Unsigned long
3Eh	2	(not used)	--	Unsigned long
50h	2	Minimum battery voltage	V	Unsigned long
52h	2	Maximum battery voltage	V	Unsigned long
54h	2	Maintenance hours line 1	nr	Unsigned long

ADDRESS	WORDS	MEASURE	UNIT	FORMAT
56h	2	Maintenance hours line 2	nr	Unsigned long
58h	2	Operations to the maintenance of the breaker 1	nr	Signed long
5Ah	2	Operations to the maintenance of the breaker 2	nr	Signed long
21C0h	1	OR of all limits	bits	Unsigned int
1D00h	2	Counter CNT 1	UM1	long
1D02h	2	Counter CNT 2	UM2	long
1D04h	2	Counter CNT 3	UM3	long
1D06h	2	Counter CNT 4	UM4	long
1D08h	2	Counter CNT 5	UM5	long
1D0Ah	2	Counter CNT 6	UM6	long
1D0Ch	2	Counter CNT 7	UM7	long
1D0Eh	2	Counter CNT 8	UM8	long
9Ah	2	Alarms ❶	bits	Unsigned long
9Ch	2	Alarms ❷	bits	Unsigned long

6. Measures supplied by serial communication protocol

❶ Reading the words starting at address 9Ah will return 32 bits with the following meaning:

BIT	CODE	ALARM
0	A01	Battery voltage too low
1	A02	Battery voltage too high
2	A03	S.Q1 breaker timeout
3	A04	S.Q2breaker timeout
4	A05	S.Q3breaker timeout
5	A06	Incorrect phase sequence Line S1
6	A07	Incorrect phase sequence Line S2
7	A08	Incorrect phase sequence Line S3
8	A09	Load timeout not powered
9	A10	Local battery charger failure
10	A11	Genset battery charger 1 failure
11	A12	Genset battery charger 2 failure
12	A13	Genset battery charger 3 failure
13	A14	Emergency
14	A15	S.Q1breaker protection trip
15	A16	S.Q2breaker protection trip
16	A17	S.Q3 breaker protection trip
17	A18	S.Q1 breaker withdrawn
18	A19	S.Q2breaker withdrawn
19	A20	S.Q3breaker withdrawn
20	A21	S.Q1genset line not available
21	A22	S.Q2genset line not available
22	A23	S.Q3genset line not available
23	A24	Maintenance hours S1
24	A25	Maintenance hours S2
25	A26	Maintenance hours S3
26	A27	Maintenance operations S.Q1
27	A28	Maintenance operations S.Q2
28	A29	Maintenance operations S.Q3
29	A30	Auxiliary voltage breaker alarm
30	A31	Non-priority load breaker timeout
31	A32	Tie breaker QC1 timeout

❷ Reading the words starting at address 9Ch will return 32 bits with the following meaning:

BIT	CODE	ALARM
0	A33	Tie breaker QC2 timeout
1	A34	NPL (Non-Priotity-Load) breaker protection trip
2	A35	QC1 tie breaker protection trip
3	A36	QC2 tie breaker protection trip
4	A37	NPL (Non-Priotity-Load) breaker withdrawn
5	A38	QC1 tie breaker withdrawn
6	A39	QC2 tie breaker withdrawn
7	UA1	User alarms
8	UA2	User alarms
9	UA3	User alarms
10	UA4	User alarms
11	UA5	User alarms
12	UA6	User alarms
13	UA7	User alarms
14	UA8	User alarms
15	-	(not used)
16	-	(not used)
17	-	(not used)
18	-	(not used)
19	-	(not used)
20	-	(not used)
21	-	(not used)
22	-	(not used)
23	-	(not used)
24	-	(not used)
25	-	(not used)
26	-	(not used)
27	-	(not used)
28	-	(not used)
29	-	(not used)
30	-	(not used)
31	-	(not used)

ADDRESS	WORDS	MEASURE	UNIT	FORMAT
80h	2	Voltage of line 3 L1-N	V	Unsigned long
82h	2	Voltage of line 3 L2-N	V	Unsigned long
84h	2	Voltage of line 3 L3-N	V	Unsigned long
86h	2	Voltage of line 3 L1-L2	V	Unsigned long
88h	2	Voltage of line 3 L2-L3	V	Unsigned long
8Ah	2	Voltage of line 3 L3-L1	V	Unsigned long
8Ch	2	Frequency of line 3	Hz/10	Unsigned long
8Eh	2	Line 3 ok total time	h/3600	Unsigned long
90h	2	Line 3 not ok total time	h/3600	Unsigned long
92h	2	Line 3 breaker closed total time	h/3600	Unsigned long
94h	2	Number of operations of line 3 breaker in AUT	nr	Unsigned long
96h	2	Number of operations of line 3 breaker in MAN	nr	Unsigned long
98h	2	Number of switching alarms of breaker 3	nr	Unsigned long
A6h	2	Maintenance hours line 3	h/3600	Unsigned long
A8h	2	Operations to the maintenance of the breaker 3	nr	Signed long
438h	2	Current line 1 – I1	A/10000	Signed long
43Ah	2	Current line 1 – I2	A/10000	Signed long
43Ch	2	Current line 1 – I3	A/10000	Signed long
43Eh	2	Current line 2 – I1	A/10000	Signed long
440h	2	Current line 2 – I2	A/10000	Signed long
442h	2	Current line 2 – I3	A/10000	Signed long
444h	2	Current line 3 – I1	A/10000	Signed long
446h	2	Current line 3 – I2	A/10000	Signed long
448h	2	Current line 3 – I3	A/10000	Signed long
494h	2	Current line 1 – In	A/10000	Signed long
49Ah	2	Current line 2 – In	A/10000	Signed long
4A0h	2	Current line 3 – In	A/10000	Signed long
44Ah	2	Active power Line 1 – L1	kW/10000	Signed long
44Ch	2	Active power Line 1 – L2	kW/10000	Signed long
44Eh	2	Active power Line 1 – L3	kW/10000	Signed long
45Ch	2	Reactive power Line 1 – L1	kVAr/10000	Signed long
45Eh	2	Reactive power Line 1 – L2	kVAr/10000	Signed long
460h	2	Reactive power Line 1 – L3	kVAr/10000	Signed long
46Eh	2	Apparent power Line 1 – L1	kVA/10000	Signed long
470h	2	Apparent power Line 1 – L2	kVA/10000	Signed long
472h	2	Apparent power Line 1 – L3	kVA/10000	Signed long
480h	2	PF Line 1 – L1	/10000	Signed long
482h	2	PF Line 1 – L2	/10000	Signed long

continue

6. Measures supplied by serial communication protocol

ADDRESS	WORDS	MEASURE	UNIT	FORMAT
484h	2	PF Line 1 – L3	/10000	Signed long
450h	2	Active power Line 2 – L1	kW/10000	Signed long
452h	2	Active power Line 2 – L2	kW/10000	Signed long
454h	2	Active power Line 2 – L3	kW/10000	Signed long
462h	2	Reactive power Line 2 – L1	kVAr/10000	Signed long
464h	2	Reactive power Line 2 – L2	kVAr/10000	Signed long
466h	2	Reactive power Line 2 – L3	kVAr/10000	Signed long
474h	2	Apparent power Line 2 – L1	kVA/10000	Signed long
476h	2	Apparent power Line 2 – L2	kVA/10000	Signed long
478h	2	Apparent power Line 2 – L3	kVA/10000	Signed long
486h	2	PF Line 2 – L1	/10000	Signed long
488h	2	PF Line 2 – L2	/10000	Signed long
48Ah	2	PF Line 2 – L3	/10000	Signed long
456h	2	Active power Line 3 – L1	kW/10000	Signed long
458h	2	Active power Line 3 – L2	kW/10000	Signed long
45Ah	2	Active power Line 3 – L3	kW/10000	Signed long
468h	2	Reactive power Line 3 – L1	kVAr/10000	Signed long
46Ah	2	Reactive power Line 3 – L2	kVAr/10000	Signed long
46Ch	2	Reactive power Line 3 – L3	kVAr/10000	Signed long
47Ah	2	Apparent power Line 3 – L1	kVA/10000	Signed long
47Ch	2	Apparent power Line 3 – L2	kVA/10000	Signed long
47Eh	2	Apparent power Line 3 – L3	kVA/10000	Signed long
48Ch	2	PF Line 3 – L1	/10000	Signed long
48Eh	2	PF Line 3 – L2	/10000	Signed long
490h	2	PF Line 3 – L3	/10000	Signed long
4A4h	2	Total active power Line 1	kW/10000	Signed long
4Aah	2	Total active power Line 2	kW/10000	Signed long
4B0h	2	Total active power Line 3	kW/10000	Signed long
4A6h	2	Total reactive power Line 1	kVAr/10000	Signed long
4ACh	2	Total reactive power Line 2	kVAr/10000	Signed long
4B2h	2	Total reactive power Line 3	kVAr/10000	Signed long
4A8h	2	Total apparent power Line 1	kVA/10000	Signed long
4AEh	2	Total apparent power Line 2	kVA/10000	Signed long
4B4h	2	Total apparent power Line 3	kVA/10000	Signed long
492h	2	PFT Line 1	/10000	Signed long
498h	2	PFT Line 2	/10000	Signed long
49Eh	2	PFT Line 3	/10000	Signed long

7. Status bits

To be used with functions 03 and 04.

ADDRESS	WORDS	FUNCTION	FORMAT
2070h	1	Front panel keyboard status ❶	Unsigned integer
2100h	2	Digital inputs status (by pin) ❷	Unsigned integer
2140h	2	Digital outputs status (by pin) ❸	Unsigned integer
2074h	1	Line 1 voltage status ❹	Unsigned integer
2075h	1	Line 1 breaker status ❺	Unsigned integer
2176h	1	Line 2 voltage status ❹	Unsigned integer
2177h	1	Line 2 breaker status ❺	Unsigned integer
2083h	1	Line 3 voltage status ❹	Unsigned integer
2084h	1	Line 3 breaker status ❺	Unsigned integer
2078h	2	Input function status ❻	Unsigned integer
207Ah	1	Output function status ❼	Unsigned integer
207Bh	1	Display messages status ❽	Unsigned integer
207Ch	1	Controller general status ❾	Unsigned integer
207Eh	1	Frontal LED status	Unsigned integer
207Fh	1	Frontal LED status	Unsigned integer
2085h	1	Display massages	Unsigned integer

❶ Following table shows meaning of bits of the word at address 2070h:

BIT	KEY
0	UP
1	OFF/RESET
2	MAN
3	DOWN
4	AUT/ENTER
5...15	Not used

7. Status bits

❷ Following table shows meaning of bits of the word at address 2100h:

BIT	INPUT
0	Input 1
1	Input 2
2	Input 3
3	Input 4
4	Input 5
5	Input 6
6	Input 7
7	Input 8
8	Input 9
9	Input 10
10	Input 11
11	Input 12
12	Input 13
13	Input 14
14	Input 15
15	Input 16
16	Input 17
17	Input 18
18	Input 19
19	Input 20

❸ Following table shows meaning of bits of the word at address 2140h:

BIT	OUTPUT
0	Output 1
1	Output 2
2	Output 3
3	Output 4
4	Output 5
5	Output 6
6	Output 7
7	Output 8
8	Output 9
9	Output 10
10	Output 11
11	Output 12
12	Output 13
13	Output 14
14	Output 15
15	Output 16
16	Output 17
17	Output 18
18	Output 19
19	Output 20
20..31	Not used

❹ Following table shows meaning of bits of the word at address 2074h (Line 1), 2176h (Line 2) or 2083h (line 3):

BIT	LINE STATUS
0	Line values into limits
1	Line values into limits delayed
2	Voltage into limits
3	Voltage ok
4	Frequency into limits
5	Frequency ok
6	Voltage below min
7	Voltage above max
8	Voltage asymmetry
9	Voltage phase loss
10	Frequency below min
11	Frequency above max
12	Wrong phase sequence
13	All line parameters ok
14-15	Not used

❺ Following table shows meaning of bits of the word at address 2075h (Line 1) and 2177h (Line 2):

BIT	BREAKER STATUS
0	Breaker closed
1	Trip alarm
2	Withdrawn alarm
3	Command status (1 = close)
4	Close command output
5	Open command output
6...15	Not used

❻ Following table shows meaning of bits of the word at address 2178h:

BIT	INPUT FUNCTIONS STATUS
0	Line 1 breaker closed feedback
1	Line 1 breaker trip
2	Not used
3	Line 2 breaker closed feedback
4	Line 2 breaker trip
5	Not used
6	Transfer to secondary line
7	Inhibit return to main line
8	Emergency pushbutton
9	Generator start
10	Generator 1 ready
11	Generator 2 ready
12	Keyboard locked
13	Lock parameters
14	Not used
15	Alarms inhibited

❼ Following table shows meaning of bits of the word at address 207Ah:

BIT	OUTPUT FUNCTIONS STATUS
0	Line 1 breaker open
1	Line 1 breaker close
2	Line 2 breaker open
3	Line 2 breaker close
4	Global alarm
5	Generator 1 start
6	Generator 2 start
7	Device ready
8	Load shed
9	Not used
10	Not used
11	Open all
12	Undervoltage coil 1
13	Undervoltage coil 2
14	Line 1 OK
15	Line 2 OK

7. Status bits

❽ Following table shows meaning of bits of the word at address 207Bh:

BIT	DISPLAY MESSAGE STATUS
0	Generator 1 start
1	Generator 2 start
2	Generator 1 cooling
3	Generator 2 cooling
4	Load transfer 2 ➔ 1
5	Load transfer 1 ➔ 2

❾ Following table shows meaning of bits of the word at address 207Ch:

BIT	OUTPUT FUNCTIONS STATUS
0	Operative mode OFF / Reset
1	Operative mode MAN
2	Operative mode AUT
3	Operative mode TEST
4	Error on
5	AC power supply present
6	DC power supply present
7	Global alarm on
8...15	Not used

8. Commands

To be used with function 06.

ADDRESS	WORDS	STATUS
4F00 H	1	Set remote variable REM1 ❶
4F01 H	1	Set remote variable REM2
……		
4F07H	1	Set remote variable REM8
2F00H	1	Operative mode change ❷
2F0AH	1	Front panel keystorke simulation ❸
2F03H	1	**Value 01h**: Memory save
		Value 04h: reboot
2F07H	1	**Value 00h**: Reset device
		Value 01h: Reset device and save memory
2FF0H	1	Command menu execution ❹
28FAH	1	**Value 01H**: Save real time clock setting

❶ Writing AAh to the indicated address the remote variable will be set to 1, writing BBh the remote variable will be set to 0.
❷ The following table shows the values to be written to address 2F00h to achieve the correspondent function.

VALUE	FUNCTION
0	Switch to OFF mode
1	Switch to MAN mode
2	Switch to AUT mode

❸ The following table shows the bit position of the value to be written to address 2F0Ah to achieve the correspondent function.

BIT	MEANING
0	Key up
1	MAN mode
2	Key right
3	START
4	TEST mode
5	OFF mode
6	AUT mode
7	STOP mode

8. Commands

❹ Writing value between 0 and 15 to the indicated address, the correspondent command will be executed:

	MEANING
0	Reset maintenance 1
1	Reset maintenance 2
2	Reset maintenance operations 1
3	Reset maintenance operations 2
4	Reset generic counters CNTx
5	Reset LIMx limits
6	Reset hours counter line 1/line 2
7	Reset hours counter S.Q1/ S.Q2
8	Reset breaker operation
9	Reset events list
10	Reset default parameters
11	Save parameters in backup memory
12	Reload parameters from backup memory
13	Forced I/O
14	Reset A03 – A04 alarms
15	Simulate line failure

9. Device global status

To be used with function 03 e 04.

ADDRESS	WORDS	STATUS	FORMAT
2210H	2	Device global status (bit 0-bit31 ❷	Unsigned integer

❷ Reading two words at address 2210H will return 32 bits with the following meaning:

BIT	MEANING
0	Device OFF
1	Device in MAN mode
2	Device in AUT mode
3	Device TEST mode
4	Voltage Line 1 OK
5	Voltage Line 2 OK
6	Voltage Line 3 OK
7	Global alarm A
8	Global alarm B
9	Automatic test line 1 in progress
10	Automatic test line 2 in progress
11	Automatic test line 3 in progress
12	Remote control
13	Clock 100 msec
14...31	(not used)

10. Real time clock

To be used with functions 04 and 06.
To make effective the changes, store them using the dedicated command.

ADDRESS	WORDS	FUNCTION	RANGE
28F0H	1	Year	2000..2099
28F1H	1	Month	1-12
28F2H	1	Day	1-31
28F3H	1	Hours	0-23
28F4H	1	Minutes	0-59
28F5H	1	Seconds	0-59

11. Event log reading

To read the events must do the following:

1. Perform the read of 1 register by using the **function 4** at address **5030H**, the most significant byte (msb) indicates how many events are stored (value between 0 to 100), the least significant byte (lsb) is incremented each time an event is saved (value between 0 to 100). Once stored the 100 events the msb will remain at 100 while the lsb will back to zero and after will continue to increase.
2. Set the index of the event that you want to read (less than the maximum number of events stored), to do this you perform the **function 6** at **5030H**, specifying which event read.
3. Perform a read of 43 registers (with a single **function 4**) at address **5032H**.
4. The value returned is a string of 86 ASCII characters, showing the same event description device visible on the display. The index of the event to be read is incremented automatically after a reading of the register **5032H**, in order to speed up the download of events.
5. If you want to read the next event performing step 4, if you want to read any other event do step 3.

EXAMPLE

Step 1: Reading events stored.

MASTER Function = 4 (04H)
Address = 5030H (5030H – 0001H =502FH)
Nr. registers = 1 (01H)

01	04	50	2F	00	01	11	03

DEVICE Function = 4
Nr. bytes. = 1 (01H)
MSB = 100 (64H)
LSB = 2 (02H)

01	04	02	64	42	13	C1

Step 2: Set the index of the event to read.

MASTER Function = 6(06H)
Address = 5030H (5030H – 0001H =502FH)
Value = 1 (01H)

01	06	50	2F	00	01	68	C3

DEVICE Function = 6
Address = 5030H (5030H – 0001H =502FH)
Value = 1 (01H)

01	06	50	2F	00	01	68	C3

Step 3: Read the event.

MASTER Function = 4 (04H)
Address = 5032H (5032H – 0001H =5031H)
Nr. registers = 43 (2BH)

01	04	50	31	00	2B	F0	DA

DEVICE Function = 4 (04H)
Address = 5030H (5030H – 0001H =502FH)
Nr. bytes = 86 (56H)

String = 2012/07/18;09:34:52;E1100, CHANGE MODE TO OFF

01	04	56	32	30	31	30	2F	30	31	2F	30	31	3B	30	30	3A	31	34	3A
30	31	3B	45	30															

12. Parameter setting

Using the Modbus® protocol it is possible to access the menu parameters.
To correctly understand the correspondence between the numeric value and the selected function and/or the unit of measure, please see the device operating manual.

12.1 Procedure for the reading of parameters

1. Write the value of the menu that you want to read by using the **function 6** at address **5000H** ❶.
2. Write the value of the submenu (if it is present) that you want to read by using the **function 6** at address **5001H** ❶.
3. Write the value of the parameter that you want to read by using the **function 6** at address **5002H** ❶.
4. Perform the **function 4** at the address **5004H**, with a number of registers appropriate to the length of the parameter (see table).
5. If you want to read the next parameter (in the same menu/submenu) repeat step 4, otherwise perform step 1.

12.2 Procedure for the writing of parameters

1. Write the value of the menu that you want to change by using the **function 6** at address **5000H** ❶.
2. Write the value of the submenu (if it is present) that you want to change by using the **function 6** at address **5001H** ❶.
3. Write the value of the parameter that you want to change by using the **function 6** at address **5001H** ❶.
4. Perform the **function 16** at address **5004H**, with a number of registers appropriate to the length of the parameter
5. If you want to write the next parameter, in the same menu / submenu repeat step 4, otherwise perform step 1, if you do not have to write additional parameters go to step 6.
6. To make effective the changes made to setup parameters it is necessary to store the values in EEPROM, using the dedicated command described in table "Status bits" (write value 4 by using **function 6** at address **2F03H**)

TYPE OF PARAMETER	NUMBER OF REGISTER
Text length 6 characters (ex. M14.0x.06)	3 registers (6 byte)
Text length 16 characters (ex. M14.0x.05)	8 registers (16 byte)
Text length 20 characters (ex. M15.0x.03)	10 registers (20 byte)
Abs(Numeric value) < 32768 (ex M01.05)	1 registers (2 byte)
Abs(Numeric value) > 32768 (ex M12.01)	2 registers (4 byte)

❶ It's 'possible to read the menu, submenus, and parameter stored at the addresses **5000H**, **5001H** and **5002H** by using the **function 4**.

EXAMPLE
Set to 8 the value of parameter M08.01.01.

Step 1: Set menu 08.
MASTER Function = 6
Address = 5000H (5000H – 0001H =4FFFH)
Value = 8 (08H)

01	06	4F	FF	00	08	AE	E8

DEVICE Function = 6
Address = 5000H (000H – 0001H =4FFFH)
Value = 8 (08H)

01	06	4F	FF	00	08	AE	E8

12. Parameter setting

Step 2: Set submenu 01.
MASTER Function = 6
Address = 5001H (5001H – 0001H =5000H)
Value = 1 (01H)

01	06	50	00	00	01	59	0A

DEVICE Function = 6
Address = 5001H (5001H – 0001H =5000H)
Value = 1 (01H)

01	06	50	00	00	01	59	0A

Step 3: Set parameter 01.
MASTER Function = 6
Address = 5002H (5002H – 0001H =5001H)
Value = 1 (01H)

01	06	50	01	00	01	08	CA

DEVICE Function = 6
Address = 5002H (5002H – 0001H =5001H)
Value = 1 (02H)

01	06	50	01	00	01	08	CA

Step 4: Set value 8.
MASTER Function = 16 (10H)
Address = 5004H (5004H – 0001H =5003H)
Nr. register = 1 (01H)
Nr. bytes = 2 (02H)
Value = 8 (0008H)

01	10	50	03	00	02	04	00	00	00	08	4E	7F

DEVICE Function = 16 (10H)
Address = 5004H (5004H – 0001H =5003H)
Value = 2 (02H)

01	10	50	03	00	02	A0	C8

Step 6: Save and reboot.
MASTER Function = 6 (06H)
Address = 2F03H (2F03H – 0001H =2F02H)
Value = 4 (04H)

01	6	2F	02	00	04	21	1D

DEVICE No answer.

Three-Sources Management System (T.S.M.S.)

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