Communication Protocol for EMT-4s Series

MODBUS RTU PROTOCOL

Modbus is a master-slave communication protocol able to support up to 247 slaves organized as a bus or as a star network. The physical link layer can be RS232 for a point to point connection or RS485 for a network.

The communication is half-duplex. The network messages can be Query-Response or Broadcast type.

The Query-Response command is transmitted from the Master to an established Slave and generally it is followed by an answering message.

The Broadcast command is transmitted from the Master to all Slaves and is never followed by an answer.

GENERIC MESSAGE STRUCTURE:

START OF FRAME	ADDRESS FIELD	FUNCTION CODE	DATA FIELD	ERROR CHECK	END OF FRAME

START OF FRAME	=	Starting message marker
ADDRESS FIELD	=	Includes device address in which you need to communicate in Query-Response mode. In case the message is a Broadcast type it includes 00.
FUNCTION CODE	=	Includes the operation code that you need to perform.
DATA FIELD	=	Includes the data field.
ERROR CHECK	=	Field for the error correction code.
END OF FRAME	=	End message marker.

Mode RTU communication frame structure:

START OF FRAME	=	silence on line for time >=4 characters
ADDRES FIELD	=	1 character
FUNCTION CODE	=	1 character
DATA FIELD	=	N characters
ERROR CHECK	=	16 bit CRC
END OF FRAME	=	silence on line for time >=4 characters

Wait time for response:

Request length	1 Register (2 bytes)	32 Register (64 bytes)
Typical	< 100 mSec	< 250 mSec
Worst case	< 150 mSec	< 400 mSec

Reading of the Registers (Function Code $03)

Reads the binary contents of holding registers (2X references) in the slave.
Broadcast is not supported.
The Query message specified the starting register and quantity of register to be read.

QUERY:

	0° Byte	1° Byte	2-3° Byte	4-5° Byte	6-7° Byte	
Start of Frame	Address Field	Function Code	Start Address	Number of Registers	Check Sum	End of Frame

START OF FRAME   =   *Starting message marker.*
ADDRESS FIELD   =   *EMT device address (0x01... 0xF7)*   *(1 byte).*
FUNCTION CODE   =   *Operation code (0x03)*   *(1 byte).*
START ADDRESS   =   *First register address to be read*   *(2 byte).*
No. OF REGISTERS   =   *Number of registers (max 64 bytes) to read*   *(4 bytes [1 long] for 1 measure value).*
CHECK SUM   =   *Check sum.*
END OF FRAME   =   *End message marker.*

<u>*Warning:*</u> It is possible to read more than one variable at the same time **(max 64 bytes)** only if their addresses are consecutive and the variables on the same line cannot be divided.
The register data in the response message are packet as two bytes per register, with the binary contents right justified within each byte.
For each register, the first byte contains the high order bits and the second contains the low order bits.

RESPONSE:

	0° Byte	1° Byte	2° Byte	n° Byte	n+1 - n+2 Byte	
Start of Frame	Address Field	Function Code	Number of Bytes	Data	Check Sum	End of Frame

START OF FRAME   =   *Starting message marker.*
ADDRESS FIELD   =   *EMT device address (0x01... 0xF7)*   *(1byte).*
FUNCTION CODE   =   *Operation code (0x03)*   *(1 Byte).*
No. OF SEND BYTES =   *Number of data bytes (0x00...??)*   *(1 byte). 1 register requires 2 data bytes.*
D0, D1, .., Dn   =   *data bytes (0x00...??)*   *(Nr. of register x 2 = n. byte).*
CHECK SUM   =   *Check sum.*
END OF FRAME   =   *End message marker.*

See the TABLE OF EMT-4s REGISTERS and the EXAMPLE.

Setup of the EMT-4s parameters (Function Code $10)

Write values into a sequence of holding registers (2X references).

Warning: It is possible to write more than one variable at the same time only if their addresses are consecutive and the variables on the same line cannot be divided (max of 4 consecutive register on the same message).

QUERY:

	0° Byte	1° Byte	2-3° Byte	4-5° Byte	6° Byte	n° Byte	n+1 - n+2 Byte		
Start of Frame	Address Field	Function Code	Start Address	Number of Registers	Number of Bytes	Data	Check Sum	End of Frame

START OF FRAME = Starting message marker.
ADDRESS FIELD = EMT-4s device address (0x01... 0xF7)   (1 byte).
FUNCTION CODE = Operation code (0x10)   (1 byte).
START ADDRESS = First register address to be written   (2 byte).
No. OF REGISTER = Number of registers to be written (1 to 4,...)   (2 byte).
No. OF BYTES = Number of data bytes (HEX)   (1 byte): 1register requires 2 data bytes.
D0,D1,..,Dn = Data bytes (0x00...?)   (1 byte) (Nr. of register x 2 = n. byte).
CHECK SUM = Check sum.
END OF FRAME = End message marker.

The normal response returns the slave address, function code, starting address and quantity of register preset.

RESPONSE:

	0° Byte	1° Byte	2-3° Byte	4-5° Byte	6-7° Byte	
Start of Frame	Address Field	Function Code	Start Address	Number of Registers	Check Sum	End of Frame

START OF FRAME = Starting message marker.
ADDRESS FIELD = EMT-4s device address (0x01... 0xF7)   (1 byte).
FUNCTION CODE = Operation code (0x10)   (1 byte).
START ADDRESS = First register address to be written   (2 byte).
No. OF REGISTER = Number of registers to be written   (2 byte).
ERROR CHECK = Check sum.
END OF FRAME = End message marker.

See the TABLE OF EMT-4s REGISTERS and the EXAMPLE.

Broadcast command

It is possible to send a broadcast command (Address Field equal 0x00) for all write command.

QUERY:

	0° Byte	1° Byte	2-3° Byte	4-5° Byte	6° Byte	n° Byte	n+1 - n+2° Byte		
Start of Frame	0x00	Function Code	Start Address	Number of Registers	Number of Bytes	Data	Check Sum	End of Frame

RESPONSE:
No Response.

Diagnostic (Function Code $08)

This function provides a test for checking the communication system.
Broadcast is not supported.
The instrument's protocol has only the sub-function 0 of the diagnostics sub-functions set of the standard modbus protocol.
The Query and the Response messages are the following:

QUERY:

	0° Byte	1° Byte	2-3° Byte	n° Byte	n+1 - n+2 Byte	
Start of Frame	Address Field	Function Code	Sub Function	Data	Check Sum	End of Frame

START OF FRAME = *Starting message marker.*
ADDRESS FIELD   = *EMT-4s device address (0x01...0xF7)*   (1 byte).
FUNCTION CODE   = *Operation code (0x08 HEX)*   (1 byte).
SUB FUNCTION   = *Sub-function 0 (0x00 0x00)*   (2 byte).
DATA   = *Max 10 data bytes.*
CHECK SUM   = *Check sum.*
END OF FRAME   = *End message marker.*

RESPONSE:

The response must be the loopback of the same data.

	0° Byte	1° Byte	2-3° Byte	n° Byte	n+1 - n+2° Byte	
Start of Frame	Address Field	Function Code	Sub Function	Data	Check Sum	End of Frame

START OF FRAME = *Starting message marker.*
ADDRESS FIELD   = *EMT-4s device address (0x01... 0xF7)*   (1 byte).
FUNCTION CODE   = *Operation code (0x08 HEX)*   (1 byte).
SUB FUNCTION   = *Sub-function 0 (0x00 0x00)*   (2 byte).
DATA   = *Data bytes.*
CHECK SUM   = *Check sum.*
END OF FRAME   = *End message marker.*

DIAGNOSTIC EXAMPLE:

QUERY		RESPONSE	
Field Name	Example (Hex)	Field Name	Example (Hex)
Slave Address	0x01	Slave Address	0x01
Function Code	0x08	Function Code	0x08
Sub-function Hi	0x00	Sub-function Hi	0x00
Sub-function Lo	0x00	Sub-function Lo	0x00
Data Hi	0xF1	Data Hi	0xF1
Data Lo	0xA7	Data Lo	0xA7
Error Check (CRC)	0x??	Error Check (CRC)	0x??
	0x??		0x??

Report Slave ID (Function Code $11)

This function returns the type of the instrument and the current status of the slave run indicator. Broadcast is not supported. The Query and the Response messages are the following:

QUERY:

	0° Byte	1° Byte	2 - 3° Byte	
Start of Frame	Address Field	Function Code	Check Sum	End of Frame

START OF FRAME   = Starting message marker.
ADDRESS FIELD   = EMT-4s device address (0x01... 0xF7)   (1 byte).
FUNCTION CODE   = Operation code (0x11)   (1 byte).
CHECK SUM   = Check sum.
END OF FRAME   = End message marker.

RESPONSE:

	0° Byte	1° Byte	2° Byte	3° Byte	4° Byte	5° - 6° Byte	
Start of Frame	Address Field	Function Code	Byte Count	Slave ID	Run Indicator Status	Check Sum	End of Frame

START OF FRAME   = Starting message marker.
ADDRESS FIELD   = EMT-4s device address (0x01... 0xF7)   (1 byte).
FUNCTION CODE   = Operation code (0x11)   (1 byte).
BYTE COUNT   = Number of data bytes (0x16)   (1 byte).
SLAVE ID   = Slave ID identifier (**0x5A**)   (1 byte).
RUN INDICATOR STATUS   = Run indicator status (**0xFF**)   (1 byte).
DATA   = Data bytes
CHECK SUM   = Check sum.
END OF FRAME   = End message marker.

The normal answer has the slave ID identifier (**0x5A**), the run indicator Status (**0xFF**), 20 data bytes with the following meaning:
- 17-18 Byte: Boot Version.
- 19-20 Byte: Firmware Version.

REPORT SLAVE ID EXAMPLE:

QUERY		RESPONSE	
Field Name	Example (Hex)	Field Name	Example (Hex)
Slave Address	0xXX	Slave Address	0x01
Function Code	0x11	Function Code	0x11
Error Check (CRC)	0x??	Byte count	0x02
	0x??	Slave ID	0x5A
		Run indicator status	0xFF
		Data	20 Bytes
		Error Check (CRC)	0x??
			0x??

Error message from Slave to Master

When a slave device receives a not valid query, it does transmit an error message.

RESPONSE:

	0° Byte	1° Byte	2° Byte	3 - 4° Byte	
Start of Frame	Address Field	Function Code	Error Code	Check Sum	End of Frame

START OF FRAME   = Starting message marker.
ADDRESS FIELD   = EMT-4s device address (0x01... 0xF7)   (1 byte).
FUNCTION CODE   = Operation code with bit 7 high   (1 byte).
ERROR CODE   = Message containing communication failure   (1 byte).
CHECK SUM   = Check sum.
END OF FRAME   = End message marker.

ERROR EXAMPLE:

QUERY		RESPONSE		
Field Name	Example (Hex)	Field Name	Example (Hex)	
Slave Address	0x01	Slave Address	0x 01	
Function Code	0x03	Function Code	0x83	(1)
Starting Address Hi	0x00	Error Code	0x02	(2)
Starting Address Lo	0x00	Error Check (CRC)	0x??	
Number Of Word Hi	0x00		0x??	
Number Of Word Lo	0x05			
Error Check (CRC)	0x??	(1): Function Code transmitted by master with bit 7 high.		
	0x??	(2): Error type:		

(1): Function Code transmitted by master with bit 7 high.
(2): Error type:
0x01 = Illegal Function
0x02 = Illegal data address
0x03 = Illegal data value

EMT-4s Registers

Instantaneous Measures

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$1000	4096	2	SYSTEM VOLTAGE	mV	R	Unsigned
$1002	4098	2	PHASE VOLTAGE L_{1-N}	mV	R	Unsigned
$1004	4100	2	PHASE VOLTAGE L_{2-N}	mV	R	Unsigned
$1006	4102	2	PHASE VOLTAGE L_{3-N}	mV	R	Unsigned
$1008	4104	2	LINE TO LINE VOLTAGE L_{1-2}	mV	R	Unsigned
$100A	4106	2	LINE TO LINE VOLTAGE L_{2-3}	mV	R	Unsigned
$100C	4108	2	LINE TO LINE VOLTAGE L_{3-1}	mV	R	Unsigned
$100E	4110	2	SYSTEM CURRENT	mA	R	Unsigned
$1010	4112	2	LINE CURRENT L_1	mA	R	Unsigned
$1012	4114	2	LINE CURRENT L_2	mA	R	Unsigned
$1014	4116	2	LINE CURRENT L_3	mA	R	Unsigned
$1016	4118	2	SYSTEM POWER FACTOR	±1000	R	Signed
$1018	4120	2	POWER FACTOR L_1	±1000	R	Signed
$101A	4122	2	POWER FACTOR L_2	±1000	R	Signed
$101C	4124	2	POWER FACTOR L_3	±1000	R	Signed
$101E	4126	2	SYSTEM COS φ	±1000	R	Signed
$1020	4128	2	PHASE COS $φ_1$	±1000	R	Signed
$1022	4130	2	PHASE COS $φ_2$	±1000	R	Signed
$1024	4132	2	PHASE COS $φ_3$	±1000	R	Signed
$1026	4134	2	SYSTEM APPARENT POWER	VA	R	Unsigned
$1028	4136	2	APPARENT POWER L_1	VA	R	Unsigned
$102A	4138	2	APPARENT POWER L_2	VA	R	Unsigned
$102C	4140	2	APPARENT POWER L_3	VA	R	Unsigned
$102E	4142	2	SYSTEM ACTIVE POWER	W	R	Signed
$1030	4144	2	ACTIVE POWER L_1	W	R	Signed
$1032	4146	2	ACTIVE POWER L_2	W	R	Signed
$1034	4148	2	ACTIVE POWER L_3	W	R	Signed
$1036	4150	2	SYSTEM REACTIVE POWER	VAR	R	Signed
$1038	4152	2	REACTIVE POWER L_1	VAR	R	Signed
$103A	4154	2	REACTIVE POWER L_2	VAR	R	Signed
$103C	4156	2	REACTIVE POWER L_3	VAR	R	Signed
$103E	4158	2	NEUTRAL CURRENT[*]	mA	R	Signed
$1040	4160	2	FREQUENCY	mHz	R	Unsigned
$1042	4162	2	TEMPERATURE	d°C	R	Signed
$1044	4164	2	THD VOLTAGE L_1[***]	% * 100	R	Unsigned
$1046	4166	2	THD VOLTAGE L_2[***]	% * 100	R	Unsigned
$1048	4168	2	THD VOLTAGE L_3[***]	% * 100	R	Unsigned
$104A	4170	2	THD CURRENT L_1[***]	% * 100	R	Unsigned
$104C	4172	2	THD CURRENT L_2[***]	% * 100	R	Unsigned
$104E	4174	2	THD CURRENT L_3[***]	% * 100	R	Unsigned
$1050	4176	2	ANGLE $_{1-2}$	0-3600	R	Unsigned
$1052	4178	2	ANGLE $_{2-3}$	0-3600	R	Unsigned
$1054	4180	2	ANGLE $_{3-1}$	0-3600	R	Unsigned
$1056	4182	2	SYSTEM TANGENT φ [*]	±1200	R	Signed
$1058	4184	2	PHASE TANGENT $φ_1$ [*]	±1200	R	Signed
$105A	4186	2	PHASE TANGENT $φ_2$ [*]	±1200	R	Signed
$105C	4184	2	PHASE TANGENT $φ_3$ [*]	±1200	R	Signed

[*]: Calculated or measured, according with EMT-4s option and command NEUTRAL CURRENT USED
[**] Examples: +1000 is equal to +1.000
  -200 is equal to -0.200
[***]: Examples: 100'00 equal to 100,00%
  50'00 equal to 50,00%

Sag

Register HEX	Register DEC	Word	Description		Measure Unit	W/R	Type
$10A0	4256	1	SAGn HOUR (**)	(last sag detected)	Hour	R	Unsigned
$10A1	4257	1	SAGn MINUTE (**)	(last sag detected)	Min	R	Unsigned
$10A2	4258	1	SAGn SECOND (**)	(last sag detected)	Sec	R	Unsigned
$10A3	4259	1	SAGn DATE (**)	(last sag detected)	Day	R	Unsigned
$10A4	4260	1	SAGn MONTH (**)	(last sag detected)	Month	R	Unsigned
$10A5	4261	1	SAGn YEAR (**)	(last sag detected)	Year	R	Unsigned
$10A6	4262	1	SAG DETECTED		-	R	-

(**):see setting frequency monitor.
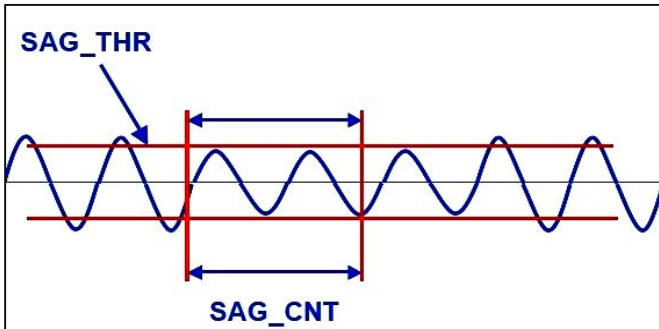
Fig.1: Sag parameters

Fig.2: Sag Explanation

See Device Parameters Section for setting SAG_THR and SAG_CNT.
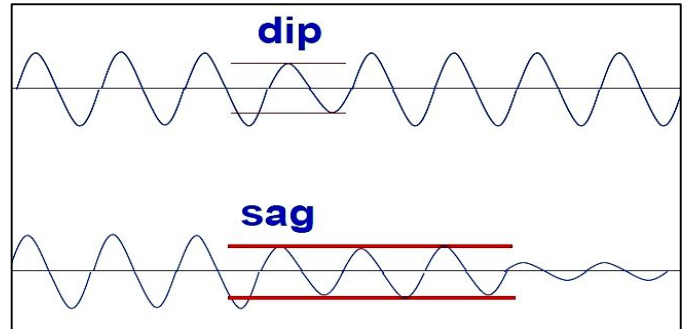
A sag is defined as an under voltage condition that persists for more than one period. A shorter under voltage condition is called a dip (see Fig. 2). The occurrence of sag could announce an impending loss of power. SAG_THR defines the threshold which the input voltage has to be continuously below, and SAG_CNT defines the time required to set the sag register.

THDs

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$1100	4352	1	THD VOLTAGE L_1	0 ÷ 10000	R	Unsigned
$1101	4353	1	THD VOLTAGE L_2	0 ÷ 10000	R	Unsigned
$1102	4355	1	THD VOLTAGE L_3	0 ÷ 10000	R	Unsigned
$1103	4356	1	THD CURRENT L_1	0 ÷ 10000	R	Unsigned
$1104	4357	1	THD CURRENT L_2	0 ÷ 10000	R	Unsigned
$1105	4358	1	THD CURRENT L_3	0 ÷ 10000	R	Unsigned

[Read Examples: 10000 equal to 10000% - 50'00 equal to 50,00%]

Harmonics

Voltage L_1

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$1200	4608	1	1ST VOLTAGE HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned
$1201	4609	1	2ND VOLTAGE HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned
$1202	4610	1	3RD VOLTAGE HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned
$1203	4611	1	4TH VOLTAGE HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned
$1204	4612	1	5TH VOLTAGE HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned
$1205	4613	1	6TH VOLTAGE HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned
$1206	4614	1	7TH VOLTAGE HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned
$1207	4615	1	8TH VOLTAGE HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned
$1208	4616	1	9TH VOLTAGE HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned
$1209	4617	1	10TH VOLTAGE HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned
$120A	4618	1	11TH VOLTAGE HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned
$120B	4619	1	12TH VOLTAGE HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned
$120C	4620	1	13TH VOLTAGE HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned
$120D	4621	1	14TH VOLTAGE HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned
$120E	4622	1	15TH VOLTAGE HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned
$120F	4623	1	16TH VOLTAGE HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned
$1210	4624	1	17TH VOLTAGE HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned
$1211	4625	1	18TH VOLTAGE HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned
$1212	4626	1	19TH VOLTAGE HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned
$1213	4627	1	20TH VOLTAGE HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned

Voltage L_2

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$1250	4688	1	1ST VOLTAGE HARMONIC OF THE L_2 PHASE	0 ÷ 10000	R	Unsigned
- - -	- - -	- - -	- - -	- - -	- - -	- - -
$1263	4707	1	20TH VOLTAGE HARMONIC OF THE L_2 PHASE	0 ÷ 10000	R	Unsigned

Voltage L_3

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$12A0	4768	1	1ST VOLTAGE HARMONIC OF THE L_3 PHASE	0 ÷ 10000	R	Unsigned
- - -	- - -	- - -	- - -	- - -	- - -	- - -
$12B3	4806	1	20TH VOLTAGE HARMONIC OF THE L_3 PHASE	0 ÷ 10000	R	Unsigned

Current L_1

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$1300	4864	1	1ST CURRENT HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned
- - -	- - -	- - -	- - -	- - -	- - -	- - -
$1313	4883	1	20TH CURRENT HARMONIC OF THE L_1 PHASE	0 ÷ 10000	R	Unsigned

Current L_2

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$1350	4944	1	1ST CURRENT HARMONIC OF THE L_2 PHASE	0 ÷ 10000	R	Unsigned
- - -	- - -	- - -	- - -	- - -	- - -	- - -
$1363	4963	1	20TH CURRENT HARMONIC OF THE L_2 PHASE	0 ÷ 10000	R	Unsigned

Current L_3

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$13A0	5024	1	1ST CURRENT HARMONIC OF THE L_3 PHASE	0 ÷ 10000	R	Unsigned
- - -	- - -	- - -	- - -	- - -	- - -	- - -
$13B3	5043	1	20TH CURRENT HARMONIC OF THE L_3 PHASE	0 ÷ 10000	R	Unsigned

Warning: All Harmonics are update every 60 Sec. [Read Examples: 10000 equal to 100,00% - 5000 equal to 50,00%]

Energies

Total Energies

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$1400	5120	2	SYSTEM ACTIVE ENERGY IN	100*Wh	R	Unsigned
$1402	5122	2	SYSTEM ACTIVE ENERGY OUT	100*Wh	R	Unsigned
$1404	5124	2	SYSTEM REACTIVE ENERGY IN	100*VARh	R	Unsigned
$1406	5126	2	SYSTEM REACTIVE ENERGY OUT	100*VARh	R	Unsigned
$1408	5128	2	SYSTEM APPARENT ENERGY	100*VAh	R	Unsigned
$140A	5130	2	ACTIVE ENERGY IN L_1	100*Wh	R	Unsigned
$140C	5132	2	ACTIVE ENERGY OUT L_1	100*Wh	R	Unsigned
$140E	5134	2	REACTIVE ENERGY IN L_1	100*VARh	R	Unsigned
$1410	5136	2	REACTIVE ENERGY OUT L_1	100*VARh	R	Unsigned
$1412	5138	2	APPARENT ENERGY L_1	100*VAh	R	Unsigned
$1414	5140	2	ACTIVE ENERGY IN L_2	100*Wh	R	Unsigned
$1416	5142	2	ACTIVE ENERGY OUT L_2	100*Wh	R	Unsigned
$1418	5144	2	REACTIVE ENERGY IN L_2	100*VARh	R	Unsigned
$141A	5146	2	REACTIVE ENERGY OUT L_2	100*VARh	R	Unsigned
$141C	5148	2	APPARENT ENERGY L_2	100*VAh	R	Unsigned
$141E	5150	2	ACTIVE ENERGY IN L_3	100*Wh	R	Unsigned
$1420	5152	2	ACTIVE ENERGY OUT L_3	100*Wh	R	Unsigned
$1422	5154	2	REACTIVE ENERGY IN L_3	100*VARh	R	Unsigned
$1424	5156	2	REACTIVE ENERGY OUT L_3	100*VARh	R	Unsigned
$1426	5158	2	APPARENT ENERGY L_3	100*VAh	R	Unsigned

Warning: All the energy values restart from 0 after the 100'000'000 kWh [1'000'000'000 * 100*Wh]

Timeband 1 - Energies

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$1450	5200	2	SYSTEM ACTIVE ENERGY IN	100*Wh	R	Unsigned
$1452	5202	2	SYSTEM ACTIVE ENERGY OUT	100*Wh	R	Unsigned
$1454	5204	2	SYSTEM REACTIVE ENERGY IN	100*VARh	R	Unsigned
$1456	5206	2	SYSTEM REACTIVE ENERGY OUT	100*VARh	R	Unsigned
$1458	5208	2	SYSTEM APPARENT ENERGY	100*VAh	R	Unsigned
$145A	5210	2	ACTIVE ENERGY IN L_1	100*Wh	R	Unsigned
$145C	5212	2	ACTIVE ENERGY OUT L_1	100*Wh	R	Unsigned
$145E	5214	2	REACTIVE ENERGY IN L_1	100*VARh	R	Unsigned
$1460	5216	2	REACTIVE ENERGY OUT L_1	100*VARh	R	Unsigned
$1462	5218	2	APPARENT ENERGY L_1	100*VAh	R	Unsigned
$1464	5220	2	ACTIVE ENERGY IN L_2	100*Wh	R	Unsigned
$1466	5222	2	ACTIVE ENERGY OUT L_2	100*Wh	R	Unsigned
$1468	5224	2	REACTIVE ENERGY IN L_2	100*VARh	R	Unsigned
$146A	5226	2	REACTIVE ENERGY OUT L_2	100*VARh	R	Unsigned
$146C	5228	2	APPARENT ENERGY L_2	100*VAh	R	Unsigned
$146E	5230	2	ACTIVE ENERGY IN L_3	100*Wh	R	Unsigned
$1470	5232	2	ACTIVE ENERGY OUT L_3	100*Wh	R	Unsigned
$1472	5234	2	REACTIVE ENERGY IN L_3	100*VARh	R	Unsigned
$1474	5236	2	REACTIVE ENERGY OUT L_3	100*VARh	R	Unsigned
$1476	5238	2	APPARENT ENERGY L_3	100*VAh	R	Unsigned

Timeband 2 – Energies

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$14A0	5280	2	SYSTEM ACTIVE ENERGY IN	100*Wh	R	Unsigned
- - -	- - -	- - -	- - -	- - -	- - -	- - -
$14C6	5318	2	APPARENT ENERGY L_3	100*VAh	R	Unsigned

Timeband 3 – Energies

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$14F0	5360	2	SYSTEM ACTIVE ENERGY IN	100*Wh	R	Unsigned
- - -	- - -	- - -	- - -	- - -	- - -	- - -
$1516	5398	2	APPARENT ENERGY L_3	100*VAh	R	Unsigned

Timeband 4 - Energies

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$1540	5440	2	SYSTEM ACTIVE ENERGY IN	100*Wh	R	Unsigned
- - -	- - -	- - -	- - -	- - -	- - -	- - -
$1566	5478	2	APPARENT ENERGY L_3	100*VAh	R	Unsigned

Timeband 5 – Energies

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$1590	5520	2	SYSTEM ACTIVE ENERGY IN	100*Wh	R	Unsigned
- - -	- - -	- - -	- - -	- - -	- - -	- - -
$15B6	5558	2	APPARENT ENERGY L_3	100*VAh	R	Unsigned

Timeband 6 - Energies

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$15E0	5600	2	SYSTEM ACTIVE ENERGY IN	100*Wh	R	Unsigned
- - -	- - -	- - -	- - -	- - -	- - -	- - -
$1606	5638	2	APPARENT ENERGY L$_3$	100*VAh	R	Unsigned

Timeband 7 – Energies

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$1630	5680	2	SYSTEM ACTIVE ENERGY IN	100*Wh	R	Unsigned
- - -	- - -	- - -	- - -	- - -	- - -	- - -
$1656	5718	2	APPARENT ENERGY L$_3$	100*VAh	R	Unsigned

Timeband 8 – Energies

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$1680	5760	2	SYSTEM ACTIVE ENERGY IN	100*Wh	R	Unsigned
- - -	- - -	- - -	- - -	- - -	- - -	- - -
$16A6	5798	2	APPARENT ENERGY L$_3$	100*VAh	R	Unsigned

Timeband 9 - Energies

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$16D0	5840	2	SYSTEM ACTIVE ENERGY IN	100*Wh	R	Unsigned
- - -	- - -	- - -	- - -	- - -	- - -	- - -
$16F6	5878	2	APPARENT ENERGY L$_3$	100*VAh	R	Unsigned

Timeband 10 - Energies

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$1720	5920	2	SYSTEM ACTIVE ENERGY IN	100*Wh	R	Unsigned
- - -	- - -	- - -	- - -	- - -	- - -	- - -
$1746	5958	2	APPARENT ENERGY L$_3$	100*VAh	R	Unsigned

Timeband 11 - Energies

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$1770	6000	2	SYSTEM ACTIVE ENERGY IN	100*Wh	R	Unsigned
- - -	- - -	- - -	- - -	- - -	- - -	- - -
$1796	6038	2	APPARENT ENERGY L$_3$	100*VAh	R	Unsigned

Timeband 12 - Energies

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$17C0	6080	2	SYSTEM ACTIVE ENERGY IN	100*Wh	R	Unsigned
- - -	- - -	- - -	- - -	- - -	- - -	- - -
$17E6	6118	2	APPARENT ENERGY L$_3$	100*VAh	R	Unsigned

Timeband 13 - Energies

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$1810	6160	2	SYSTEM ACTIVE ENERGY IN	100*Wh	R	Unsigned
- - -	- - -	- - -	- - -	- - -	- - -	- - -
$1836	6198	2	APPARENT ENERGY L$_3$	100*VAh	R	Unsigned

Timeband 14 - Energies

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$1860	6240	2	SYSTEM ACTIVE ENERGY IN	100*Wh	R	Unsigned
- - -	- - -	- - -	- - -	- - -	- - -	- - -
$1886	6278	2	APPARENT ENERGY L$_3$	100*VAh	R	Unsigned

Timeband 15 - Energies

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$18B0	6320	2	SYSTEM ACTIVE ENERGY IN	100*Wh	R	Unsigned
- - -	- - -	- - -	- - -	- - -	- - -	- - -
$18D6	6358	2	APPARENT ENERGY L$_3$	100*VAh	R	Unsigned

Timeband 16 - Energies

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$1900	6400	2	SYSTEM ACTIVE ENERGY IN	100*Wh	R	Unsigned
- - -	- - -	- - -	- - -	- - -	- - -	- - -
$1926	6438	2	APPARENT ENERGY L$_3$	100*VAh	R	Unsigned

**Warning:** All the energy values restart from 0 after the 100'000'000 kWh [1'000'000'000 * 100*Wh]

Input Counters

Total Input Counters

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$2000	8192	2	INPUT COUNTER 1	---	R	Unsigned
$2002	8194	2	INPUT COUNTER 2	---	R	Unsigned
$2004	8196	2	INPUT COUNTER 3	---	R	Unsigned
$2006	8198	2	INPUT COUNTER 4	---	R	Unsigned

Timeband 1 - Input Counters

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$2020	8224	2	INPUT COUNTER 1	---	R	Unsigned
$2022	8226	2	INPUT COUNTER 2	---	R	Unsigned
$2024	8228	2	INPUT COUNTER 3	---	R	Unsigned
$2026	8230	2	INPUT COUNTER 4	---	R	Unsigned

Timeband 2 - Input Counters

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$2040	8256	2	INPUT COUNTER 1	---	R	Unsigned
$2042	8258	2	INPUT COUNTER 2	---	R	Unsigned
$2044	8260	2	INPUT COUNTER 3	---	R	Unsigned
$2046	8262	2	INPUT COUNTER 4	---	R	Unsigned

Timeband 3 - Input Counters

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$2060	8288	2	INPUT COUNTER 1	---	R	Unsigned
$2062	8290	2	INPUT COUNTER 2	---	R	Unsigned
$2064	8292	2	INPUT COUNTER 3	---	R	Unsigned
$2066	8294	2	INPUT COUNTER 4	---	R	Unsigned

Timeband 4 - Input Counters

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$2080	8320	2	INPUT COUNTER 1	---	R	Unsigned
$2082	8322	2	INPUT COUNTER 2	---	R	Unsigned
$2084	8324	2	INPUT COUNTER 3	---	R	Unsigned
$2086	8326	2	INPUT COUNTER 4	---	R	Unsigned

Timeband 5 - Input Counters

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$20A0	8352	2	INPUT COUNTER 1	---	R	Unsigned
$20A2	8354	2	INPUT COUNTER 2	---	R	Unsigned
$20A4	8356	2	INPUT COUNTER 3	---	R	Unsigned
$20A6	8358	2	INPUT COUNTER 4	---	R	Unsigned

Timeband 6 - Input Counters

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$20C0	8384	2	INPUT COUNTER 1	---	R	Unsigned
$20C2	8386	2	INPUT COUNTER 2	---	R	Unsigned
$20C4	8388	2	INPUT COUNTER 3	---	R	Unsigned
$20C6	8390	2	INPUT COUNTER 4	---	R	Unsigned

Timeband 7- Input Counters

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$20E0	8416	2	INPUT COUNTER 1	---	R	Unsigned
$20E2	8418	2	INPUT COUNTER 2	---	R	Unsigned
$20E4	8420	2	INPUT COUNTER 3	---	R	Unsigned
$20E6	8422	2	INPUT COUNTER 4	---	R	Unsigned

Timeband 8 - Input Counters

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$2100	8448	2	INPUT COUNTER 1	---	R	Unsigned
$2102	8450	2	INPUT COUNTER 2	---	R	Unsigned
$2104	8452	2	INPUT COUNTER 3	---	R	Unsigned
$2106	8454	2	INPUT COUNTER 4	---	R	Unsigned

Timeband 9 - Input Counters

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$2120	8480	2	INPUT COUNTER 1	---	R	Unsigned
$2122	8482	2	INPUT COUNTER 2	---	R	Unsigned
$2124	8484	2	INPUT COUNTER 3	---	R	Unsigned
$2126	8486	2	INPUT COUNTER 4	---	R	Unsigned

Timeband 10 - Input Counters

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$2140	8512	2	INPUT COUNTER 1	---	R	Unsigned
$2142	8514	2	INPUT COUNTER 2	---	R	Unsigned
$2144	8516	2	INPUT COUNTER 3	---	R	Unsigned
$2146	8518	2	INPUT COUNTER 4	---	R	Unsigned

Timeband 11 - Input Counters

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$2160	8544	2	INPUT COUNTER 1	---	R	Unsigned
$2162	8546	2	INPUT COUNTER 2	---	R	Unsigned
$2164	8548	2	INPUT COUNTER 3	---	R	Unsigned
$2166	8550	2	INPUT COUNTER 4	---	R	Unsigned

Timeband 12 - Input Counters

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$2180	8576	2	INPUT COUNTER 1	---	R	Unsigned
$2182	8578	2	INPUT COUNTER 2	---	R	Unsigned
$2184	8580	2	INPUT COUNTER 3	---	R	Unsigned
$2186	8582	2	INPUT COUNTER 4	---	R	Unsigned

Timeband 13 - Input Counters

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$21A0	8608	2	INPUT COUNTER 1	---	R	Unsigned
$21A2	8610	2	INPUT COUNTER 2	---	R	Unsigned
$21A4	8612	2	INPUT COUNTER 3	---	R	Unsigned
$21A6	8614	2	INPUT COUNTER 4	---	R	Unsigned

Timeband 14 - Input Counters

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$21C0	8624	2	INPUT COUNTER 1	---	R	Unsigned
$21C2	8626	2	INPUT COUNTER 2	---	R	Unsigned
$21C4	8628	2	INPUT COUNTER 3	---	R	Unsigned
$21C6	8630	2	INPUT COUNTER 4	---	R	Unsigned

Timeband 15 - Input Counters

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$21E0	8672	2	INPUT COUNTER 1	---	R	Unsigned
$21E2	8674	2	INPUT COUNTER 2	---	R	Unsigned
$21E4	8676	2	INPUT COUNTER 3	---	R	Unsigned
$21E6	8678	2	INPUT COUNTER 4	---	R	Unsigned

Timeband 16 - Input Counters

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$2200	8704	2	INPUT COUNTER 1	---	R	Unsigned
$2202	8706	2	INPUT COUNTER 2	---	R	Unsigned
$2204	8708	2	INPUT COUNTER 3	---	R	Unsigned
$2206	8710	2	INPUT COUNTER 4	---	R	Unsigned

Warning: Ton_{min} Input Signal: 30 mS
$Toff_{min}$ Input Signal: 30 mS

Instantaneous Minimum and Maximum

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$3000	12288	1	HOUR	---	R	Unsigned
$3001	12289	1	MINUTE	---	R	Unsigned
$3002	12290	1	SECOND	---	R	Unsigned
$3003	12291	1	DAY	---	R	Unsigned
$3004	12292	1	MONTH	---	R	Unsigned
$3005	12293	1	YEAR	---	R	Unsigned
$3006	12294	2	MIN SYSTEM VOLTAGE	mV	R	Unsigned
$3008	12296	1	HOUR	---	R	Unsigned
$3009	12297	1	MINUTE	---	R	Unsigned
$300A	12298	1	SECOND	---	R	Unsigned
$300B	12299	1	DAY	---	R	Unsigned
$300C	12300	1	MONTH	---	R	Unsigned
$300D	12301	1	YEAR	---	R	Unsigned
$300E	12302	2	MAX SYSTEM VOLTAGE	mV	R	Unsigned
$3010	12304	1	HOUR	---	R	Unsigned
$3011	12305	1	MINUTE	---	R	Unsigned
$3012	12306	1	SECOND	---	R	Unsigned
$3013	12307	1	DAY	---	R	Unsigned
$3014	12308	1	MONTH	---	R	Unsigned
$3015	12309	1	YEAR	---	R	Unsigned
$3016	12310	2	MIN PHASE VOLTAGE L_1	mV	R	Unsigned
…	…	…	H,M,S – D,M,Y	…	…	…
$301E	12318	2	MAX PHASE VOLTAGE L_1	mV	R	Unsigned
…	…	…	H,M,S – D,M,Y	…	…	…
$3026	12326	2	MIN PHASE VOLTAGE L_2	mV	R	Unsigned
…	…	…	H,M,S – D,M,Y	…	…	…
$302E	12334	2	MAX PHASE VOLTAGE L_2	mV	R	Unsigned
…	…	…	H,M,S – D,M,Y	…	…	…
$3036	12342	2	MIN PHASE VOLTAGE L_3	mV	R	Unsigned
…	…	…	H,M,S – D,M,Y	…	…	…
$303E	12350	2	MAX PHASE VOLTAGE L_3	mV	R	Unsigned
…	…	…	H,M,S – D,M,Y	…	…	…
$3046	12358	2	MIN LINE TO LINE VOLTAGE L_{1-2}	mV	R	Signed
…	…	…	H,M,S – D,M,Y	…	…	…
$304E	12366	2	MAX LINE TO LINE VOLTAGE L_{1-2}	mV	R	Signed
…	…	…	H,M,S – D,M,Y	…	…	…
$3056	12374	2	MIN LINE TO LINE VOLTAGE L_{2-3}	mV	R	Signed
…	…	…	H,M,S – D,M,Y	…	…	…
$305E	12382	2	MAX LINE TO LINE VOLTAGE L_{2-3}	mV	R	Signed
…	…	…	H,M,S – D,M,Y	…	…	…
$3066	12390	2	MIN LINE TO LINE VOLTAGE L_{3-1}	mV	R	Signed
…	…	…	H,M,S – D,M,Y	…	…	…
$306E	12398	2	MAX LINE TO LINE VOLTAGE L_{3-1}	mV	R	Signed
…	…	…	H,M,S – D,M,Y	…	…	…
$3076	12406	2	MIN SYSTEM CURRENT	mA	R	Unsigned
…	…	…	H,M,S – D,M,Y	…	…	…
$307E	12414	2	MAX SYSTEM CURRENT	mA	R	Unsigned
…	…	…	H,M,S – D,M,Y	…	…	…
$3086	12422	2	MIN LINE CURRENT L_1	mA	R	Unsigned
…	…	…	H,M,S – D,M,Y	…	…	…
$308E	12430	2	MAX LINE CURRENT L_1	mA	R	Unsigned
…	…	…	H,M,S – D,M,Y	…	…	…
$3096	12438	2	MIN LINE CURRENT L_2	mA	R	Unsigned
…	…	…	H,M,S – D,M,Y	…	…	…
$309E	12446	2	MAX LINE CURRENT L_2	mA	R	Unsigned
…	…	…	H,M,S – D,M,Y	…	…	…
$30A6	12454	2	MIN LINE CURRENT L_3	mA	R	Unsigned
…	…	…	H,M,S – D,M,Y	…	…	…
$30AE	12462	2	MAX LINE CURRENT L_3	mA	R	Unsigned
…	…	…	H,M,S – D,M,Y	…	…	…
$30B6	12470	2	MIN SYSTEM POWER FACTOR	±1000	R	Signed
…	…	…	H,M,S – D,M,Y	…	…	…
$30BE	12478	2	MAX SYSTEM POWER FACTOR	±1000	R	Signed
…	…	…	H,M,S – D,M,Y	…	…	…
$30C6	12486	2	MIN POWER FACTOR L_1	±1000	R	Signed
…	…	…	H,M,S – D,M,Y	…	…	…
$30CE	12494	2	MAX POWER FACTOR L_1	±1000	R	Signed
…	…	…	H,M,S – D,M,Y	…	…	…
$30D6	12502	2	MIN POWER FACTOR L_2	±1000	R	Signed
…	…	…	H,M,S – D,M,Y	…	…	…
$30DE	12510	2	MAX POWER FACTOR L_2	±1000	R	Signed
…	…	…	H,M,S – D,M,Y	…	…	…
$30E6	12518	2	MIN POWER FACTOR L_3	±1000	R	Signed
…	…	…	H,M,S – D,M,Y	…	…	…
$30EE	12526	2	MAX POWER FACTOR L_3	±1000	R	Signed
…	…	…	H,M,S – D,M,Y	…	…	…
$30F6	12534	2	MIN SYSTEM COS φ	±1000	R	Signed

...	...	...	H,M,S – D,M,Y	...	...	...
$30FE	12542	2	MAX SYSTEM COS φ	±1000	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$3106	12550	2	MIN PHASE COS φ_1	±1000	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$310E	12558	2	MAX PHASE COS φ_1	±1000	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$3116	12566	2	MIN PHASE COS φ_2	±1000	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$311E	12574	2	MAX PHASE COS φ_2	±1000	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$3126	12582	2	MIN PHASE COS φ_3	±1000	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$312E	12590	2	MAX PHASE COS φ_3	±1000	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$3136	12598	2	MIN SYSTEM APPARENT POWER	VA	R	Unsigned
...	...	...	H,M,S – D,M,Y	...	...	...
$313E	12606	2	MAX SYSTEM APPARENT POWER	VA	R	Unsigned
...	...	...	H,M,S – D,M,Y	...	...	...
$3146	12614	2	MIN APPARENT POWER L_1	VA	R	Unsigned
...	...	...	H,M,S – D,M,Y	...	...	...
$314E	12622	2	MAX APPARENT POWER L_1	VA	R	Unsigned
...	...	...	H,M,S – D,M,Y	...	...	...
$3156	12630	2	MIN APPARENT POWER L_2	VA	R	Unsigned
...	...	...	H,M,S – D,M,Y	...	...	...
$315E	12638	2	MAX APPARENT POWER L_2	VA	R	Unsigned
...	...	...	H,M,S – D,M,Y	...	...	...
$3166	12646	2	MIN APPARENT POWER L_3	VA	R	Unsigned
...	...	...	H,M,S – D,M,Y	...	...	...
$316E	12654	2	MAX APPARENT POWER L_3	VA	R	Unsigned
...	...	...	H,M,S – D,M,Y	...	...	...
$3176	12662	2	MIN SYSTEM ACTIVE POWER	W	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$317E	12670	2	MAX SYSTEM ACTIVE POWER	W	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$3186	12678	2	MIN ACTIVE POWER L_1	W	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$318E	12686	2	MAX ACTIVE POWER L_1	W	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$3196	12694	2	MIN ACTIVE POWER L_2	W	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$319E	12702	2	MAX ACTIVE POWER L_2	W	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$31A6	12710	2	MIN ACTIVE POWER L_3	W	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$31AE	12718	2	MAX ACTIVE POWER L_3	W	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$31B6	12726	2	MIN SYSTEM REACTIVE POWER	VAR	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$31BE	12734	2	MAX SYSTEM REACTIVE POWER	VAR	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$31C6	12742	2	MIN REACTIVE POWER L_1	VAR	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$31CE	12750	2	MAX REACTIVE POWER L_1	VAR	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$31D6	12758	2	MIN REACTIVE POWER L_2	VAR	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$31DE	12766	2	MAX REACTIVE POWER L_2	VAR	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$31E6	12774	2	MIN REACTIVE POWER L_3	VAR	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$31EE	12782	2	MAX REACTIVE POWER L_3	VAR	R	Signed
...	...	...	H,M,S – D,M,Y	...	...	...
$31F6	12790	2	MIN NEUTRAL CURRENT	mA	R	Unsigned
...	...	...	H,M,S – D,M,Y	...	...	...
$31FE	12798	2	MAX NEUTRAL CURRENT	mA	R	Unsigned
...	...	...	H,M,S – D,M,Y	...	...	...
$3206	12806	2	MIN FREQUENCY	mHz	R	Unsigned
...	...	...	H,M,S – D,M,Y	...	...	...
$320E	12814	2	MAX FREQUENCY	mHz	R	Unsigned

Actual Average

Register HEX	Register DEC	Word	Description	Measure Unit	R/W	Type
$3400	13312	2	LINE CURRENT L_1	mA	R	Unsigned
$3402	13314	2	LINE CURRENT L_2	mA	R	Unsigned
$3404	13316	2	LINE CURRENT L_3	mA	R	Unsigned
$3406	13318	2	SYSTEM APPARENT POWER	VA	R	Unsigned
$3408	13320	2	SYSTEM ACTIVE POWER	W	R	Signed
$340A	13322	2	SYSTEM REACTIVE POWER	VAR	R	Signed
$340C	13324	2	NEUTRAL CURRENT[(*)]	mA	R	Unsigned

[(*)]: calculated or measured, according with EMT-4s version and command NEUTRAL CURRENT USED

Maximum Demand

Register HEX	Register DEC	Word	Description	Measure Unit	R/W	Type
$3500	13568	1	HOUR	---	R	Unsigned
$3501	13569	1	MINUTE	---	R	Unsigned
$3502	13570	1	SECOND	---	R	Unsigned
$3503	13571	1	DAY	---	R	Unsigned
$3504	13572	1	MONTH	---	R	Unsigned
$3505	13573	1	YEAR	---	R	Unsigned
$3506	13574	2	MAX CURRENT L_1	mA	R	Unsigned
$3508	13576	1	HOUR	---	R	Unsigned
$3509	13577	1	MINUTE	---	R	Unsigned
$350A	13578	1	SECOND	---	R	Unsigned
$350B	13579	1	DAY	---	R	Unsigned
$350C	13580	1	MONTH	---	R	Unsigned
$350D	13581	1	YEAR	---	R	Unsigned
$350E	13582	2	MAX CURRENT L_2	mA	R	Unsigned
$3510	13584	1	HOUR	---	R	Unsigned
$3511	13585	1	MINUTE	---	R	Unsigned
$3512	13586	1	SECOND	---	R	Unsigned
$3513	13587	1	DAY	---	R	Unsigned
$3514	13588	1	MONTH	---	R	Unsigned
$3515	13589	1	YEAR	---	R	Unsigned
$3516	13590	2	MAX CURRENT L_3	mA	R	Unsigned
$3518	13592	1	HOUR	---	R	Unsigned
$3519	13593	1	MINUTE	---	R	Unsigned
$351A	13594	1	SECOND	---	R	Unsigned
$351B	13595	1	DATE	---	R	Unsigned
$351C	13596	1	MONTH	---	R	Unsigned
$351D	13597	1	YEAR	---	R	Unsigned
$351E	13598	2	MAX SYSTEM APPARENT POWER	VA	R	Unsigned
$3520	13600	1	HOUR	---	R	Unsigned
$3521	13601	1	MINUTE	---	R	Unsigned
$3522	13602	1	SECOND	---	R	Unsigned
$3523	13603	1	DAY	---	R	Unsigned
$3524	13604	1	MONTH	---	R	Unsigned
$3525	13605	1	YEAR	---	R	Unsigned
$3526	13606	2	MAX SYSTEM ACTIVE POWER	W	R	Unsigned
$3528	13608	1	HOUR	---	R	Unsigned
$3529	13609	1	MINUTE	---	R	Unsigned
$352A	13610	1	SECOND	---	R	Unsigned
$352B	13611	1	DAY	---	R	Unsigned
$352C	13612	1	MONTH	---	R	Unsigned
$352D	13613	1	YEAR	---	R	Unsigned
$352E	13614	2	MAX SYSTEM REACTIVE POWER	VAR	R	Unsigned
$3530	13616	1	HOUR	---	R	Unsigned
$3531	13617	1	MINUTE	---	R	Unsigned
$3532	13618	1	SECOND	---	R	Unsigned
$3533	13619	1	DAY	---	R	Unsigned
$3534	13620	1	MONTH	---	R	Unsigned
$3535	13621	1	YEAR	---	R	Unsigned
$3536	13622	2	MAX NEUTRAL CURRENT[(*)]	mA	R	Unsigned

[(*)]: calculated or measured, according with EMT-4s version and command NEUTRAL CURRENT USED

Note: Maximum Demand is saved in not volatile memory.

Alarms

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Type
$3A00	14848	1	HOUR Threshold Overcoming	---	R	Unsigned
$3A01	14849	1	MINUTE Threshold Overcoming	---	R	Unsigned
$3A02	14850	1	SECOND Threshold Overcoming	---	R	Unsigned
$3A03	14851	1	DATE Threshold Overcoming	---	R	Unsigned
$3A04	14852	1	MONTH Threshold Overcoming	---	R	Unsigned
$3A05	14853	1	YEAR Threshold Overcoming	---	R	Unsigned
$3A06	14854	2	SYSTEM VOLTAGE ALARM VALUE	mV	R	Unsigned
$3A08	14856	1	HOUR Threshold Re-Entry *	---	R	Unsigned
$3A09	14857	1	MINUTE Threshold Re-Entry *	---	R	Unsigned
$3A0A	14858	1	SECOND Threshold Re-Entry *	---	R	Unsigned
$3A0B	14859	1	DATE Threshold Re-Entry *	---	R	Unsigned
$3A0C	14860	1	MONTH Threshold Re-Entry *	---	R	Unsigned
$3A0D	14861	1	YEAR Threshold Re-Entry *	---	R	Unsigned
$3A0E	14862	2	SYSTEM VOLTAGE ALARM RE-ENTRY VALUE	mV	R	Unsigned
$3A10	14864	1	HOUR Threshold Overcoming	---	R	Unsigned
$3A11	14865	1	MINUTE Threshold Overcoming	---	R	Unsigned
$3A12	14866	1	SECOND Threshold Overcoming	---	R	Unsigned
$3A13	14867	1	DATE Threshold Overcoming	---	R	Unsigned
$3A14	14868	1	MONTH Threshold Overcoming	---	R	Unsigned
$3A15	14869	1	YEAR Threshold Overcoming	---	R	Unsigned
$3A16	14870	2	PHASE VOLTAGE L_{1-N} ALARM VALUE	mV	R	Unsigned
$3A18	14872	1	HOUR Threshold Re-Entry *	---	R	Unsigned
$3A19	14873	1	MINUTE Threshold Re-Entry *	---	R	Unsigned
$3A1A	14874	1	SECOND Threshold Re-Entry *	---	R	Unsigned
$3A1B	14875	1	DATE Threshold Re-Entry *	---	R	Unsigned
$3A1C	14876	1	MONTH Threshold Re-Entry *	---	R	Unsigned
$3A1D	14877	1	YEAR Threshold Re-Entry *	---	R	Unsigned
$3A1E	14878	2	PHASE VOLTAGE L_{1-N} ALARM RE-ENTRY VALUE	mV	R	Unsigned
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3A26	14886	2	PHASE VOLTAGE L_{2-N} ALARM VALUE	mV	R	Unsigned
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3A2E	14894	2	PHASE VOLTAGE L_{2-N} ALARM RE-ENTRY VALUE	mV	R	Unsigned
…	…	…	H,M,S – D,M,Y Overcoming	---	R	Unsigned
$3A36	14902	2	PHASE VOLTAGE L_{3-N} ALARM VALUE	mV	R	Unsigned
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3A3E	14910	2	PHASE VOLTAGE L_{3-N} ALARM RE-ENTRY VALUE	mV	R	Unsigned
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3A46	14918	2	LINE TO LINE VOLTAGE L_{1-2} ALARM VALUE	mV	R	Unsigned
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3A4E	14926	2	LINE TO LINE VOLTAGE L_{1-2} ALARM RE-ENTRY VALUE	mV	R	Unsigned
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3A56	14934	2	LINE TO LINE VOLTAGE L_{2-3} ALARM VALUE	mV	R	Unsigned
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3A5E	14942	2	LINE TO LINE VOLTAGE L_{2-3} ALARM RE-ENTRY VALUE	mV	R	Unsigned
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3A66	14950	2	LINE TO LINE VOLTAGE L_{3-1} ALARM VALUE	mV	R	Unsigned
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3A6E	14958	2	LINE TO LINE VOLTAGE L_{3-1} ALARM RE-ENTRY VALUE	mV	R	Unsigned
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3A76	14966	2	SYSTEM CURRENT ALARM VALUE	mA	R	Unsigned
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3A7E	14974	2	SYSTEM CURRENT ALARM RE-ENTRY VALUE	mA	R	Unsigned
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3A86	14982	2	LINE CURRENT L_1 ALARM VALUE	mA	R	Unsigned
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3A8E	14990	2	LINE CURRENT L_1 ALARM RE-ENTRY VALUE	mA	R	Unsigned
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3A96	14998	2	LINE CURRENT L_2 ALARM VALUE	mA	R	Unsigned
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3A9E	15006	2	LINE CURRENT L_2 ALARM RE-ENTRY VALUE	mA	R	Unsigned
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3AA6	15014	2	LINE CURRENT L_3 ALARM VALUE	mA	R	Unsigned
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3AAE	15022	2	LINE CURRENT L_3 ALARM RE-ENTRY VALUE	mA	R	Unsigned
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3AB6	15030	2	SYSTEM POWER FACTOR ALARM VALUE	±1000	R	Signed
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3ABE	15038	2	SYSTEM POWER FACTOR ALARM RE-ENTRY VALUE	±1000	R	Signed
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3AC6	15046	2	POWER FACTOR L_1 ALARM VALUE	±1000	R	Unsigned
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3ACE	15054	2	POWER FACTOR L_1 ALARM RE-ENTRY VALUE	±1000	R	Unsigned
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3AD6	15062	2	POWER FACTOR L_2 ALARM VALUE	±1000	R	Unsigned
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3ADE	15070	2	POWER FACTOR L_2 ALARM RE-ENTRY VALUE	±1000	R	Unsigned
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…

$3AE6	15078	2	POWER FACTOR L₃ ALARM VALUE	±1000	R	Unsigned
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3AEE	15086	2	POWER FACTOR L₃ ALARM RE-ENTRY VALUE	±1000	R	Unsigned
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3AF6	15094	2	SYSTEM COS Ø ALARM VALUE	±1000	R	Signed
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3AFE	15102	2	SYSTEM COS Ø ALARM RE-ENTRY VALUE	±1000	R	Unsigned
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3B06	15110	2	PHASE COS Ø₁ ALARM VALUE	±1000	R	Signed
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3B0E	15118	2	PHASE COS Ø₁ ALARM RE-ENTRY VALUE	±1000	R	Signed
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3B16	15126	2	PHASE COS Ø₂ ALARM VALUE	±1000	R	Signed
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3B1E	15134	2	PHASE COS Ø₂ ALARM RE-ENTRY VALUE	±1000	R	Signed
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3B26	15142	2	PHASE COS Ø₃ ALARM VALUE	±1000	R	Signed
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3B2E	15150	2	PHASE COS Ø₃ ALARM RE-ENTRY VALUE	±1000	R	Signed
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3B36	15158	2	SYSTEM APPARENT POWER ALARM VALUE	VA	R	Unsigned
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3B3E	15166	2	SYSTEM APPARENT POWER ALARM RE-ENTRY VALUE	VA	R	Unsigned
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3B46	15174	2	APPARENT POWER L₁ ALARM VALUE	VA	R	Unsigned
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3B4E	15182	2	APPARENT POWER L₁ ALARM RE-ENTRY VALUE	VA	R	Unsigned
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3B56	15190	2	APPARENT POWER L₂ ALARM VALUE	VA	R	Unsigned
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3B5E	15198	2	APPARENT POWER L₂ ALARM RE-ENTRY VALUE	VA	R	Unsigned
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3B66	15206	2	APPARENT POWER L₃ ALARM VALUE	VA	R	Unsigned
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3B6E	15214	2	APPARENT POWER L₃ ALARM RE-ENTRY VALUE	VA	R	Unsigned
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3B76	15222	2	SYSTEM ACTIVE POWER ALARM VALUE	W	R	Unsigned
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3B7E	15230	2	SYSTEM ACTIVE POWER ALARM RE-ENTRY VALUE	W	R	Unsigned
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3B86	15238	2	ACTIVE POWER L₁ ALARM VALUE	W	R	Signed
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3B8E	15246	2	ACTIVE POWER L₁ ALARM RE-ENTRY VALUE	W	R	Signed
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3B96	15254	2	ACTIVE POWER L₂ ALARM VALUE	W	R	Signed
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3B9E	15262	2	ACTIVE POWER L₂ ALARM RE-ENTRY VALUE	W	R	Signed
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3BA6	15270	2	ACTIVE POWER L₃ ALARM VALUE	W	R	Signed
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3BAE	15278	2	ACTIVE POWER L₃ ALARM RE-ENTRY VALUE	W	R	Signed
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3BB6	15286	2	SYSTEM REACTIVE POWER ALARM VALUE	VAR	R	Unsigned
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3BBE	15294	2	SYSTEM REACTIVE POWER ALARM RE-ENTRY VALUE	VAR	R	Unsigned
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3BC6	15302	2	REACTIVE POWER L₁ ALARM VALUE	VAR	R	Signed
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3BCE	15310	2	REACTIVE POWER L₁ ALARM RE-ENTRY VALUE	VAR	R	Signed
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3BD6	15318	2	REACTIVE POWER L₂ ALARM VALUE	VAR	R	Signed
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3BDE	15326	2	REACTIVE POWER L₂ ALARM RE-ENTRY VALUE	VAR	R	Signed
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3BE6	15334	2	REACTIVE POWER L₃ ALARM VALUE	VAR	R	Signed
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3BEE	15342	2	REACTIVE POWER L₃ ALARM RE-ENTRY VALUE	VAR	R	Signed
…	…	…	H,M,S – D,M,Y Overcoming	…	…	…
$3BF6	15350	2	NEUTRAL CURRENT ALARM VALUE[(*)]	mA	R	Unsigned
…	…	…	H,M,S – D,M,Y Re-Entry	…	…	…
$3BFE	15358	2	NEUTRAL CURRENT ALARM RE-ENTRY VALUE[(*)]	mA	R	Unsigned

* zero value if overcoming threshold setted but not re-entry yet
[(*)]: calculated or measured, according with EMT-4s version and command NEUTRAL CURRENT USED

Note: *Alarms is saved in not volatile memory.*

Info Device & Firmware Version

Register HEX	Register DEC	Word	Description	W/R	Note:
$4000	16384	6	SERIAL NUMBER	R	Expressed in ASCII Code
$4006	16390	32	CONFIGURATION CODE	R	Expressed in ASCII Code(**) *(for details see the following table)*
$4026	16422	4	HW REVISION	R	Expressed in ASCII Code
$402A	16426	4	HW CUSTOMIZATION	R	Expressed in ASCII Code

(**): Read the Configuration Code register for hardware EMT-4s configuration.

Detail Configuration code

	CT	Neutral CT	RTC Backup	Digital IO	COM2	Supply	Class
	00	**00**	**00**	**00**	**00**	**00**	**00**
	Internal - 1 A	None	Super Cap	4DI	None	115/230/400 Vac	1.0
	01	**01**	**01**	**01**	**01**		**01**
	Internal - 5 A	Present	Battery	2DI + 2DO	Present		0.5 S
EMT-4s-	**02**			**02**			**02**
	Front - 30 A			4DO			0.2 S
				03			
				2DI			
				04			
				2DO			

Boot Version

Register HEX	Register DEC	Word	Description	W/R	Note:
$4030	16432	1	BOOT VERSION	R	

Firmware Version

Register HEX	Register DEC	Word	Description	W/R	Note:
$4040	16448	1	FIRMWARE VERSION	R	

Device State

Register HEX	Register DEC	Word	Description	Measure Unit	W/R	Note:
$4100	16640	2	DEVICE STATE	---	R	Bit 00: calibration corrupted [B] Bit 01: calibration corrupted [A] Bit 02: calibration corrupted [P] Bit 03: setup corrupted Bit 04: old data corrupted Bit 05: alarm present Bit 06: alarm temperature Bit 07: setup COM1 corrupted Bit 08: setup COM2 corrupted Bit 09: Warning voltage connection * Bit 10: Warning current connection ** Bit 11: Warning CT 1 inversion *** Bit 12: Warning CT 2 inversion *** Bit 13: Warning CT 3 inversion *** Bit 14: No Voltages Apply Bit 15: No Currents Apply
$4102	16642	1	DIGITAL INPUT STATE *(**)*	[---]	R	Bit 00: State Input 01 Bit 01: State Input 02 Bit 02: State Input 03 Bit 03: State Input 04 Bit 04 - 15: Not Used *[Default: 0]*
$4103	16643	1	DIGITAL OUTPUT STATE *(**)*	[---]	W/R	Bit 00: State Output 01 Bit 01: State Output 02 Bit 02: State Output 03 Bit 03: State Output 04 Bit 04 - 15: Not Used *[Default: 0]*
$4104	16644	2	ALARM STATE	[---]	R	Bit 00: SYSTEM VOLTAGE Bit 01: PHASE VOLTAGE L_{1-N} Bit 02: PHASE VOLTAGE L_{2-N} Bit 03: PHASE VOLTAGE L_{3-N} Bit 04: LINE TO LINE VOLTAGE L_{1-2} Bit 05: LINE TO LINE VOLTAGE L_{2-3} Bit 06: LINE TO LINE VOLTAGE L_{3-1} Bit 07: SYSTEM CURRENT Bit 08: LINE CURRENT L_1 Bit 09: LINE CURRENT L_2 Bit 10: LINE CURRENT L_3 Bit 11: SYSTEM POWER FACTOR Bit 12: POWER FACTOR L_1 Bit 13: POWER FACTOR L_2 Bit 14: POWER FACTOR L_3 Bit 15: SYSTEM COS∅ Bit 16: PHASE COS∅$_1$ Bit 17: PHASE COS∅$_2$ Bit 18: PHASE COS∅$_3$ Bit 19: SYSTEM APPARENT POWER Bit 20: APPARENT POWER L_1 Bit 21: APPARENT POWER L_2 Bit 22: APPARENT POWER L_3 Bit 23: SYSTEM ACTIVE POWER Bit 24: ACTIVE POWER L_1 Bit 25: ACTIVE POWER L_2 Bit 26: ACTIVE POWER L_3 Bit 27: SYSTEM REACTIVE POWER Bit 28: REACTIVE POWER L_1 Bit 29: REACTIVE POWER L_2 Bit 30: REACTIVE POWER L_3 Bit 31: NEUTRAL CURRENT MEASURED

* The order of voltage connections not be correct (don't respect 120° between the phases) in the following insertion:
- Three phase
- Three phase balanced
- Three phase multi load balanced
- Single phase multi load
- Multi single phase
Must be apply all voltage inputs.

** The order of current connections not be correct in the following insertion:
- Three phase
- Three phase balanced
- Three phase multi load balanced
- Single phase multi load
- Multi single phase
Must be apply all current and all voltage inputs and the loads to be balanced.

*** The current in the CT has the opposite sign respect others two phase.
Must be apply all current and all voltage inputs.

Device Parameters

It is possible to send a broadcast command (Address Field equal 0x00) for all write command.

<u>Warning</u>: All Write command could be send in Broadcast Mode (Modbus Node ID 0) but if the Modbus Register or Modbus Parameters is wrong anything messages are returned.

Register HEX	Register DEC	Word	Description	W/R	Parameters
$5000	20480	2	SOFTWARE RESET	W	MSW: $55AA LSW: $AA55 **Note:** Subsequent command are ignored.
$5002	20482	2	RESET PARAMETERS	W	**MSW - Reset:** $0000: Reset All Energies $0001: Reset All Energies TB (no total energies) $0002: Reset Energies TB 01 $0003: Reset Energies TB 02 $0004: Reset Energies TB 03 $0005: Reset Energies TB 04 $0006: Reset Energies TB 05 $0007: Reset Energies TB 06 $0008: Reset Energies TB 07 $0009: Reset Energies TB 08 $000A: Reset Energies TB 09 $000B: Reset Energies TB 10 $000C: Reset Energies TB 11 $000D: Reset Energies TB 12 $000E: Reset Energies TB 13 $000F: Reset Energies TB 14 $0010: Reset Energies TB 15 $0011: Reset Energies TB 16 $0012: Reset All Min & Max $0013: Reset Min & Max Voltage $0014: Reset Min & Max Current $0015: Reset Min & Max Power $0016: Reset Maximum Avg $0017: Reset Alarm Limits $0018: Reset Alarm State $0019: Reset Alarm Stored $001A: Reset Activation Alarm Threshold $001B: Reset All Counters $001C: Reset All Counters TB (no total counters) $001D: Reset Counters TB 01 $001E: Reset Counters TB 02 $001F: Reset Counters TB 03 $0020: Reset Counters TB 04 $0021: Reset Counters TB 05 $0022: Reset Counters TB 06 $0023: Reset Counters TB 07 $0024: Reset Counters TB 08 $0025: Reset Counters TB 09 $0026: Reset Counters TB 10 $0027: Reset Counters TB 11 $0028: Reset Counters TB 12 $0029: Reset Counters TB 13 $002A: Reset Counters TB 14 $002B: Reset Counters TB 15 $002C: Reset Counters TB 16 $FFFD: Reset COM1 Setting $FFFE: Reset Setup (not include Reset COM1 Setting) $FFFF: Reset to Default **LSW:** $55AA
$5004	20484	1	HOUR	W/R	00 to 23 hours (00=Midnight)
$5005	20485	1	MINUTE	W/R	00 to 59 minutes
$5006	20486	1	SECOND	W/R	00 to 59 seconds
$5007	20487	1	DAY OF WEEK	W/R	$0001 = Sunday $0005 = Thursday $0002 = Monday $0006 = Friday $0003 = Tuesday $0007 = Saturday $0004 = Wednesday
$5008	20488	1	DATE	W/R	01 to 31 day-of-month
$5009	20489	1	MONTH	W/R	01 to 12 month
$500A	20490	1	YEAR	W/R	00 to 255 year **Note:** 00 corresponding at 2000 (leap year).
$500B	20491	1	SYNCRONIZE_CLOCK	W	$0000: only valid parameter (set to 00 second)
$500C	20492	1	KCT TRANSFORM RATIO CURRENT	W/R	1 ÷ 10000 [Default: 1] with KVT*KCT equal or less 350000
$500D	20493	1	KCTN TRANSFORM RATIO NEUTRAL CURRENT	W/R	1 ÷ 10000 [Default: 1] with KVT*KCT equal or less 350000
$500E	20494	1	KVT TRANSFORM RATIO VOLTAGE	W/R	1 ÷ 5000 [Default: 1] with KVT*KCT equal or less 350000
$500F	20495	1	INPUT MODE	W/R	$0000: Input State [Default] $0001: Up to 4 Input Counter $0002: Select Energy Timeband Used $0003: Select Counter Timeband Used Examples for Timeband Selection:

						DI03 = 1, DI02 = 0, DI01 = 0, DI00 = 1 TB selected is 1001bin→ TB 9 DI03 = 0, DI02 = 0, DI01 = 1, DI00 = 1 TB selected is 0011bin→ TB 3
$5010	20496	1	OUTPUT LEVEL		W/R	$0000: Active Low (Initial State: High Level) $0001: Active High (Initial State: Low Level) [Default]
$5011	20497	1	OUTPUT MODE		W/R	$0000: Output State (will be modify with DIGITAL OUTPUT STATE command) [Default] $0001: Output Pulse (see following commands)
$5012	20498	2	OUTPUT PULSE WEIGHT		W/R	Weight from 1 to 10000 (from fw revision 0009): - 1: pulse every 1 Wh, 1 VARh, 1 VAh. - 10: pulse every 10 Wh, 10 VARh ,10 VAh. - 100: pulse every 100 Wh, ... [Default] - 1k: pulse every 1 kWh, …. - 10k: pulse every 10 kWh, ….
$5014	20500	1	OUTPUT PULSE PERIOD		W/R	60 mSec ÷ 1000 mSec with step to 20 mSec Duty cycle fixed at 50% [Default: 500mSec] For example if it send: 100 mSec → T_{On} 50 mSec – T_{Off} 50 mSec 500 mSec → T_{On} 250 mSec – T_{Off} 250 mSec
$5015	20501	1	MEASURE PULSED DO 1		W/R	00: SYSTEM ACTIVE ENERGY IN [Default] 01: SYSTEM ACTIVE ENERGY OUT 02: SYSTEM REACTIVE ENERGY IN 03: SYSTEM REACTIVE ENERGY OUT 04: SYSTEM APPARENT ENERGY 05: ACTIVE ENERGY L_1 IN 06: ACTIVE ENERGY L_2 IN 07: ACTIVE ENERGY L_3 IN 08: ACTIVE ENERGY L_1 OUT 09: ACTIVE ENERGY L_2 OUT 10: ACTIVE ENERGY L_3 OUT 11: REACTIVE ENERGY L_1 IN 12: REACTIVE ENERGY L_2 IN 13: REACTIVE ENERGY L_3 IN 14: REACTIVE ENERGY L_1 OUT 15: REACTIVE ENERGY L_2 OUT 16: REACTIVE ENERGY L_3 OUT 17: APPARENT ENERGY L_1 18: APPARENT ENERGY L_2 19: APPARENT ENERGY L_3
$5016	20502	1	MEASURE PULSED DO 2		W/R	See Previous Modbus Command [Default: 01]
$5017	20503	1	MEASURE PULSED DO 3		W/R	See Previous Modbus Command [Default: 02]
$5018	20504	1	MEASURE PULSED DO 4		W/R	See Previous Modbus Command [Default: 03]
$5019	20505	1	DEMAND TIME		W/R	Up to FW rev.0008: 1 ÷ 60 minutes [Default: 15 min] From FW rev.0009: 1, 2, 3, 5, 6, 10, 12, 15, 20, 30, 60 synchronized with RTC. [Default: 15 min]
$501A	20506	1	ENERGIES TIMEBAND USED		W/R	01: Timeband 1 Used [Default] 02: Timeband 2 Used - 16: Timeband 16 Used
$501B	20507	1	COUNTERS TIMEBAND USED		W/R	01: Timeband 1 Used [Default] 02: Timeband 2 Used - 16: Timeband 16 Used
$501C	20508	2	ACTIVATION HIGH ALARM THRESHOLD		W/R	Bit Value "High" → Enable Alarm Corresponding Bit Value "Low" → Disable Alarm Corresponding [Default: All Alarm Disable, all bits are "Low"] Bit 00: SYSTEM VOLTAGE Bit 01: PHASE VOLTAGE L_{1-N} Bit 02: PHASE VOLTAGE L_{2-N} Bit 03: PHASE VOLTAGE L_{3-N} Bit 04: LINE TO LINE VOLTAGE L_{1-2} Bit 05: LINE TO LINE VOLTAGE L_{2-3} Bit 06: LINE TO LINE VOLTAGE L_{3-1} Bit 07: SYSTEM CURRENT Bit 08: LINE CURRENT L_1 Bit 09: LINE CURRENT L_2 Bit 10: LINE CURRENT L_3 Bit 11: SYSTEM POWER FACTOR Bit 12: POWER FACTOR L_1 Bit 13: POWER FACTOR L_2 Bit 14: POWER FACTOR L_3 Bit 15: SYSTEM COS∅ Bit 16: PHASE COS∅$_1$ Bit 17: PHASE COS∅$_2$ Bit 18: PHASE COS∅$_3$ Bit 19: SYSTEM APPARENT POWER Bit 20: APPARENT POWER L_1 Bit 21: APPARENT POWER L_2

|						
						Bit 22: APPARENT POWER L_3 Bit 23: SYSTEM ACTIVE POWER Bit 24: ACTIVE POWER L_1 Bit 25: ACTIVE POWER L_2 Bit 26: ACTIVE POWER L_3 Bit 27: SYSTEM REACTIVE POWER Bit 28: REACTIVE POWER L_1 Bit 29: REACTIVE POWER L_2 Bit 30: REACTIVE POWER L_3 Bit 31: NEUTRAL CURRENT **Warning**: Set corresponding alarm limit value before change this register.
$501E	20510	2	ACTIVATION LOW ALARM THRESHOLD		W/R	See Previous Modbus Command [Default: All Alarm Disable, all bits are "Low"]
$5020	20512	1	CLEAR ALARM MODE		W/R	$0000: Automatic [Default] $0001: Manual
$5021	20513	1	AUTOMATIC CLEAR ALARM HYSTERESIS THRESHOLD		W/R	$0000: Hysteresis Threshold - 3,125 % [Default] $0001: Hysteresis Threshold - 6,25 % $0002: Hysteresis Threshold - 12,5 % $0003: Hysteresis Threshold - 25 %
$5022	20514	1	ALARM PERSISTENCE BEFORE ALARM SET		W/R	0 ÷ 240 Sec 0: instantaneous alarm [Default] 1: 1 Sec - - - - - - - - - - - 240: 240 Sec
$5023	20515	1	FUNDAMENTAL FREQUENCY		W/R	$0000: 50 Hz [Default] $0001: 60 Hz
$5024	20516	1	FREQUENCY & SAG MONITOR		W/R	Select phase for frequency and sag monitor: $0000: Phase A [Default] $0001: Phase B $0002: Phase C
$5025	20517	2	SAG THRESHOLD		W/R	30 ÷ 400: Volt RMS value (send 200 for 200V RMS) [Default: 210]. See Fig.3 for detail. **Warning**: The new value will be valid after the next Power Up
$5027	20519	2	SAG PERIOD		W/R	1 ÷ 1000 mS [Default: 32]. See Fig.3 for detail. **Warning**: The new value will be valid after the next Power Up
$5029	20521	2	INSERTION USED		W/R	**MSW - Insertion Used:** 00: Three-Phase [Default] 01: Three Phase Balanced 02: Three-Phase Multi Load Balanced 03: Single-Phase 04: Single-Phase - Multi Load (from 1 to 3) 05: Multi Single-Phase 06: Two-Phase **LSW:** $55AA or 21930dec
$502B	20523	1	NEUTRAL CURRENT USED		W/R	00: computed 01: measured (if Neutral CT is present) [Default].
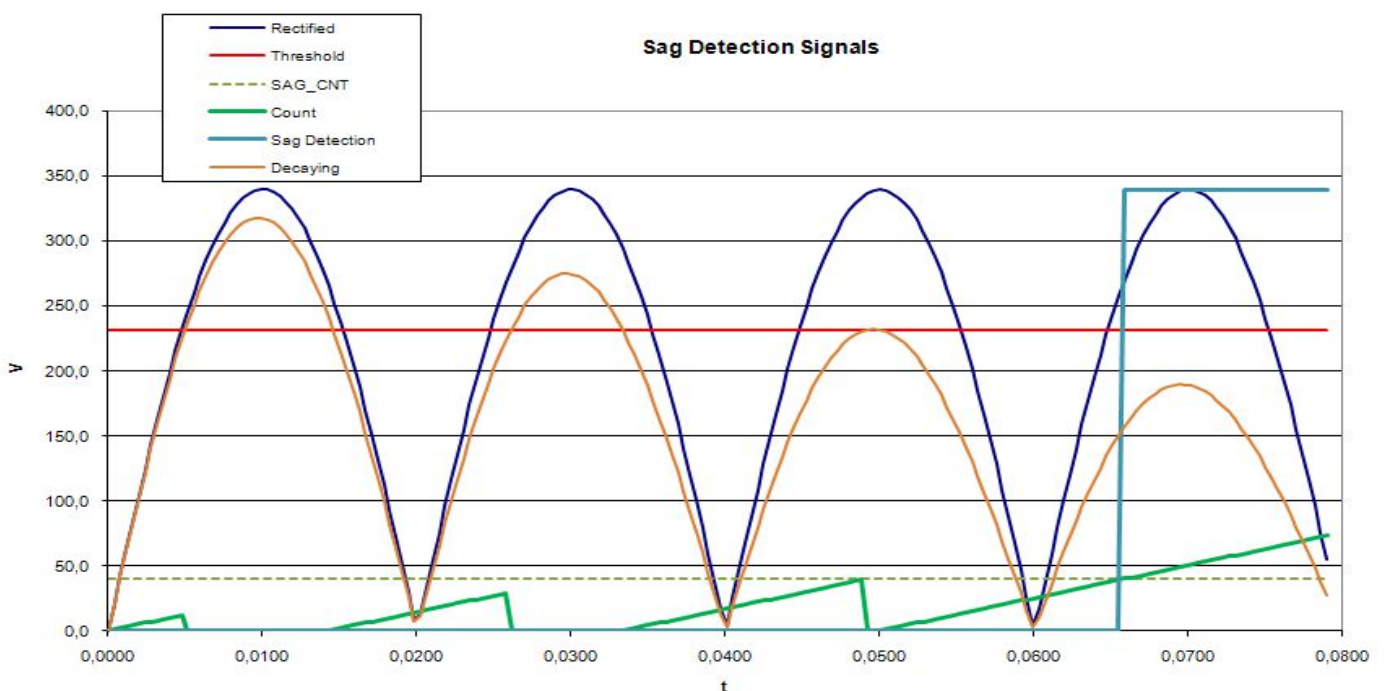
Fig.3: Sag Detection (sag counter and sag threshold)

Insertion Parameters

Description Insertion	Three-Phase	Aron	Three-Phase Balanced	Three-Phase Multi Load Balanced	Single-Phase	Singe-Phase Multi Load	Multi Single-Phase	Two-Phase 3 Wires
SYSTEM VOLTAGE	X	X	X	X				
PHASE VOLTAGE L_{1-N}	X	X	X	X	X	X	X	X
PHASE VOLTAGE L_{2-N}	X	X	X	X		X	X	X
PHASE VOLTAGE L_{3-N}	X	X	X	X		X	X	
LINE TO LINE VOLTAGE L_{1-2}	X	X	X	X				
LINE TO LINE VOLTAGE L_{2-3}	X	X	X	X				
LINE TO LINE VOLTAGE L_{3-1}	X	X	X	X				
SYSTEM CURRENT	X	X	calc	X				
LINE CURRENT L_1	X	X	X	x3	X	X	X	X
LINE CURRENT L_2	X	X	calc	x3		X	X	X
LINE CURRENT L_3	X	X	calc	x3		X	X	
SYSTEM POWER FACTOR	X	X	calc	X				
POWER FACTOR L_1	X	X	X	X	X	X	X	X
POWER FACTOR L_2	X	X	calc	X		X	X	X
POWER FACTOR L_3	X	X	calc	X		X	X	
SYSTEM COS φ	X	X	calc	X				
PHASE COS φ_1	X	X	X	X	X	X	X	X
PHASE COS φ_2	X	X	calc	X		X	X	X
PHASE COS φ_3	X	X	calc	X		X	X	
SYSTEM APPARENT POWER	X	X	calc	X				
APPARENT POWER L_1	X	X	X	x3	X	X	X	X
APPARENT POWER L_2	X	X	calc	x3		X	X	X
APPARENT POWER L_3	X	X	calc	x3		X	X	
SYSTEM ACTIVE POWER	X	X	calc	X				
ACTIVE POWER L_1	X	X	X	x3	X	X	X	X
ACTIVE POWER L_2	X	X	calc	x3		X	X	X
ACTIVE POWER L_3	X	X	calc	x3		X	X	
SYSTEM REACTIVE POWER	X	X	calc	X				
REACTIVE POWER L_1	X	X	X	x3	X	X	X	X
REACTIVE POWER L_2	X	X	calc	x3		X	X	X
REACTIVE POWER L_3	X	X	calc	x3		X	X	
NEUTRAL CURRENT MEASURED	X*	X*	X*	X*	X*	X*	X*	X*
NEUTRAL CURRENT COMPUTED	X	X				X		X
THD VOLTAGE L_1	X	X	X	X	X	X	X	X
THD VOLTAGE L_2	X	X	X	X		X	X	X
THD VOLTAGE L_3	X	X	X	X		X	X	
THD CURRENT L_1	X	X	X	X	X	X	X	X
THD CURRENT L_2	X	X	calc	X		X	X	X
THD CURRENT L_3	X	X	calc	X		X	X	
SAG	X	X	X	X	X	X	X	X
SYSTEM ACTIVE ENERGY IN	X	X	calc	x3	X	X	X	X
SYSTEM ACTIVE ENERGY OUT	X	X	calc	x3	X	X	X	X
SYSTEM REACTIVE ENERGY IN	X	X	calc	x3	X	X	X	X
SYSTEM REACTIVE ENERGY OUT	X	X	calc	x3	X	X	X	X
SYSTEM APPARENT ENERGY	X	X	calc	x3	X	X	X	X
ACTIVE ENERGY IN L_1	X	X	X	x3	X	X	X	X
ACTIVE ENERGY OUT L_1	X	X	X	x3	X	X	X	X
REACTIVE ENERGY IN L_1	X	X	X	x3	X	X	X	X
REACTIVE ENERGY OUT L_1	X	X	X	x3	X	X	X	X
APPARENT ENERGY L_1	X	X	X	x3	X	X	X	X
ACTIVE ENERGY IN L_2	X	X	calc	x3		X	X	X
ACTIVE ENERGY OUT L_2	X	X	calc	x3		X	X	X
REACTIVE ENERGY IN L_2	X	X	calc	x3		X	X	X
REACTIVE ENERGY OUT L_2	X	X	calc	x3		X	X	X
APPARENT ENERGY L_2	X	X	calc	x3		X	X	X
ACTIVE ENERGY IN L_3	X	X	calc	x3		X	X	
ACTIVE ENERGY OUT L_3	X	X	calc	x3		X	X	
REACTIVE ENERGY IN L_3	X	X	calc	x3		X	X	
REACTIVE ENERGY OUT L_3	X	X	calc	x3		X	X	
APPARENT ENERGY L_3	X	X	calc	x3		X	X	

[grey box] : the value read in this configuration aren't significant.

*: according with EMT-4s version

Serial 1 Setting

Register HEX	Register DEC	Word	Description	W/R	Parameters
$5100	20736	1	NODE ID SERIAL 1*	W	$0001 ÷ $00F7 (001÷247 dec) *[Default: 1]*
$5101	20737	1	BAUD RATE SERIAL 1*	W	$0000: 4800 Baud $0001: 9600 Baud $0002: 19200 Baud $0003: 38400 Baud *[default]*
$5102	20738	1	STOP BITS SERIAL 1*	W	$0001: 1 Stop Bit *[default]* $0002: 2 Stop Bits
$5103	20739	1	PARITY SERIAL 1*	W	$0000: None *[default]* $0001: Parity Odd $0002: Parity Even

* The Serial setting will be changed after the command response.

Serial 2 Setting

Register HEX	Register DEC	Word	Description	W/R	Parameters
$5113	20755	1	BAUD RATE SERIAL 2	W/R	$0000: 4800 Baud $0001: 9600 Baud $0002: 19200 Baud $0003: 38400 Baud *[default]*
$5114	20756	1	STOP BITS SERIAL 2	W/R	$0001: 1 Stop Bit *[default]* $0002: 2 Stop Bits
$5115	20757	1	PARITY SERIAL 2	W/R	$0000: None *[default]* $0001: Parity Odd $0002: Parity Even
$5116	20758	1	STATUS SERIAL 2	R	Default: All bit are "Low" (not error present) Bit 00: No slave response Bit 01: Corrupted message Bit 02: Illegal message received

Alarm Limits

Warning: All Write command could be send in Broadcast Mode (Modbus Node ID 0) but if the Modbus Register or Modbus Parameters is wrong anything messages are returned. *[Default: 0 for all parameters]*

Register HEX	Register DEC	Word	Description	W/R	Type
$5200	20992	2	HIGH LIMIT SYSTEM VOLTAGE	W/R	Unsigned
$5202	20994	2	LOW LIMIT SYSTEM VOLTAGE	W/R	Unsigned
$5204	20996	2	HIGH LIMIT PHASE VOLTAGE L_{1-N}	W/R	Unsigned
$5206	20998	2	LOW LIMIT PHASE VOLTAGE L_{1-N}	W/R	Unsigned
$5208	21000	2	HIGH LIMIT PHASE VOLTAGE L_{2-N}	W/R	Unsigned
$520A	21002	2	LOW LIMIT PHASE VOLTAGE L_{2-N}	W/R	Unsigned
$520C	21004	2	HIGH LIMIT PHASE VOLTAGE L_{3-N}	W/R	Unsigned
$520E	21006	2	LOW LIMIT PHASE VOLTAGE L_{3-N}	W/R	Unsigned
$5210	21008	2	HIGH LIMIT LINE TO LINE VOLTAGE L_{1-2}	W/R	Signed
$5212	21010	2	LOW LIMIT LINE TO LINE VOLTAGE L_{1-2}	W/R	Signed
$5214	21012	2	HIGH LIMIT LINE TO LINE VOLTAGE L_{2-3}	W/R	Signed
$5216	21014	2	LOW LIMIT LINE TO LINE VOLTAGE L_{2-3}	W/R	Signed
$5218	21016	2	HIGH LIMIT LINE TO LINE VOLTAGE L_{3-1}	W/R	Signed
$521A	21018	2	LOW LIMIT LINE TO LINE VOLTAGE L_{3-1}	W/R	Signed
$521C	21020	2	HIGH LIMIT SYSTEM CURRENT	W/R	Unsigned
$521E	21022	2	LOW LIMIT SYSTEM CURRENT	W/R	Unsigned
$5220	21024	2	HIGH LIMIT LINE CURRENT L_1	W/R	Unsigned
$5222	21026	2	LOW LIMIT LINE CURRENT L_1	W/R	Unsigned
$5224	21028	2	HIGH LIMIT LINE CURRENT L_2	W/R	Unsigned
$5226	21030	2	LOW LIMIT LINE CURRENT L_2	W/R	Unsigned
$5228	21032	2	HIGH LIMIT LINE CURRENT L_3	W/R	Unsigned
$522A	21034	2	LOW LIMIT LINE CURRENT L_3	W/R	Unsigned
$522C	21036	2	HIGH LIMIT SYSTEM POWER FACTOR	W/R	Signed
$522E	21038	2	LOW LIMIT SYSTEM POWER FACTOR	W/R	Signed
$5230	21040	2	HIGH LIMIT POWER FACTOR L_1	W/R	Signed
$5232	21042	2	LOW LIMIT POWER FACTOR L_1	W/R	Signed
$5234	21044	2	HIGH LIMIT POWER FACTOR L_2	W/R	Signed
$5236	21046	2	LOW LIMIT POWER FACTOR L_2	W/R	Signed
$5238	21048	2	HIGH LIMIT POWER FACTOR L_3	W/R	Signed
$523A	21050	2	LOW LIMIT POWER FACTOR L_3	W/R	Signed
$523C	21052	2	HIGH LIMIT SYSTEM COS$\varnothing$	W/R	Signed
$523E	21054	2	LOW LIMIT SYSTEM COS$\varnothing$	W/R	Signed
$5240	21056	2	HIGH LIMIT PHASE COS$\varnothing_1$	W/R	Signed
$5242	21058	2	LOW LIMIT PHASE COS$\varnothing_1$	W/R	Signed
$5244	21060	2	HIGH LIMIT PHASE COS$\varnothing_2$	W/R	Signed
$5246	21062	2	LOW LIMIT PHASE COS$\varnothing_2$	W/R	Signed
$5248	21064	2	HIGH LIMIT PHASE COS$\varnothing_3$	W/R	Signed
$524A	21066	2	LOW LIMIT PHASE COS$\varnothing_3$	W/R	Signed
$524C	21068	2	HIGH LIMIT SYSTEM APPARENT POWER	W/R	Unsigned
$524E	21070	2	LOW LIMIT SYSTEM APPARENT POWER	W/R	Unsigned
$5250	21072	2	HIGH LIMIT APPARENT POWER L_1	W/R	Unsigned
$5252	21074	2	LOW LIMIT APPARENT POWER L_1	W/R	Unsigned
$5254	21076	2	HIGH LIMIT APPARENT POWER L_2	W/R	Unsigned
$5256	21078	2	LOW LIMIT APPARENT POWER L_2	W/R	Unsigned
$5258	21080	2	HIGH LIMIT APPARENT POWER L_3	W/R	Unsigned
$525A	21082	2	LOW LIMIT APPARENT POWER L_3	W/R	Unsigned
$525C	21084	2	HIGH LIMIT SYSTEM ACTIVE POWER	W/R	Signed
$525E	21086	2	LOW LIMIT SYSTEM ACTIVE POWER	W/R	Signed
$5260	21088	2	HIGH LIMIT ACTIVE POWER L_1	W/R	Signed
$5262	21090	2	LOW LIMIT ACTIVE POWER L_1	W/R	Signed
$5264	21092	2	HIGH LIMIT ACTIVE POWER L_2	W/R	Signed
$5266	21094	2	LOW LIMIT ACTIVE POWER L_2	W/R	Signed
$5268	21096	2	HIGH LIMIT ACTIVE POWER L_3	W/R	Signed
$526A	21098	2	LOW LIMIT ACTIVE POWER L_3	W/R	Signed
$526C	21100	2	HIGH LIMIT SYSTEM REACTIVE POWER	W/R	Signed
$526E	21102	2	LOW LIMIT SYSTEM REACTIVE POWER	W/R	Signed
$5270	21104	2	HIGH LIMIT REACTIVE POWER L_1	W/R	Signed
$5272	21106	2	LOW LIMIT REACTIVE POWER L_1	W/R	Signed
$5274	21108	2	HIGH LIMIT REACTIVE POWER L_2	W/R	Signed
$5276	21110	2	LOW LIMIT REACTIVE POWER L_2	W/R	Signed
$5278	21112	2	HIGH LIMIT REACTIVE POWER L_3	W/R	Signed
$527A	21114	2	LOW LIMIT REACTIVE POWER L_3	W/R	Signed
$527C	21116	2	HIGH LIMIT NEUTRAL CURRENT	W/R	Unsigned
$527E	21118	2	LOW LIMIT NEUTRAL CURRENT	W/R	Unsigned

if alarm persistence > 0
alarm is setting after n seconds

High Threshold

MeasureTrend

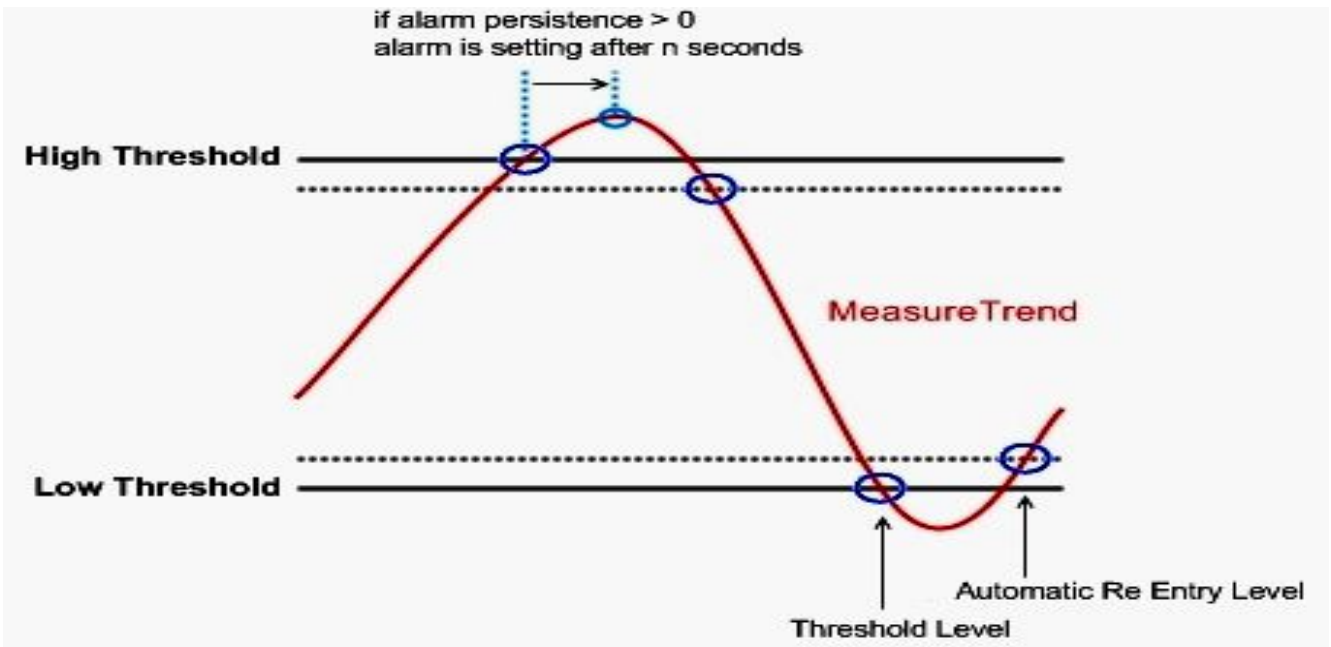Low Threshold

Automatic Re Entry Level

Threshold Level

Fig.4: Threshold

Valid Configuration Example:
If it must be enable the High Alarm Threshold for the following Measure:
- PHASE VOLTAGE L_{1-N}
- PHASE VOLTAGE L_{2-N}
- PHASE VOLTAGE L_{3-N}
- LINE CURRENT L_1
- LINE CURRENT L_2
- LINE CURRENT L_3
- SYSTEM ACTIVE POWER
- ACTIVE POWER L_1
- ACTIVE POWER L_2
- ACTIVE POWER L_3

And Low Threshold for:
- PHASE VOLTAGE L_{1-N}
- PHASE VOLTAGE L_{2-N}
- PHASE VOLTAGE L_{3-N}
- LINE CURRENT L_1
- LINE CURRENT L_2
- LINE CURRENT L_3

It is necessary to send the Modbus **ACTIVATION HIGH ALARM THRESHOLD** command with this parameters **$0780 + $070E**.

Activation High Alarm Threshold:

Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Value	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	1	1	0

Activation Low Alarm Threshold:

Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	1	1	0

Analog Output 1 Setting

Register HEX	Register DEC	Word	Description	W/R	Parameters	
$5400	21504	1	ANALOG OUTPUT 1 RANGE	W/R	0: 0÷20mA *[Default]* 1: 4÷20mA *WARNING: available only for Z3AO FW Rev. 0x0F00*	
$5401	21505	1	ANALOG OUTPUT 1 ASSOCIED MEASURE	W/R	00: Disabled *[Default]* 01: SYSTEM VOLTAGE 02: PHASE VOLTAGE L_{1-N} 03: PHASE VOLTAGE L_{2-N} 04: PHASE VOLTAGE L_{3-N} 05: LINE TO LINE VOLTAGE L_{1-2} 06: LINE TO LINE VOLTAGE L_{2-3} 07: LINE TO LINE VOLTAGE L_{3-1} 08: SYSTEM CURRENT 09: LINE CURRENT L_1 10: LINE CURRENT L_2 11: LINE CURRENT L_3 12: SYSTEM POWER FACTOR [*] 13: POWER FACTOR L_1 [*] 14: POWER FACTOR L_2 [*] 15: POWER FACTOR L_3 [*] 16: SYSTEM COS∅ [*] 17: PHASE COS∅$_1$ [*] 18: PHASE COS∅$_2$ [*] 19: PHASE COS∅$_3$ [*] 20: SYSTEM APPARENT POWER 21: APPARENT POWER L_1 22: APPARENT POWER L_2 23: APPARENT POWER L_3 24: SYSTEM ACTIVE POWER 25: ACTIVE POWER L_1 26: ACTIVE POWER L_2 27: ACTIVE POWER L_3 28: SYSTEM REACTIVE POWER 29: REACTIVE POWER L_1 30: REACTIVE POWER L_2 31: REACTIVE POWER L_3 32: NEUTRAL CURRENT 33: FREQUENCY 34: TEMPERATURE 35: THD VOLTAGE L_1 36: THD VOLTAGE L_2 37: THD VOLTAGE L_3 38: THD CURRENT L_1 39: THD CURRENT L_2 40: THD CURRENT L_3	--- mV mV mV mV mV mV mV mA mA mA mA ±1000 ±1000 ±1000 ±1000 ±1000 ±1000 ±1000 ±1000 VA VA VA VA W W W W VAR VAR VAR VAR mA mHz d °C % * 100 % * 100 % * 100 % * 100 % * 100 % * 100
					WARNING: Set the correct min, max value before enable.	
$5402	21506	2	ANALOG OUTPUT 1 MINIMUM VALUE ASSOCIED MEASURE	W/R	*Note: Signed long [default: 0]*	
$5404	21508	2	ANALOG OUTPUT 1 MAXIMUM VALUE ASSOCIED MEASURE	W/R	*Note: Signed long [default: 0]*	

Analog Output 2 Setting

Register HEX	Register DEC	Word	Description	W/R	Parameters
$5410	21520	1	ANALOG OUTPUT 2 RANGE	W/R	0: 0÷20mA *[Default]* 1: 4÷20mA *WARNING: available only for Z3AO FW Rev. 0x0F00*
$5411	21521	1	ANALOG OUTPUT 2 ASSOCIED MEASURE	W/R	See ANALOG OUTPUT 0 ASSOCIED MEASURE *[Default: 0]*
$5412	21522	2	ANALOG OUTPUT 2 MINIMUM VALUE ASSOCIED MEASURE	W/R	*Note: Signed long [default: 0]*
$5414	21524	2	ANALOG OUTPUT 2 MAXIMUM VALUE ASSOCIED MEASURE	W/R	*Note: Signed long [default: 0]*

Analog Output 3 Setting

| Register HEX	Register DEC	Word	Description	W/R	Parameters
$5420	21536	1	ANALOG OUTPUT 3 RANGE	W/R	0: 0÷20mA *[Default]* 1: 4÷20mA *WARNING: available only for Z3AO FW Rev. 0x0F00*
$5421	21537	1	ANALOG OUTPUT 3 ASSOCIED MEASURE	W/R	See ANALOG OUTPUT 0 ASSOCIED MEASURE *[Default: 0]*
$5422	21538	2	ANALOG OUTPUT 3 MINIMUM VALUE ASSOCIED MEASURE	W/R	*Note: Signed long [default: 0]*
$5424	21540	2	ANALOG OUTPUT 3 MAXIMUM VALUE ASSOCIED MEASURE	W/R	*Note: Signed long [default: 0]*

Note: The output values are updated every ~1 Sec.

Analog Explanation:

When you enable the analog output (writing ANALOG OUTPUT n ASSOCIED MEASURE with value different from 0) you must set also the MINIMUM VALUE ASSOCIED MEASURE (corresponding at 0 or 4 mA) and the MAXIMUM VALUE ASSOCIED MEASURE (corresponding at 20mA).

Example: if you select the PHASE VOLTAGE L_{1-N} with minimum value at 100000 mV and maximum 300000 mV when you have 200000 mV the current output is 10mA (0÷20mA) or 12mA (4÷20mA).

This logic is valid for all measure except measure marked with [*]. For these measures the setting logic and the output logic is different:
You must set for the minimum register with negative value (for example -800 [corresponding at -0,800]) and for maximum register with a positive value (for example +800 [corresponding at +0,800]) so the 1000 (1,000) is in the center of scale (10mA or 12mA) and decrease if the value goes to -800 and increase if goes to +800.
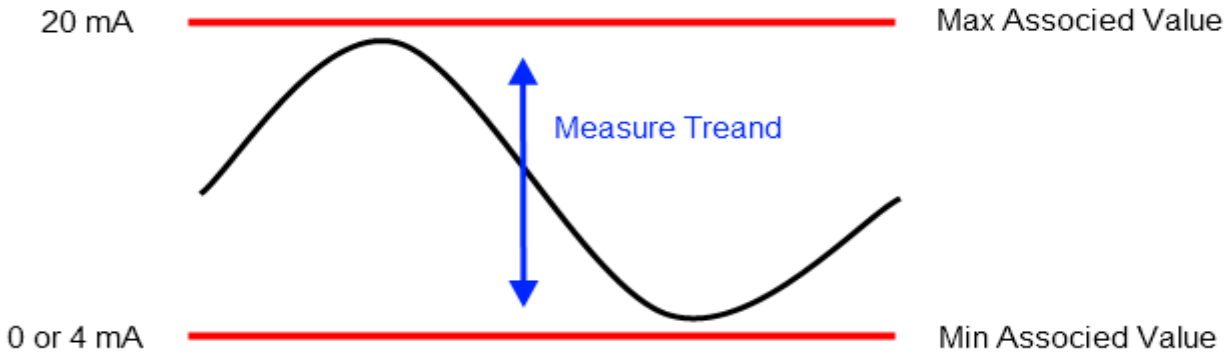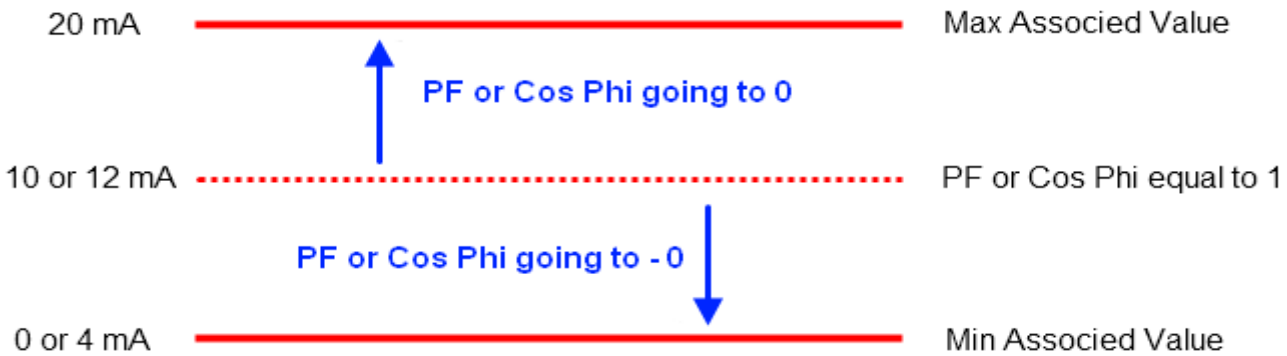
Service Button Function

Timing:	Function:
From 10 to 15 seconds	Keep press the service button for reset the COM 1 parameters (node id 1 – baudrate 38400 – no parity – 1 stop bit)
From 20 to 25 seconds	Keep press the service button for reset to default include COM1 parameters After this time the led SS blinking with a frequency of 1 Second

TROUBLESHOOTING

If response from EMT-4s doesn't happen:
- check connection from EMT-4s and RS232/RS485 converter;
- check if data outgoing from the RS232 serial port of the PC come in the RS232/485 converter;
- try to increase the wait time for response (1000 mS is good);
- check if the transmitted data stream is **EXACTLY** as in example, monitoring the data on the RS485 serial line with a terminal (i.e. Hyperterminal or other emulator);
- if the RS232/485 converter is not our model EMI-1, be sure the turnaround-time is set in range 1 to 2 mS