

MODBUS

Communication Protocol

for three-phase energy meters with built-in ETHERNET

PROTOCOL MANUAL

Ed2602

Limitation of Liability

The Manufacturer reserves the right to modify the specifications in this manual without previous warning. Any copy of this manual, in part or in full, whether by photocopy or by other means, even of electronic nature, without the manufacture giving written authorization, breaches the terms of copyright and is liable to prosecution.

It is absolutely forbidden to use the device for different uses other than those for which it has been devised for, as inferred to in this manual. When using the features in this device, obey all laws and respect privacy and legitimate rights of others.

EXCEPT TO THE EXTENT PROHIBITED BY APPLICABLE LAW, UNDER NO CIRCUMSTANCES SHALL THE MANUFACTURER BE LIABLE FOR CONSEQUENTIAL DAMAGES SUSTAINED IN CONNECTION WITH SAID PRODUCT AND THE MANUFACTURER NEITHER ASSUMES NOR AUTHORIZES ANY REPRESENTATIVE OR OTHER PERSON TO ASSUME FOR IT ANY OBLIGATION OR LIABILITY OTHER THAN SUCH AS IS EXPRESSLY SET FORTH HEREIN.

All trademarks in this manual are property of their respective owners.

The information contained in this manual is for information purposes only, is subject to changes without previous warning and cannot be considered binding for the Manufacturer. The Manufacturer assumes no responsibility for any errors or incoherence possibly contained in this manual.

Index

1. Description.....	3
2. Reading Command Structure	4
2.1 Modbus TCP.....	4
2.2 Floating Point as per IEEE Standard.....	5
3. Writing Command Structure	6
3.1 Modbus TCP.....	6
4. Exception Codes.....	7
4.1 Modbus TCP.....	7
5. General Information on Register Tables.....	8
6. Reading Registers (Function codes \$03, \$04)	9
7. Coils Reading (Function code \$01)	12
8. Writing Registers (Function code \$10)	13

1. DESCRIPTION

MODBUS TCP is a variant of the MODBUS family. Specifically, it covers the use of MODBUS messaging in an “Intranet” or “Internet” environment using the TCP/IP protocol on a fixed port 502.

Master-slave messages can be:

- Reading (Function codes \$01, \$03, \$04): the communication is between the master and a single slave. It allows to read information about the queried counter
- Writing (Function code \$10): the communication is between the master and a single slave. It allows to change the counter settings

In case of MODBUS TCP, slave address is replaced by a single byte, the Unit identifier.

Communication frame structure - TCP mode

Bit per byte: 1 Start, 7 Bit, Even, 2 Stop (7E2)

Name	Length	Function
TRANSACTION ID	2 bytes	For synchronization between messages of server & client
PROTOCOL ID	2 bytes	Zero for MODBUS TCP
BYTE COUNT	2 bytes	Number of remaining bytes in this frame
UNIT ID	1 byte	Slave address (255 if not used)
FUNCTION CODE	1 byte	Function code (\$01/ \$03 / \$04 / \$10)
DATA BYTES	n bytes	Data as response or command

2. READING COMMAND STRUCTURE

The master communication device can send commands to the meter to read its status, setup and the measured values.

More registers can be read, at the same time, sending a single command, only if the registers are consecutive (see chapter 5).The read command is structured as follows.

2.1 Modbus TCP

Values contained both in Query or Response messages are in hex format.

Query example in case of MODBUS TCP: 01000000006010400020002

Example	Byte	Description	No. of bytes
01	-	Transaction identifier	1
00	High	Protocol identifier	4
00	Low		
00	High		
00	Low		
06	-	Byte count	1
01	-	Unit identifier	1
04	-	Function code	1
00	High	Starting register	2
02	Low		
00	High	No. of words to be read	2
02	Low		

Response example in case of MODBUS TCP: 010000000070104040003571

Example	Byte	Description	No. of bytes
01	-	Transaction identifier	1
00	High	Protocol identifier	4
00	Low		
00	High		
00	Low		
07	-	Byte count	1
01	-	Unit identifier	1
04	-	Function code	1
04	-	No. of byte of requested data	2
00	High	Requested data	4
03	Low		
55	High		
71	Low		

2.2 Floating Point as per IEEE Standard

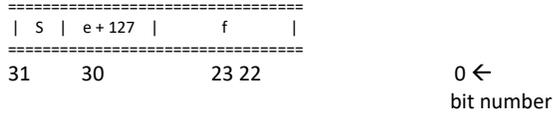
The basic format allows a IEEE standard floating-point number to be represented in a single 32 bit format, as shown below:

$$N.n = (-1)^S 2^{e'-127} (1.f)$$

where **S** is the sign bit, **e'** is the first part of the exponent and **f** is the decimal fraction placed next to 1. Internally the exponent is 8 bits in length and the stored fraction is 23 bits long.

A round to nearest method is applied to the calculated value of floating point.

The floating-point format is shown as follows:



where:

	bit length
Sign	1
Exponent	8
Fraction	23 + (1)
Total	m = 32 + (1)
Exponent	
Min e'	0
Max e'	255
Bias	127

NOTE: Fractions (decimals) are always shown while the leading 1 (hidden bit) is not stored.

Example of conversion of value shown with floating point

Value read with floating point:

45AACC00₍₁₆₎

Value converted in binary format:

0	10001011	010101011001100000000000 ₍₂₎
sign	exponent	fraction

sign = 0

exponent = 10001011₍₂₎ = 139₍₁₀₎

fraction = 010101011001100000000000₍₂₎ / 8388608₍₁₀₎ =
= 2804736₍₁₀₎ / 8388608₍₁₀₎ = 0.334350585₍₁₀₎

$N.n = (-1)^S 2^{e'-127} (1+f) =$
 $= (-1)^0 2^{139-127} (1.334350585) =$
 $= (+1) (4096) (1.334350585) =$
 $= 5465.5$

3. WRITING COMMAND STRUCTURE

The master communication device can send commands to the meter to program it.

More settings can be carried out, at the same time, sending a single command, only if the relevant registers are consecutive (see chapter 5). The write command is structured as follows.

3.1 Modbus TCP

Values contained both in Request or Response messages are in hex format.

Query example in case of MODBUS TCP: 0100000000901100515000102008

Example	Byte	Description	No. of bytes
01	-	Transaction identifier	1
00	High	Protocol identifier	4
00	Low		
00	High		
00	Low		
09	-	Byte count	1
01	-	Unit identifier	1
10	-	Function code	1
05	High	Starting register	2
15	Low		
00	High	No. of words to be written	2
01	Low		
02	-	Data byte counter	1
00	High	Data for programming	2
08	Low		

Response example in case of MODBUS TCP: 01000000006011005150001

Example	Byte	Description	No. of bytes
01	-	Transaction identifier	1
00	High	Protocol identifier	4
00	Low		
00	High		
00	Low		
06	-	Byte count	1
01	-	Unit identifier	1
10	-	Function code	1
05	High	Starting register	2
15	Low		
00	High	Command successfully sent	2
01	Low		

4. EXCEPTION CODES

When the meter receives a not-valid query, an error message (exception code) is sent.

The possible exception codes are as follows.

4.1 Modbus TCP

Values contained in Response messages are in hex format.

Response example in case of MODBUS TCP: 010000000003018302

Example	Byte	Description	No. of bytes
01	-	Transaction identifier	1
00	High	Protocol identifier	4
00	Low		
00	High	No. of byte of next data in this string	1
00	Low		
03	-	Unit identifier	1
01	-	Function code (80+03)	1
83	-	Exception code	1
02	-		

Exception codes for MODBUS TCP are following described:

- \$01** **ILLEGAL FUNCTION:** the function code is unknown by the server.
- \$02** **ILLEGAL DATA ADDRESS:** the data address received in the query is not an allowable address for the counter (i.e. the combination of register and transfer length is invalid).
- \$03** **ILLEGAL DATA VALUE:** a value contained in the query data field is not an allowable value for the counter.
- \$04** **SERVER FAILURE:** the server failed during the execution.
- \$05** **ACKNOWLEDGE:** the server accepted the server invocation but the service requires a relatively long time to execute. The server therefore returns only an acknowledgement of the service invocation receipt.
- \$06** **SERVER BUSY:** the server was unable to accept the MB request PDU. The client application has the responsibility of deciding if and when re-sending the request.
- \$0A** **GATEWAY PATH UNAVAILABLE:** the communication module (or the counter, in case of counter with integrated communication) is not configured or cannot communicate.
- \$0B** **GATEWAY TARGET DEVICE FAILED TO RESPOND:** the counter is not available in the network.

5. GENERAL INFORMATION ON REGISTER TABLES

NOTE: Highest number of registers (or bytes) which can be read with a single command:
 - 256 bytes in TCP mode

NOTE: Highest number of registers which can be programmed with a single command:
 - 1 register in TCP mode

NOTE: The register values are in hex format (\$).

Table HEADER	Meaning
PARAMETER	Symbol and description of the parameter to be read/written.
+/-	<p>Positive or negative sign on the read value. The sign representation changes according to the meter model:</p> <p>Sign Bit Mode: If this column is checked, the read register value can have positive or negative sign. Convert a signed register value as shown in the following instructions: The Most Significant Bit (MSB) indicates the sign as follows: 0=positive (+), 1=negative (-). Negative value example:</p> <pre> MSB \$8020 = 1000000000100000 = -32 hex bin dec </pre> <p>2's Complement Mode: If this column is checked, the read register value can have positive or negative sign. The negative values are represented with 2's complement. To identify the Sign representation in use, please refer to \$051D/\$052E registers.</p>
INTEGER	<p>INTEGER register data. It shows the Unit of measure, the RegSet type and the corresponding Word number and the Address in hex format. Two RegSet types are available: RegSet 0: even / odd word registers. RegSet 1: even word registers. To identify the RegSet in use, please refer to \$0523/\$0538 registers.</p>
IEEE	<p>IEEE standard register data. It shows the Unit of measure, the Word number and the Address in hex format.</p>
DATA MEANING	Description of data received by a response of a reading command.
PROGRAMMABLE DATA	Description of data which can be sent for a writing command.

6. READING REGISTERS (FUNCTION CODES \$03, \$04)

PARAMETER		+/-	INTEGER					IEEE		
			Signed	RegSet 0		RegSet 1		Unit of measure	Words	Address
Symbol	Description	Words		Address	Words	Address	Words			
REALTIME VALUES										
U1N	Ph 1-N Voltage		2	0000	2	0000	mV	2	1000	V
U2N	Ph 2-N Voltage		2	0002	2	0002	mV	2	1002	V
U3N	Ph 3-N Voltage		2	0004	2	0004	mV	2	1004	V
U12	L 1-2 Voltage		2	0006	2	0006	mV	2	1006	V
U23	L 2-3 Voltage		2	0008	2	0008	mV	2	1008	V
U31	L 3-1 Voltage		2	000A	2	000A	mV	2	100A	V
UΣ	System Voltage		2	000C	2	000C	mV	2	100C	V
A1	Ph1 Current	●	2	000E	2	000E	mA	2	100E	A
A2	Ph2 Current	●	2	0010	2	0010	mA	2	1010	A
A3	Ph3 Current	●	2	0012	2	0012	mA	2	1012	A
AN	Neutral Current	●	2	0014	2	0014	mA	2	1014	A
AΣ	System Current	●	2	0016	2	0016	mA	2	1016	A
PF1	Ph1 Power Factor	●	1	0018	2	0018	0.001	2	1018	-
PF2	Ph2 Power Factor	●	1	0019	2	001A	0.001	2	101A	-
PF3	Ph3 Power Factor	●	1	001A	2	001C	0.001	2	101C	-
PFΣ	Sys Power Factor	●	1	001B	2	001E	0.001	2	101E	-
P1	Ph1 Active Power	●	3	001C	4	0020	mW	2	1020	W
P2	Ph2 Active Power	●	3	001F	4	0024	mW	2	1022	W
P3	Ph3 Active Power	●	3	0022	4	0028	mW	2	1024	W
PΣ	Sys Active Power	●	3	0025	4	002C	mW	2	1026	W
S1	Ph1 Apparent Power	●	3	0028	4	0030	mVA	2	1028	VA
S2	Ph2 Apparent Power	●	3	002B	4	0034	mVA	2	102A	VA
S3	Ph3 Apparent Power	●	3	002E	4	0038	mVA	2	102C	VA
SΣ	Sys Apparent Power	●	3	0031	4	003C	mVA	2	102E	VA
Q1	Ph1 Reactive Power	●	3	0034	4	0040	mvar	2	1030	var
Q2	Ph2 Reactive Power	●	3	0037	4	0044	mvar	2	1032	var
Q3	Ph3 Reactive Power	●	3	003A	4	0048	mvar	2	1034	var
QΣ	Sys Reactive Power	●	3	003D	4	004C	mvar	2	1036	var
F	Frequency		1	0040	2	0050	mHz	2	1038	Hz
PH SEQ	Phase Sequence Meaning of read data: INTEGER: \$00=123-CCW, \$01=321-CW, \$02=not defined IEEE: \$3DFBE76D=123-CCW, \$3E072802=321-CW, \$0=not define		1	0041	2	0052	-	2	103A	-
-	Reserved		3	0042	-	-	-	-	-	-
TOTAL COUNTERS										
+kWh1	Ph1 Imp. Active En.		3	0100	4	0100	0.1Wh	2	1100	Wh
+kWh2	Ph2 Imp. Active En.		3	0103	4	0104	0.1Wh	2	1102	Wh
+kWh3	Ph3 Imp. Active En.		3	0106	4	0108	0.1Wh	2	1104	Wh
+kWhΣ	Sys Imp. Active En.		3	0109	4	010C	0.1Wh	2	1106	Wh
-kWh1	Ph1 Exp. Active En.		3	010C	4	0110	0.1Wh	2	1108	Wh
-kWh2	Ph2 Exp. Active En.		3	010F	4	0114	0.1Wh	2	110A	Wh
-kWh3	Ph3 Exp. Active En.		3	0112	4	0118	0.1Wh	2	110C	Wh
-kWhΣ	Sys Exp. Active En.		3	0115	4	011C	0.1Wh	2	110E	Wh
+kVAh1-L	Ph1 Imp. Lag. Apparent En.		3	0118	4	0120	0.1VAh	2	1110	VAh
+kVAh2-L	Ph2 Imp. Lag. Apparent En.		3	011B	4	0124	0.1VAh	2	1112	VAh
+kVAh3-L	Ph3 Imp. Lag. Apparent En.		3	011E	4	0128	0.1VAh	2	1114	VAh
+kVAhΣ-L	Sys Imp. Lag. Apparent En.		3	0121	4	012C	0.1VAh	2	1116	VAh
-kVAh1-L	Ph1 Exp. Lag. Apparent En.		3	0124	4	0130	0.1VAh	2	1118	VAh
-kVAh2-L	Ph2 Exp. Lag. Apparent En.		3	0127	4	0134	0.1VAh	2	111A	VAh
-kVAh3-L	Ph3 Exp. Lag. Apparent En.		3	012A	4	0138	0.1VAh	2	111C	VAh
-kVAhΣ-L	Sys Exp. Lag. Apparent En.		3	012D	4	013C	0.1VAh	2	111E	VAh
+kVAh1-C	Ph1 Imp. Lead. Apparent En.		3	0130	4	0140	0.1VAh	2	1120	VAh
+kVAh2-C	Ph2 Imp. Lead. Apparent En.		3	0133	4	0144	0.1VAh	2	1122	VAh
+kVAh3-C	Ph3 Imp. Lead. Apparent En.		3	0136	4	0148	0.1VAh	2	1124	VAh
+kVAhΣ-C	Sys Imp. Lead. Apparent En.		3	0139	4	014C	0.1VAh	2	1126	VAh
-kVAh1-C	Ph1 Exp. Lead. Apparent En.		3	013C	4	0150	0.1VAh	2	1128	VAh
-kVAh2-C	Ph2 Exp. Lead. Apparent En.		3	013F	4	0154	0.1VAh	2	112A	VAh
-kVAh3-C	Ph3 Exp. Lead. Apparent En.		3	0142	4	0158	0.1VAh	2	112C	VAh
-kVAhΣ-C	Sys Exp. Lead. Apparent En.		3	0145	4	015C	0.1VAh	2	112E	VAh
+kvarh1-L	Ph1 Imp. Lag. Reactive En.		3	0148	4	0160	0.1varh	2	1130	varh
+kvarh2-L	Ph2 Imp. Lag. Reactive En.		3	014B	4	0164	0.1varh	2	1132	varh
+kvarh3-L	Ph3 Imp. Lag. Reactive En.		3	014E	4	0168	0.1varh	2	1134	varh
+kvarhΣ-L	Sys Imp. Lag. Reactive En.		3	0151	4	016C	0.1varh	2	1136	varh

PARAMETER		+/-	INTEGER					IEEE		
Symbol	Description	Signed	RegSet 0		RegSet 1		Unit of measure	IEEE		
			Words	Address	Words	Address		Words	Address	Unit of measure
TOTAL COUNTERS										
-kvarh1-L	Ph1 Exp. Lag. Reactive En.		3	0154	4	0170	0.1varh	2	1138	varh
-kvarh2-L	Ph2 Exp. Lag. Reactive En.		3	0157	4	0174	0.1varh	2	113A	varh
-kvarh3-L	Ph3 Exp. Lag. Reactive En.		3	015A	4	0178	0.1varh	2	113C	varh
-kvarhΣ-L	Sys Exp. Lag. Reactive En.		3	015D	4	017C	0.1varh	2	113E	varh
+kvarh1-C	Ph1 Imp. Lead. Reactive En.		3	0160	4	0180	0.1varh	2	1140	varh
+kvarh2-C	Ph2 Imp. Lead. Reactive En.		3	0163	4	0184	0.1varh	2	1142	varh
+kvarh3-C	Ph3 Imp. Lead. Reactive En.		3	0166	4	0188	0.1varh	2	1144	varh
+kvarhΣ-C	Sys Imp. Lead. Reactive En.		3	0169	4	018C	0.1varh	2	1146	varh
-kvarh1-C	Ph1 Exp. Lead. Reactive En.		3	016C	4	0190	0.1varh	2	1148	varh
-kvarh2-C	Ph2 Exp. Lead. Reactive En.		3	016F	4	0194	0.1varh	2	114A	varh
-kvarh3-C	Ph3 Exp. Lead. Reactive En.		3	0172	4	0198	0.1varh	2	114C	varh
-kvarhΣ-C	Sys Exp. Lead. Reactive En.		3	0175	4	019C	0.1varh	2	114E	varh
MHrCnt	INTEGER RegSet0: Reserved, INTEGER RegSet1 & IEEE: Measure hour counter		3	0178	2	01A0	0.1h	2	1150	h
MHrCnt	Measure hour counter		2	017B	-	-	0.1h	-	-	-
PARTIAL COUNTERS										
+kWhΣ-P	Sys Imp. Active En.		3	0400	4	0400	0.1Wh	2	1400	Wh
-kWhΣ-P	Sys Exp. Active En.		3	0403	4	0404	0.1Wh	2	1402	Wh
+kVAhΣ-L-P	Sys Imp. Lag. Apparent En.		3	0406	4	0408	0.1VAh	2	1404	VAh
-kVAhΣ-L-P	Sys Exp. Lag. Apparent En.		3	0409	4	040C	0.1VAh	2	1406	VAh
+kVAhΣ-C-P	Sys Imp. Lead. Apparent En.		3	040C	4	0410	0.1VAh	2	1408	VAh
-kVAhΣ-C-P	Sys Exp. Lead. Apparent En.		3	040F	4	0414	0.1VAh	2	140A	VAh
+kvarhΣ-L-P	Sys Imp. Lag. Reactive En.		3	0412	4	0418	0.1varh	2	140C	varh
-kvarhΣ-L-P	Sys Exp. Lag. Reactive En.		3	0415	4	041C	0.1varh	2	140E	varh
+kvarhΣ-C-P	Sys Imp. Lead. Reactive En.		3	0418	4	0420	0.1varh	2	1410	varh
-kvarhΣ-C-P	Sys Exp. Lead. Reactive En.		3	041B	4	0424	0.1varh	2	1412	varh
BALANCE COUNTERS										
kWhΣ-B	Sys Active En.	●	3	041E	4	0428	0.1Wh	2	1414	Wh
kVAhΣ-L-B	Sys Lag. Apparent En.	●	3	0421	4	042C	0.1VAh	2	1416	VAh
kVAhΣ-C-B	Sys Lead. Apparent En.	●	3	0424	4	0430	0.1VAh	2	1418	VAh
kvarhΣ-L-B	Sys Lag. Reactive En.	●	3	0427	4	0434	0.1varh	2	141A	varh
kvarhΣ-C-B	Sys Lead. Reactive En.	●	3	042A	4	0438	0.1varh	2	141C	varh
-	Reserved		3	042D	-	-	-	-	-	-

PARAMETER		INTEGER				DATA MEANING
		RegSet 0		RegSet 1		
Symbol	Description	Words	Address	Words	Address	Values
INFORMATION ON ENERGY METER						
EC SN	Meter Serial Number	5	0500	6	0500	10 ASCII chars. (\$00...\$FF)
EC MODEL	Meter Model	1	0505	2	0506	\$03=6A 3phases, 4wires \$08=80A 3phases, 4wires
EC TYPE	Meter Type	1	0506	2	0508	\$02=MID \$09=MID, Wiring selection
EC FW REL	Meter Firmware Release	1	0507	2	050A	Convert the read Hex value in Dec value. e.g. \$66=102 => rel. 1.02
EC HW VER	Meter Hardware Version	1	0508	2	050C	Convert the read Hex value in Dec value. e.g. \$64=100 => ver. 1.00
-	Reserved	2	0509	2	050E	-
-	Reserved	1	050B	2	0510	-
PRI/SEC	Primary/Secondary Value <i>Only 6A model. Reserved and fixed to 0 for other models.</i>	1	050C	2	0512	\$00=primary \$01=secondary
ERR	Error Code	1	050D	2	0514	Bit field coding: - bit0 (LSb)=Phase sequence - bit1=Memory - bit2=Clock (RTC) - other bits not used Bit=1 means error condition, Bit=0 means no error
CT	CT Ratio Value <i>Only 6A model. Reserved and fixed to 1 for other models.</i>	1	050E	2	0516	\$0001...\$2710
-	Reserved	2	050F	2	0518	-
FSA	FSA Value	1	0511	2	051A	\$00=1A \$01=5A \$02=80A
WIR	Wiring Mode	1	0512	2	051C	\$01=3phases, 4 wires, 3 currents \$02=3phases, 3 wires, 2 currents \$03=1phase \$04=3phases, 3 wires, 3 currents
ADDR	MODBUS Address	1	0513	2	051E	\$01...\$F7
-	Reserved	1	0514	2	0520	-
-	Reserved	1	0515	2	0522	-
-	Reserved	1	0516	2	0524	-
EC-P STAT	Partial Counter Status	1	0517	2	0526	Bit field coding: - bit0 (LSb)= +kWhΣ PAR - bit1=-kWhΣ PAR - bit2=+kVAhΣ-L PAR - bit3=-kVAhΣ-L PAR - bit4=+kVAhΣ-C PAR - bit5=-kVAhΣ-C PAR - bit6=+kvarhΣ-L PAR - bit7=-kvarhΣ-L PAR - bit8=+kvarhΣ-C PAR - bit9=-kvarhΣ-C PAR - other bits not used Bit=1 means counter active, Bit=0 means counter stopped
-	Reserved	5	0518	6	0528	-
SIGN	Signed Value Representation	1	051D	2	052E	\$00=sign bit \$01=2's complement
-	Reserved	1	051E	2	0530	-
-	Reserved	1	051F	2	0532	-
-	Reserved	1	0520	2	0534	-
-	Reserved	2	0521	2	0536	-
REGSET	RegSet in use	1	0523	2	0538	\$00=register set 0 \$01=register set 1
-	Reserved	1	0600	2	0600	-
RTC-DAY	Ethernet interface RTC day	1	2000	1	2000	Convert the read Hex value in Dec value. e.g. \$1F=31 => day 31
RTC-MONTH	Ethernet interface RTC month	1	2001	1	2001	Convert the read Hex value in Dec value. e.g. \$0C=12 => december
RTC-YEAR	Ethernet interface RTC year	1	2002	1	2002	Convert the read Hex value in Dec value. e.g. \$15=21 => year 2021
RTC-HOURS	Ethernet interface RTC hours	1	2003	1	2003	Convert the read Hex value in Dec value. e.g. \$0F=15 => 15 hours
RTC-MIN	Ethernet interface RTC minutes	1	2004	1	2004	Convert the read Hex value in Dec value. e.g. \$1E=30 => 30 minutes
RTC-SEC	Ethernet interface RTC seconds	1	2005	1	2005	Convert the read Hex value in Dec value. e.g. \$0A=10 => 10 seconds

7. COILS READING (FUNCTION CODE \$01)

PARAMETER		INTEGER		DATA MEANING
Symbol	Description	Bits	Address	Values
AL	Alarms	40	0000	<p>Bit sequence bit 39 (MSb) ... bit 0 (LSb):</p> <p> U3N-L U2N-L U1N-L UΣ-L U3N-H U2N-H U1N-H UΣ-H COM RES U31-L U23-L U12-L U31-H U23-H U12-H RES RES RES RES RES RES AN-L A3-L A2-L A1-L AΣ-L AN-H A3-H A2-H A1-H AΣ-H RES RES RES RES RES RES RES RES f-O </p> <p>LEGEND</p> <p>L=Under the Threshold (Low) H=Over the Threshold (High) O=Out of Range COM=Communication on IR port OK. Do not consider in case of models with integrated SERIAL communication RES=Bit Reserved to 0</p> <p>NOTE: Voltage, Current and Frequency Threshold Values can change according to the meter model. Please refer to the tables shown below.</p>

VOLTAGE AND FREQUENCY RANGES ACCORDING TO MODEL	PARAMETER THRESHOLDS			
	PHASE-NEUTRAL VOLTAGE	PHASE-PHASE VOLTAGE	CURRENT	FREQUENCY
3x230/400V 50Hz	ULN-L=230V-20%=184V ULN-H=230V+20%=276V	ULL-L=230V x $\sqrt{3}$ -20%=318V ULL-H=230V x $\sqrt{3}$ +20%=478V	I-L=Starting Current (I _{st}) I-H=Current Full Scale (I _{FS})	f-L=45Hz f-H=65Hz
3x230/400...3x240/415V 50/60Hz	ULN-L=230V-20%=184V ULN-H=240V+20%=288V	ULL-L=398V-20%=318V ULL-H=415V+20%=498V		

8. WRITING REGISTERS (FUNCTION CODE \$10)

PARAMETER		INTEGER				PROGRAMMABLE DATA
Symbol	Description	RegSet 0		RegSet 1		Values
		Words	Address	Words	Address	
PROGRAMMABLE DATA FOR ENERGY METER						
ADDR	MODBUS Address	1	0513	2	051E	\$01...\$F7
-	Reserved	1	0514	2	0520	-
-	Reserved	1	0515	2	0522	-
-	Reserved	1	0516	2	0524	-
EC-P OPER	Partial Counter Operation	1	0517	2	0526	For RegSet1, set the MS word always to 0000. The LS word must be structured as follows: <u>Byte 1 – PARTIAL Counter Selection</u> \$00=+kWhΣ PAR \$01=-kWhΣ PAR \$02=+kVAhΣ-L PAR \$03=-kVAhΣ-L PAR \$04=+kVAhΣ-C PAR \$05=-kVAhΣ-C PAR \$06=+kvarhΣ-L PAR \$07=-kvarhΣ-L PAR \$08=+kvarhΣ-C PAR \$09=-kvarhΣ-C PAR \$0A=ALL Partial Counters <u>Byte 2 – PARTIAL Counter Operation</u> \$01=start \$02=stop \$03=reset e.g. Start +kWhΣ PAR Counter 00=+kWhΣ PAR 01=start Final value to be set: -RegSet0=0001 -RegSet1=00000001
REGSET	RegSet switching	1	100B	2	1010	\$00=switch to RegSet 0 \$01=switch to RegSet 1
RTC-DAY	Ethernet interface RTC day	1	2000	1	2000	\$01...\$1F (1...31)
RTC-MONTH	Ethernet interface RTC month	1	2001	1	2001	\$01...\$0C (1...12)
RTC-YEAR	Ethernet interface RTC year	1	2002	1	2002	\$01...\$25 (1...37=2001...2037) e.g. to set 2021, write \$15
RTC-HOURS	Ethernet interface RTC hours	1	2003	1	2003	\$00...\$17 (0...23)
RTC-MIN	Ethernet interface RTC minutes	1	2004	1	2004	\$00...\$3B (0...59)
RTC-SEC	Ethernet interface RTC seconds	1	2005	1	2005	\$00...\$3B (0...59)

NOTE: if the RTC writing command contains inappropriate values (e.g. 30th February), the value will not be accepted and the device replies with exception code (Illegal Value).

NOTE: in case of RTC lost due to long time power off, set again the RTC value (day, month, year, hours, min, sec) to restart the recordings.