WM3-96
(rev. B02 and following)

WM3-96 N2
(rev. C01 and following)

SERIAL COMMUNICATION PROTOCOL

Vers. 1 Rev. 3

February 24th, 2002

Index

SERIAL COMMUNICATION PROTOCOL

INTRODUCTION

WM3-96 can be equipped with a RS485 or RS232 serial interface. The serial communication protocol, MODBUS-RTU, is the same on both interfaces. When using RS485, it is possible to connect up to 255 instruments using MODBUS protocol. When using RS232 it is only possible to connect a single instrument (multidrop feature is not available).
The time-out for the answer is fixed in 300 ms.

The command's structure of the protocol allows the user to read and write from/in the μP RAM memory, the EEPROM (measured data, stored data, real time clock), so that all the functions are completely transparent.
The communication parameters are configurable when using the RS485 interface while are fixed when using the RS232 one, in accordance with the following table:

Interface	Baud rate (bps)	Parity	Stop bit
RS232	9600	None	1
RS485	1200	None, even, odd	1
	2400	None, even, odd	1
	4800	None, even, odd	1
	9600	None, even, odd	1

NOTE: please refer to the instruction manual for any detail on the instrument programming.

The communication can be started only by the HOST unit, which sends the request frame. Each frame contains the following information:

- slave address: is a number from 1 to 255, which identifies the instrument connected to the network. Address 0 (zero) is accepted (in write frames only) by all the instruments, which will execute the relevant command but won't send any answer frame.
  NOTE: The request frame must always contain the address even if, when using RS232, it is not considered (every legal value is accepted).
- command: it defines the command type (e.g. read function, write function etc.).
- data fields: these numbers define the operating parameters of the command (e.g. the address of the word, the value of the word to be written, etc.).
- CRC word: it allows to detect transmission errors that may occur. CRC calculation is carried out by the MASTER unit once it has defined address, command and data fields. When the frame is received by the SLAVE, it is stored in a temporary buffer. The CRC is calculated and then compared with the received one. If they correspond and the address is recognised by the SLAVE unit, the command is executed and an answer frame is sent.

If the CRC is not correct, the frame is discarded and no answer is sent.

FUNCTIONS

WM3-96 accepts the following three commands:

- Read words (code 04)
- Write one word (code 06)
- Send a check frame (code 08)

Function 04 (read words)

Request frame

Address	Function	Data address		n° of words		CRC	
1 byte	1 byte	2 byte		2 byte		2 byte	
from 1 to 255	04h	MSB	LSB	MSB	LSB	MSB	LSB

NOTE: - The maximum number of word is 120 (240 byte).
- The address 00 is not allowed (it generates no answer)

Answer frame

Address	Function	n° byte (=2 x n° word)		Values	CRC	
1 byte	1 byte	1 byte		n° byte (=2 x n° word)	2 byte	
from 1 to 255	04h	MSB	LSB	…	MSB	LSB

Function 06 (write one word)

Request frame

Address	Function	Data address		Value		CRC	
1 byte	1 byte	2 byte		2 byte		2 byte	
from 1 to 255	06h	MSB	LSB	MSB	LSB	MSB	LSB

Answer frame

Address	Function	Data address		Value		CRC	
1 byte	1 byte	2 byte		2 byte		2 byte	
from 1 to 255	06h	MSB	LSB	MSB	LSB	MSB	LSB

NOTE: the answer frame is an echo of the request frame, which confirm the execution of the command.
The write function cannot be used to modify the contents of the energy counter memory area.

Function 08 (send a check frame)

Request frame

Address	Function	Diagnostic code		Value		CRC	
1 byte	1 byte	2 byte		2 byte		2 byte	
From 1 to 255	08h	00h	00h	AAh	55h	MSB	LSB

Answer frame

Address	Function	Diagnostic code		Value		CRC	
1 byte	1 byte	2 byte		2 byte		2 byte	
From 1 to 255	08h	00h	00h	AAh	55h	MSB	LSB

NOTE: the answer frame is an echo of the request frame, which confirm the execution of the command.

IMPORTANT: if the address is 00 (zero) all the instruments connected to the network will execute the command but won't send an answer frame.
If the request frame contains an invalid function, the answer frame will be an "exception response".

Exception response

Address	Function	Diagnostic code		Value		CRC	
1 byte	1 byte	2 byte		2 byte		2 byte	
From 1 to 255	88h	00h	00h	AAh	55h	MSB	LSB

MEMORY AREA

WM3-96 manages four different memory areas addressed as follows:

Memory area	Area		Byte reading order
Internal RAM	0000h	00E7h	MSB,LSB
Internal RAM	00E8h	1fffh	LSB,MSB
Data storage EEPROM	2000h	3fffh	MSB,LSB
Real Time Clock	4000h	5fffh	LSB

The bytes which are included in the answer frame following a read request of a short or int variable stored in the internal RAM from address 00E8h to address 1FFFh are sent in the following order: LSB, …, …, MSB.

NOTE: in the following pages the following notation will be used:
1 int = 4 byte;
1 short = 2 byte;
1 word = 2 byte;
1 byte = 8 bit.

RAM VARIABLES MAP

INSTANTANEOUS VARIABLES MAP

Word	ADDRESS	BYTE	VARIABLE	Type	Word	ADDRESS	BYTE	VARIABLE	Type
1	000	4	V L1-N	V	31	078	4	THD V2	D
2	004	4	A L1	A	32	07C	4	THDe V2	D
3	008	4	W L1	P	33	080	4	THDo V2	D
4	00C	4	V L2-N	V	34	084	4	THD V3	D
5	010	4	A L2	A	35	088	4	THDe V3	D
6	014	4	W L2	P	36	08C	4	THDo V3	D
7	018	4	V L3-N	V	37	090	4	THD A1	D
8	01C	4	A L3	A	38	094	4	THDe A1	D
9	020	4	W L3	P	39	098	4	THDo A1	D
10	024	4	V L1	V	40	09C	4	THD A2	D
11	028	4	V L2	V	41	0A0	4	THDe A2	D
12	02C	4	V L3	V	42	0A4	4	THDo A2	D
13	030	4	VA L1	P	43	0A8	4	THD A3	D
14	034	4	var L1	P	44	0AC	4	THDe A3	D
15	038	4	PF L1	C	45	0B0	4	THDo A3	D
16	03C	4	VA L2	P	46	0B4	4	A dmd	A
17	040	4	var L2	P	47	0B8	4	VA dmd	P
18	044	4	PF L2	C	48	0BC	4	TPF avg	C
19	048	4	VA L3	P	49	0C0	4	W dmd	P
20	04C	4	var L3	P	50	0C4	4	Hz	H
21	050	4	PF L3	C	51	0C8	4	ASY	D
22	054	4	V ∑	V	52	0CC	4	VL-N ∑	V
23	058	4	A n	A	53	0D0	4	UN	V
24	05C	4	W ∑	P	54		4		
25	060	4	VA ∑	P	55		4		
26	064	4	var ∑	P	56		4		
27	068	4	PF ∑	C	57		4		
28	06C	4	THD V1	D	58		4		
29	070	4	THDe V1	D	59	0E8	1+1+ 1+1	Unit V,A/P	inf1/2
30	074	4	THDo V1	D					

NOTE: all the variables in this table are contiguous. It is possible to read the whole area with a single command sending, in the request frame, 000h as data address and 0076h as number of words (that is 118 in decimal).
The values of the instantaneous variables are stored in the addresses from 000h to 0E7h. The data are sent in 4-byte groups in the following order: MSB, ..., ..., LSB.

VARIABLE FORMAT

The value of all the instantaneous variables is stored as a 4 byte (2 word) integer value. The decimal point and the multiplier have to be set according to the **inf1/2** word coding (see the following table) for voltage (V), current (A) and power (P), in the position "**111.1**" for the variables of type THD (%) and H (Hz) and in position "**1.111**" for the variables of type C (PF). The variables "PF L1", "PF L2", PF L3", "PF ∑" are stored with a positive value if the power factor is "L" (inductive), and with a negative value if the power factor is "C" (capacitive).

Variable format info map

Address	Byte	Variable	Type
0E8	1	Info voltage value	inf1
0E9	1	Info current value	inf1
0EA	1	Info power value	inf2

Decimal point and multiplier coding

INF value	d.p	INF value	d.p
0	1.111m	8	111.1k
1	11.11m	9	1111k
2	111.1m	10	11.11M
3	1.111	11	111.1M
4	11.11	12	1111M
5	111.1	13	11.11G
6	1111	14	111.1G
7	11.11K	15	

NOTE: if a power value exceeds 9999, the autoranging function will intervene and modify the inf2 value. If the power value is lower than 99999 the inf2 will be increased of 1 unit, if the power value is greater than 99999 but lower than 999999 the inf2 will be increased of 2 units and so on.

***Example 1:* reading of an int variable stored at address 100h**

An int variable is 4 byte (2 word) long, so a 2-word read request must be sent:

Read command request frame

Address	Function	Word address		n° of words		CRC	
1 byte	1 byte	2 byte		2 byte		2 byte	
from 1 to 255	04	01h	00h	00h	02h	MSB	LSB

Read command answer frame

Address	Function	n° byte	Value of int type variable				CRC	
1 byte	1 byte	1 byte	1° byte	2° byte	3° byte	4° byte	2 byte	
from 1 to 255	04	04	LSB			MSB	MSB	LSB

NOTE: Char variables
Char type variable (1 byte) must always be read carrying out a 1 word (2 bytes) read request and taking only the needed byte into account. Note that the first byte which is sent is the byte relevant to the specified word address. The following bytes are relevant to the previous address+1.

***Example 2*: reading of 4 char variables (4 bytes=2 words) starting from address 1C0h**

Read command request frame

Address	Function	Word address		n° of words		CRC	
1 byte	1 byte	2 byte		2 byte		2 byte	
from 1 to 255	04	01h	C0h	00h	02h	MSB	LSB

Read command answer frame

Address	Function	n° byte	Value	Value	Value	Value	CRC	
1 byte	1 byte	1 byte	1° byte	2° byte	3° byte	4° byte	2 byte	
From 1 to 255	04	04	**01C0h**	**01C1h**	**01C2h**	**01C3h**	MSB	LSB

INSTANTANEOUS VARIABLES READING

***Example 3*: Reading of a single variable: W1**

Value request frame (8 byte):

01h	04h	00h	08h	00h	02h	CRC	CRC

Value answer frame (9 byte):

01h	04h	04h	00h	00h	63h	8Dh	CRC	CRC

Info request frame (8 byte):

01h	04h	00h	E8h	00h	02h	CRC	CRC

Info answer frame (frame 9 byte):

01h	04h	04h	07h	07h	06h	00h	CRC	CRC

Stored value: 638Dh (25485 decimal)
Info value (P type): 06h

Since 9999<25485<99999, the inf2 value to be considered is 06+1=07 (11.11K)
Variable value (W1): 25.48 kW

***Example 4*: Reading of all the instantaneous variables:**

All instantaneous values (+ info) request frame (8 byte):

01h	04h	00h	00h	00h	76h	CRC	CRC

All instantaneous values (+ info) answer frame (241 byte):

01h	04h	ECh	00h	00h	01h	37h		07h	07h	0Ah	03h	CRC	CRC

VL1-N stored value: 0137h (0311 decimal)
....
....
Info (V type) value: 07h
Info (A type) value: 07h
Info (P type) value: 0Ah

Variable value (VL1-N): 3.11 kV

ENERGY COUNTERS MAP

Table 1

ADDRESS	BYTE	SEASON	PERIOD	COUNTER TYPE
0EC	4	TOTALE		KWh+ (LSB)
0F0	4			KWh- (LSB)
0F4	4			KVARh+ (LSB)
0F8	4			KVARh- (LSB)
0FC	1			KWh+ (MSB)
0FD	1			KWh- (MSB)
0FE	1			KVARh+ (MSB)
0FF	1			KVARh- (MSB)
100	4	WINTER	1	KWh+ (LSB)
104	4			KWh- (LSB)
108	4			KVARh+ (LSB)
10C	4			KVARh- (LSB)
110	4		2	KWh+ (LSB)
114	4			KWh- (LSB)
118	4			KVARh+ (LSB)
11C	4			KVARh- (LSB)
120	4		3	KWh+ (LSB)
124	4			KWh- (LSB)
128	4			KVARh+ (LSB)
12C	4			KVARh- (LSB)
130	4		4	KWh+ (LSB)
134	4			KWh- (LSB)
138	4			KVARh+ (LSB)
13C	4			KVARh- (LSB)
140	4	SUMMER	1	KWh+ (LSB)
144	4			KWh- (LSB)
148	4			KVARh+ (LSB)
14C	4			KVARh- (LSB)
150	4		2	KWh+ (LSB)
154	4			KWh- (LSB)
158	4			KVARh+ (LSB)
15C	4			KVARh- (LSB)
160	4		3	KWh+ (LSB)
164	4			KWh- (LSB)
168	4			KVARh+ (LSB)
16C	4			KVARh- (LSB)
170	4		4	KWh+ (LSB)
174	4			KWh- (LSB)
178	4			KVARh+ (LSB)
17C	4			KVARh- (LSB)
180	4	HOLYDAY	1	KWh+ (LSB)
184	4			KWh- (LSB)
188	4			KVARh+ (LSB)
18C	4			KVARh- (LSB)
190	4		2	KWh+ (LSB)
194	4			KWh- (LSB)
198	4			KVARh+ (LSB)
19C	4			KVARh- (LSB)
1A0	4		3	KWh+ (LSB)
1A4	4			KWh- (LSB)
1A8	4			KVARh+ (LSB)
1AC	4			KVARh- (LSB)
1B0	4		4	KWh+ (LSB)
1B4	4			KWh- (LSB)
1B8	4			KVARh+ (LSB)
1BC	4			KVARh- (LSB)

Table 2

ADDRESS	BYTE	SEASON	PERIOD	COUNTER TYPE
8EC	1	WINTER	1	KWh+ (MSB)
8ED	1			KWh- (MSB)
8EE	1			KVARh+ (MSB)
8EF	1			KVARh- (MSB)
8F0	1		2	KWh+ (MSB)
8F1	1			KWh- (MSB)
8F2	1			KVARh+ (MSB)
8F3	1			KVARh- (MSB)
8F4	1		3	KWh+ (MSB)
8F5	1			KWh- (MSB)
8F6	1			KVARh+ (MSB)
8F7	1			KVARh- (MSB)
8F8	1		4	KWh+ (MSB)
8F9	1			KWh- (MSB)
8FA	1			KVARh+ (MSB)
8FB	1			KVARh- (MSB)
8FC	1	SUMMER	1	KWh+ (MSB)
8FD	1			KWh- (MSB)
8FE	1			KVARh+ (MSB)
8FF	1			KVARh- (MSB)
900	1		2	KWh+ (MSB)
901	1			KWh- (MSB)
902	1			KVARh+ (MSB)
903	1			KVARh- (MSB)
904	1		3	KWh+ (MSB)
905	1			KWh- (MSB)
906	1			KVARh+ (MSB)
907	1			KVARh- (MSB)
908	1		4	KWh+ (MSB)
909	1			KWh- (MSB)
90A	1			KVARh+ (MSB)
90B	1			KVARh- (MSB)
90C	1	HOLYDAY	1	KWh+ (MSB)
90D	1			KWh- (MSB)
90E	1			KVARh+ (MSB)
90F	1			KVARh- (MSB)
910	1		2	KWh+ (MSB)
911	1			KWh- (MSB)
912	1			KVARh+ (MSB)
913	1			KVARh- (MSB)
914	1		3	KWh+ (MSB)
915	1			KWh- (MSB)
916	1			KVARh+ (MSB)
917	1			KVARh- (MSB)
918	1		4	KWh+ (MSB)
919	1			KWh- (MSB)
91A	1			KVARh+ (MSB)
91B	1			KVARh- (MSB)

A further table, relevant to the monthly energy counters, will be explained afterwards.

NOTE: Table 1 and Table 2 are not contiguous. The variables included in each table are contiguous, so that it is possible to read every variables with two request frames. With the first request frame the 106 words included in Table 1 could be read, with the second request frame the 24 words included in Table 2 could be read.
The values of all the total and partial energy counters are stored as a 5-byte integer (the first 4 bytes are the less significant part, the 5th is the most significant one). The resolution of the counters is 10W

(the decimal point position has to be set to "**`1.11Kwh (Kvarh)`**").
Whereas the total counters MSB (5th byte) is contiguous to the less significant bytes, the partial counters MSB (5th byte) is stored in a different area of the memory. For this reason it is required to carry out two different read commands in order to get all the energy counter information.

READING OF THE ENERGY COUNTER VALUES

8-bytes request frame (read command, 10 word):

01h	04h	00h	ECh	00h	0Ah	CRC	CRC

25-bytes answer frame (read command):

			1 ECh	**2 EDh**	**3 EEh**	**4 EFh**	**5 F0h**	**6 F1h**	**7 F2h**	**8 F3h**	**9 F4h**	**10 F5h**
01h	04h	14h	**00h**	**00h**	**00h**	**00h**	**94h**	**59h**	**FFh**	**FFh**	**94h**	**02h**

11 F6h	**12 F7h**	**13 F8h**	**14 F9h**	**15 FAh**	**16 FBh**	**17 FCh**	**18 FDh**	**19 Feh**	**20 FFh**		
00h	**00h**	**BEh**	**FEh**	**FFh**	**FFh**	**00h**	**00h**	**00h**	**00h**	CRC	CRC

Starting from address ECh, it is possible to read all the energy counters by means of a single read command (10 word, see the example above).

Reconstruction of the kWh+ total counter
The first 4 data bytes (less significant bytes) have to be placed side by side in the opposite order:

4 Efh	**3 EEh**	**2 EDh**	**1 ECh**
00h	**00h**	**00h**	**00h**

00000000h=0

The obtained 32-bit value has to be interpreted as a two's complement value.
The relevant kWh+ MSB (byte n° 17), which has to be interpreted as a two's complement value too, must be multiplied by 1000000000 (decimal value). The result has to be algebraically added to the previous value.

17 FCh
00h

1000000000*0=0
Finally the last result has to be divided by 100.
0+0/100=0 kWh

***Example 5*: reconstruction of the kWh- total counter**

5 F0h	**6 F1h**	**7 F2h**	**8 F3h**
94h	**59h**	**FFh**	**FFh**

FF FF 59 94h = -42604

18 FDh
00h

1000000000*0 = 0

(- 42604 + 0*1000000000)/100 = - 426.04 kWh

WRITING OF THE ENERGY COUNTER VALUES

The user is not allowed to write in the energy counter memory area. It is only possible to reset the energy counter using fixed frames.

ENERGY COUNTERS RESET COMMANDS

The fixed frames to be used to reset the energy counters are listed below:

1. **General reset command (reset of all the total, partial and monthly counters)**

Reset request frame (8 byte):

01h	06h	00h	ECh	D4h	F0h	CRC	CRC

Reset answer frame (8 byte):

01h	06h	00h	ECh	D4h	F0h	CRC	CRC

2. **Total positive energy counters (kWh+ and kvarh+) and monthly counters reset command**

Reset request frame (8 byte):

01h	06h	01h	00h	A5h	F0h	CRC	CRC

Reset answer frame (8 byte):

01h	06h	01h	00h	A5h	F0h	CRC	CRC

3. **Total negative energy counters (kWh- and kvarh-) and monthly counters reset command**

Reset request frame (8 byte):

01h	06h	01h	04h	23h	44h	CRC	CRC

Reset answer frame (8 byte):

01h	06h	01h	04h	23h	44h	CRC	CRC

4. **Partial positive energy counters (kWh+ and kvarh+) and monthly counters reset command**

Reset request frame (8 byte):

01h	06h	01h	08h	87h	35h	CRC	CRC

Reset answer frame (8 byte):

01h	06h	01h	08h	87h	35h	CRC	CRC

5. **Partial negative energy counters (kWh- and kvarh-) and monthly counters reset command**

Reset request frame (8 byte):

01h	06h	01h	C0h	59h	12h	CRC	CRC

Reset answer frame (8 byte):

01h	06h	01h	C0h	59h	12h	CRC	CRC

ALARM STATUS MAP

Table 3

ADDRESS	BYTE	Variable type
1C0	1+1	Diagn0 , diagn1
1C2	1+1	Diagn2 , diagn3
1C4	1+1	Alarm0 , alarm1
1C6	1+1	Alarm2 , alarm3
1C8	2	control 0 type
1CA	2	control 1 type
1CC	2	control 2 type
1CE	2	control 3 type
1D0	2	status Relay 0
1D2	2	status Relay 1
1D4	2	status Relay 2
1D6	2	status Relay 3
1D8	2	Variable associated to alarm 0
1DA	2	Variable associated to alarm 1
1DC	2	Variable associated to alarm 2
1DE	2	Variable associated to alarm 3
1E0	2	ON set-point 0
1E2	2	ON set-point 1
1E4	2	ON set-point 2
1E6	2	ON set-point 3
1E8	2	OFF set-point 0
1EA	2	OFF set-point 1
1EC	2	OFF set-point 2
1EE	2	OFF set-point 3
1F0	2	delay 0
1F2	2	delay 1
1F4	2	delay 2
1F6	2	delay 3

Table 4

ADDRESS	BYTE	Variable type
8DC	1+1	Remote 1, Remote 2
8DE	1+1	Remote 3, Remote 4

NOTE: the variables included in each of the previous tables are contiguous, so it is possible to read every variables with two request frames. With the first request frame the 28 words included in Table 3 can be read, with the second request frame the 2 words included in Table 4 can be read.
In order to know the current digital output settings, see the EEPROM map paragraph.

READING OF ALARM, DIAGNOSTIC AND REMOTE CONTROL OUTPUT STATUS

The n^{th} digital output can work as pulse output, alarm output, diagnostic output or remote control output.
In order to know if the n^{th} digital output is set as alarm, the n^{th} alarm byte (“alarm n”) must be read. If the byte is equal to 0 it means that the digital output is not set as alarm, if it is equal to 1 the alarm status is OFF, if it is equal to 2 the alarm status is ON.
The same considerations are valid in case of diagnostic output (“diagn n” byte must be read) or remote control output (“Remote n” byte must be read).
Of course, only one among “alarm n”, “diagn n” and “remote n” byte can be different from 0. If all these three bytes are equal to 0, it means that the n^{th} digital output is set as pulse output.

The values stored in addresses from 1C8h to 1CEh explain the control type, coded as follows:
0 = UP
1 = UP-LATCH
2 = DOWN
3 = DOWN LATCH

The values stored in addresses from 1D0h to 1D6h explain if the relay is normally energised or de-energized:
0 = Normally de-energized
1 = Normally energized

In the addresses from 1D8h to 1DEh the variables associated to the alarms are stored, according to the "Variable type coding" table (see page 28).

Example: if a control on variable W1 has been associated to alarm1, in the address 1DAh the value 12 must be stored

The Set-point ON and OFF values are stored as unsigned short.
The delay values are stored as short and must be included in the range from 0 to 255 seconds.

***Example 6*: "Diagnostic" read command**

2-word read command request frame (8 byte):

01h	04h	01h	C0h	00h	02h	CRC	CRC

Read command answer frame (9 byte):

01h	04h	04h	**00h**	**00h**	**01h**	**00h**	CRC	CRC

Digital output 0: NO Diagnostic
Digital output 1: NO Diagnostic
Digital output 2: Diagnostic OFF
Digital output 3: NO Diagnostic

***Example 7*: "Alarm" read command**

2-word read command request frame (8 byte):

01h	04h	01h	C4h	00h	02h	CRC	CRC

Read command answer frame (9 byte):

01h	04h	04h	**00h**	**01h**	**00h**	**00h**	CRC	CRC

Digital output 0: NO Alarm
Digital output 1: Alarm OFF
Digital output 2: NO Alarm
Digital output 3: NO Alarm

***Example 8*: "Control type" read command**

4-word read command request frame (8 byte):

01h	04h	01h	C8h	00h	04h	CRC	CRC

Read command answer frame (13 byte):

			LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB		
01h	04h	08h	**00h**	**00h**	**00h**	**00h**	**00h**	**00h**	**00h**	**00h**	CRC	CRC

Digital output 0: Not used (digital output 0 is not set as alarm, see previous example)
Digital output 1: UP control
Digital output 2: Not used
Digital output 3: Not used

***Example 9*: "Relay status" read command**

4-word read command request frame (8 byte):

01h	04h	01h	D0h	00h	04h	CRC	CRC

Read command answer frame (13 byte):

01h	04h	08h	**00h**	**00h**	**01h**	**00h**	**00h**	**00h**	**00h**	**00h**	CRC	CRC

Digital output 0: Not used (digital output 0 is not set as alarm, see example 7)
Digital output 1: Normally energized
Digital output 2: Not used
Digital output 3: Not used

***Example 10*: "Variable associated to the alarm" read command**

4-word read command request frame (8 byte):

01h	04h	01h	D8h	00h	04h	CRC	CRC

Read command answer frame (13 byte):

01h	04h	08h	**00h**	**00h**	**26h**	**00h**	**00h**	**00h**	**00h**	**00h**	CRC	CRC

Digital output 0: not used (digital output 0 is not set as alarm, see example 7)
Digital output 1: THD A1
Digital output 2: not used
Digital output 3: not used

***Example 11*: "ON Set-point" (alarm activation) read command**

4-word read command request frame (8 byte):

01h	04h	01h	E0h	00h	04h	CRC	CRC

Read command answer frame (13 byte):

01h	04h	08h	**00h**	**00h**	**64h**	**00h**	**00h**	**00h**	**00h**	**00h**	CRC	CRC

Digital output 0: not used (digital output 0 is not set as alarm, see example 7)
Digital output 1: 10.0% (0064h = 100 decimal)
Digital output 2: not used
Digital output 3: not used

***Example 12*: "OFF Set-point" (alarm deactivation) read command**

4-word read command request frame (8 byte):

01h	04h	01h	E8h	00h	04h	CRC	CRC

Read command answer frame (13 byte):

01h	04h	08h	**00h**	**00h**	**32h**	**00h**	**00h**	**00h**	**00h**	**00h**	CRC	CRC

Digital output 0: not used (digital output 0 is not set as alarm, see example 7)
Digital output 1: 5.0% (0032h = 50 decimal)
Digital output 2: not used
Digital output 3: not used

***Example 13*: "Alarm activation delay" read command**

4-word read command request frame (8 byte):

01h	04h	01h	F0h	00h	04h	CRC	CRC

Read command answer frame (13 byte):

01h	04h	08h	**00h**	**00h**	**04h**	**00h**	**00h**	**00h**	**00h**	**00h**	CRC	CRC

Digital output 0: not used (digital output 0 is not set as alarm, see example 7)
Digital output 1: 4 seconds
Digital output 2: not used
Digital output 3: not used

***Example 14*: "Latch alarm" reset command**

To reset a UP-LATCH or DOWN-LATCH alarm, the relevant alarm byte must be set to 1.

Reset command request frame (8 byte):

01h	06h	**01h**	**C4h**	**00h**	**01h**	CRC	CRC

Reset command answer frame (8 byte):

01h	06h	**01h**	**C4h**	**00h**	**01h**	CRC	CRC

To reset the alarm 1, the byte at address 01C5h must be set to 1. The byte at address 01C4h must be set to 00h, since it is relevant to alarm 0.

WRITE COMMAND FOR REMOTE CONTROL OUTPUT

The remote control digital output memory area is described in Table 4 and consists in 4 bytes starting from address 08D8h (Remote1=8D8h, Remote2=8D9h, and so on).
To switch ON the n^{th} remote control output, the value 02h must be written in the "Remote n" byte, while to switch OFF the n^{th} remote control output, the value 01h must be written in the "Remote n" byte. Note again that the write command always writes 1 word (2 bytes).

Request frame: R1 = ON and R2 = OFF (8 byte):

01h	06h	**08h**	**D8h**	**02h**	**01h**	CRC	CRC

Answer frame (8 byte):

01h	06h	**08h**	**D8h**	**02h**	**01h**	CRC	CRC

Request frame: R1 = OFF and R2 = OFF (8 byte):

01h	06h	**08h**	**D8h**	**01h**	**01h**	CRC	CRC

Answer frame (8 byte):

01h	06h	**08h**	**D8h**	**01h**	**01h**	CRC	CRC

NOTE: a digital output can be used as remote control output only if the relevant “digital output type” variable stored in EEPROM is correctly set (see page 20 and following).

FORMAT OF THE “PRESENT MODULES” VARIABLE

ADDRESS	BYTE	Code	Variable type
800	2	XXXXXXXXXXXXXXXX	Module

Code

bit15	bit14	bit13	bit12	bit11	bit10	bit9	Bit8	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
	In3	In2	In1				S3	S4	S2	232	CLK	485	AG34	AG12	Ing_d

Inputs

Ing_d	Input module
0	Not present
1	Present

Analogue output

AG12	Analogue (out 1, 2) module
0	Not present
1	Present

AG34	Analogue (out 3, 4) module
0	Not present
1	Present

Serial output

485	RS485 module
0	Not present
1	Present

232	RS232 module
0	Not present
1	Present

CLK	RTC Clock
0	Not present
1	Present

Digital output code

S3A	S4A	S2A	Available digital outputs on the inserted modules
0	0	0	1,2,3,4
0	0	1	1,2,3,4
0	1	0	1,2,3,4
0	1	1	1,2
1	0	0	3,4
1	0	1	3,4
1	1	0	1,2,3,4
1	1	1	None

Digital inputs code

In1	Digital input 1
0	ON
1	OFF

In2	Digital input 2
0	ON
1	OFF

In3	Digital input 3
0	ON
1	OFF

***Example 15*: reading of the "present modules" variable**

1-word read request frame (8 byte)

01h	04h	08h	00h	00h	01h	CRC	CRC

1-word read answer frmae (8 byte):

01h	04h	02h	**5Bh**	**61h**	CRC	CRC

Module variable value: 615Bh = 0110000101011011

Available modules: input module, digital inputs, analogue output AG12, RS485, clock, digital output 3,4,

Digital inputs: In3=OFF (open contact), In2=OFF, In1=ON (close contact)

HARMONIC ANALYSIS MAP

ORDER/ VARIAB.	Voltages[1] (%)			Currents (%)			Relative angles[2] (°)		
	L1-N ADD.	L2-N ADD.	L3-N ADD.	L1 ADD.	L2 ADD.	L3 ADD.	L1 ADD.	L2 ADD.	L3 ADD.
THD	220	222	224	226	228	22A			
1°	234	236	238	23A	23C	23E	240	242	244
2°	248	24A	24C	24E	250	252	254	256	258
3°	25C	25E	260	262	264	266	268	26A	26C
4°	270	272	274	276	278	27A	27C	27E	280
5°	284	286	288	28A	28C	28E	290	292	294
6°	298	29A	29C	29E	2A0	2A2	2A4	2A6	2A8
7°	2AC	2AE	2B0	2B2	2B4	2B6	2B8	2BA	2BC
8°	2C0	2C2	2C4	2C6	2C8	2CA	2CC	2CE	2D0
9°	2D4	2D6	2D8	2DA	2DC	2DE	2E0	2E2	2E4
10°	2E8	2EA	2EC	2EE	2F0	2F2	2F4	2F6	2F8
11°	2FC	2FE	300	302	304	306	308	30A	30C
12°	310	312	314	316	318	31A	31C	31E	320
13°	324	326	328	32A	32C	32E	330	332	334
14°	338	33A	33C	33E	340	342	344	346	348
15°	34C	34E	350	352	354	356	358	35A	35C
16°	360	362	364	366	368	36A	36C	36E	370
17°	374	376	378	37A	37C	37E	380	382	384
18°	388	38A	38C	38E	390	392	394	396	398
19°	39C	39E	3A0	3A2	3A4	3A6	3A8	3AA	3AC
20°	3B0	3B2	3B4	3B6	3B8	3BA	3BC	3BE	3C0
21°	3C4	3C6	3C8	3CA	3CC	3CE	3D0	3D2	3D4
22°	3D8	3DA	3DC	3DE	3E0	3E2	3E4	3E6	3E8
23°	3EC	3EE	3F0	3F2	3F4	3F6	3F8	3FA	3FC
24°	400	402	404	406	408	40A	40C	40E	410
25°	414	416	418	41A	41C	41E	420	422	424
26°	428	42A	42C	42E	430	432	434	436	438
27°	43C	43E	440	442	444	446	448	44A	44C
28°	450	452	454	456	458	45A	45C	45E	460
29°	464	466	468	46A	46C	46E	470	472	474
30°	478	47A	47C	47E	480	482	484	486	488
31°	48C	48E	490	492	494	496	498	49A	49C
32°	4A0	4A2	4A4	4A6	4A8	4AA	4AC	4AE	4B0
33°	4B4	4B6	4B8	4BA	4BC	4BE	4C0	4C2	4C4
34°	4C8	4CA	4CC	4CE	4D0	4D2	4D4	4D6	4D8
35°	4DC	4DE	4E0	4E2	4E4	4E6	4E8	4EA	4EC
36°	4F0	4F2	4F4	4F6	4F8	4FA	4FC	4FE	500
37°	504	506	508	50A	50C	50E	510	512	514
38°	518	51A	51C	51E	520	522	524	526	528
39°	52C	52E	530	532	534	536	538	53A	53C
40°	540	542	544	546	548	54A	54C	54E	550
41°	554	556	558	55A	55C	55E	560	562	564
42°	568	56A	56C	56E	570	572	574	576	578
43°	57C	57E	580	582	584	586	588	58A	58C
44°	590	592	594	596	598	59A	59C	59E	5A0
45°	5A4	5A6	5A8	5AA	5AC	5AE	5B0	5B2	5B4
46°	5B8	5BA	5BC	5BE	5C0	5C2	5C4	5C6	5C8
47°	5CC	5CE	5D0	5D2	5D4	5D6	5D8	5DA	5DC
48°	5E0	5E2	5E4	5E6	5E8	5EA	5EC	5EE	5F0
49°	5F4	5F6	5F8	5FA	5FC	5FE	600	602	604
50°	608	60A	60C	60E	610	612	614	616	618
THDo	61C	61E	620	622	624	626			
THDe	630	632	634	636	638	63A			

NOTE:
[1] According to the selected electrical system, the voltages can be Phase to Phase Voltage or Phase to Neutral Voltages.
[2] Negligible values when the selected system is without neutral.

All the variables of the previous table are contiguous. Since the read command can read at most 120 words, it is possible to read all the harmonic analysis values with at least four request frames.

The values of the harmonic and distortion variables are represented as short (2 byte long). The decimal point must be set to "**`111.1`**" for distortion and angle variables (THD, THDo, THDe), and to "**`111.11`**" for the harmonic variables (h).

The stored values have physical meaning only if the harmonic analysis of the relevant phase is enabled (please refer to the user manual for FFT enable function).

READING OF THE HARMONIC DATA: EXAMPLES

***Example 16*: reading of the `VL1` 3rd order harmonic**

"Value" request frame (frame 8 byte):

01h	04h	02h	5Ch	00h	01h	CRC	CRC

"Value" answer frame (frame 7 byte):

01h	04h	02h	13h	0Dh	CRC	CRC

Variable value:	0D13h	3347 (decimal)
Value format:	111.11	
VL1 3rd order harmonic value	33.47%	(the display shows 33.4%)

***Example 17*: reading of the phase 1 - 3rd order relative angle**

"Value" read request frame (frame 8 byte):

01h	04h	02h	68h	00h	01h	CRC	CRC

"Value" read answer frame (frame 7 byte):

01h	04h	02h	EFh	06h	CRC	CRC

Variable value:	06EFh	1775 (decimal)
Value format:	111.1	
Phase 1–3rd order relative angle:	177.5°	(the display shows 177°)

EEPROM VARIABLE MAP

NOTE: f.s. means full scale; b.s. means beginning of the scale

WM3-96 configuration map

ADD.	VARIABLE	MAX	MIN	DEFAULT	BIT CHECK
2000	Password	500	0	0	0101XXXX XXXXXXXX
2002	System	4	0	2	0101XXXX XXXXXXXX
2004	CT	60000	1	10	not present
2006	VT	60000	1	10	not present
2008	type avg	1	0	0	0101XXXX XXXXXXXX
200A	time avg	30	1	15	0101XXXX XXXXXXXX
200C	enable FFT	See EEPROM data format tables			0100XXXX XXXXXXXX
200E	type digit	1	0	0	0101XXXX XXXXXXXX
2010	field 1 e 2	See EEPROM data format tables			0101XXXX XXXXXXXX
2012	field 3 e 4	See EEPROM data format tables			0101XXXX XXXXXXXX
2014	RS485: address	255	1	1	not present
2016	RS485: baud rate	3	0	3	not present
2018	RS485: parity	2	0	0	not present
201A					
201C	Reserved				
201E	filter range	1000	1	10	not present
2020	filter coeff.	255	1	3	not present
2022	event selection				XXXXXXXX XXXXXXXX
2024	event selection				XXXXXXXX XXXXXXXX
2026					
2028	USA/EUROclockformat	See EEPROM data format tables			0101XXXX XXXXXXXX
202A	Language	See EEPROM data format tables			0101XXXX XXXXXXXX
202C	Pulse type selection	See EEPROM data format tables			XXXXXXXX XXXXXXXX
202E					
2030					
2032					
2034					
2036					
2038					
203A					
203C					
203E	dig. out type	See EEPROM data format tables			not present
2040	Pulses/KWh out1	1000	1	1	01XXXXXX XXXXXXXX
2042	Pulses/KWh out2	1000	1	1	01XXXXXX XXXXXXXX
2044	Pulses/KWh out3	1000	1	1	01XXXXXX XXXXXXXX
2046	Pulses/KWh out4	1000	1	1	01XXXXXX XXXXXXXX
2048	info dig. out 1	See EEPROM data format tables			not present
204A	Delay out 1	255	0	0	not present
204C	set-point out 1	f.s	b.s.	0	01XXXXXX XXXXXXXX
204E	Hysteresis out 1	f.s	0	0	01XXXXXX XXXXXXXX
2050	info dig. out 2	See EEPROM data format tables			not present
2052	delay out 2	255	0	0	not present
2054	set-point out 2	f.s	b.s.	0	01XXXXXX XXXXXXXX
2056	Hysteresis out 2	f.s	0	0	01XXXXXX XXXXXXXX
2058	info dig. out 3	See EEPROM data format tables			not present
205A	delay out 3	255	0	0	not present
205C	set-point out 3	f.s	b.s.	0	01XXXXXX XXXXXXXX
205E	Hysteresis out 3	f.s	0	0	01XXXXXX XXXXXXXX
2060	info dig. out 4	See EEPROM data format tables			not present
2062	delay out 4	255	0	0	not present
2064	set-point out 4	f.s	b.s.	0	01XXXXXX XXXXXXXX
2066	Hysteresis out 4	f.s	0	0	01XXXXXX XXXXXXXX

WM3-96 configuration map (continue)

ADD.	VARIABLE	MAX	MIN	DEFAULT	BIT CHECK
2080	info analog out 1	See EEPROM data format tables			not present
2082	min % an. out 1	1000	0	0	not present
2084	max % an. out 1	1000	0	1000	not present
2086	min input out 1	f.s.	b.s.	b.s.	not present
2088	max input 1	f.s.	b.s.	f.s.	not present
208A	info an. out 2	See EEPROM data format tables			not present
208C	min % an. out 2	1000	0	0	not present
208E	max % an. out 2	1000	0	1000	not present
2090	min input out 2	f.s.	b.s.	b.s.	not present
2092	max input out 2	f.s.	b.s.	f.s.	not present
2094	info an. out 3	See EEPROM data format tables			not present
2096	min % an. out 3	1000	0	0	not present
2098	max % an. out 3	1000	0	1000	not present
209A	min input out 3	f.s.	b.s.	b.s.	not present
209C	max input out 3	f.s.	b.s.	f.s.	not present
209E	info an. out 4	See EEPROM data format tables			not present
20A0	min % an. out 4	1000	0	0	not present
20A2	max % an. out 4	1000	0	1000	not present
20A4	min input out 4	f.s.	b.s.	b.s.	not present
20A6	max input out 4	f.s.	b.s.	f.s.	not present
20A8					
20AA					
20AC					
20AE					
20B0					
20B2					
20B4					
20B6					
20B8					
20BA					
20BC					
20BE					
20C0	type MAX1	---	---		0101XXXX XXXXXXXX
20C2	type MAX2	---	---		0101XXXX XXXXXXXX
20C4	type MAX3	---	---		0101XXXX XXXXXXXX
20C6	type MAX4	---	---		0101XXXX XXXXXXXX
20C8	type MAX5	---	---		0101XXXX XXXXXXXX
20CA	type MAX6	---	---		0101XXXX XXXXXXXX
20CC	type MAX7	---	---		0101XXXX XXXXXXXX
20CE	type MAX8	---	---		0101XXXX XXXXXXXX
20D0	type MAX9	---	---		0101XXXX XXXXXXXX
20D2	type MAX10	---	---		0101XXXX XXXXXXXX
20D4	type MAX11	---	---		0101XXXX XXXXXXXX
20D6	type MAX12	---	---		0101XXXX XXXXXXXX
20D8	type MIN1	---	---		0101XXXX XXXXXXXX
20DA	type MIN2	---	---		0101XXXX XXXXXXXX
20DC	type MIN3	---	---		0101XXXX XXXXXXXX
20DE	type MIN4	---	---		0101XXXX XXXXXXXX
20E0	type MIN5	---	---		0101XXXX XXXXXXXX
20E2	type MIN6	---	---		0101XXXX XXXXXXXX
20E4	type MIN7	---	---		0101XXXX XXXXXXXX
20E6	type MIN8	---	---		0101XXXX XXXXXXXX

WM3-96 configuration map (continue)

ADD.	VARIABLE	MAX	MIN	DEFAULT	BIT CHECK
2100	val MAX1(msb)				
2101	val MAX1(lsb)				
2102	val MAX2(msb)				
2103	val MAX2(lsb)				
2104	val MAX3(msb)				
2105	val MAX3(lsb)				
2106	val MAX4(msb)				
2107	val MAX4(lsb)				
2108	val MAX5(msb)				
2109	val MAX5(lsb)				
210A	val MAX6(msb)				
210B	val MAX6(lsb)				
210C	val MAX7(msb)				
210D	val MAX7(lsb)				
210E	val MAX8(msb)				
210F	val MAX8(lsb)				
2110	val MAX9(msb)				
2111	val MAX9(lsb)				
2112	val MAX10(msb)				
2113	val MAX10(lsb)				
2114	val MAX11(msb)				
2115	val MAX11(lsb)				
2116	val MAX12(msb)				
2117	val MAX12(lsb)				
2118					
2119					
211A					
211B					
211C					
211D					
211E					
211F					
2120	val MIN1(msb)				
2121	val MIN1(lsb)				
2122	val MIN2(msb)				
2123	val MIN2(lsb)				
2124	val MIN3(msb)				
2125	val MIN3(lsb)				
2126	val MIN4(msb)				
2127	val MIN4(lsb)				
2128	val MIN5(msb)				
2129	val MIN5(lsb)				
212A	val MIN6(msb)				
212B	val MIN6(lsb)				
212C	val MIN7(msb)				
212D	val MIN7(lsb)				
212E	val MIN8(msb)				
212F	val MIN8(lsb)				

EVENT LOGGING

Event logging map

2300	4 words	Event 1
2308	4 words	Event 2
2310	4 words	Event 3
2318	4 words	Event 4
2320	4 words	Event 5
2328	4 words	Event 6
…	…	…
31F8	4 words	Event 480

The stored information relevant to every event are the following: event type, hour, minutes, seconds, day, month, year, value.
All these data are included in the relevant 4 words, coded as follow.

To reset the events, it is necessary to write 0 in every of the sideways listed addresses and to reset the event counter, placed at the address 80Ch.

Nth event coding

	hour	min	event type
Word1	XXXXX	XXXXXX	XXXXX

	month	day	year
Word2	XXXX	XXXXX	XXXXXXX

	Seconds	variable type
Word3	0101XXXXXX	XXXXXX

	value
Word3	XXXXXXXXXXXXXXXX

Variable type coding

Refer to the relevant table in “EEPROM configuration data” chapter.

Event type coding:

MAX		1
MIN		2
DIAGNOSTIC 1	ON	3
DIAGNOSTIC 2	ON	4
DIAGNOSTIC 3	ON	5
DIAGNOSTIC 4	ON	6
DIAGNOSTIC 1	OFF	7
DIAGNOSTIC 2	OFF	8
DIAGNOSTIC 3	OFF	9
DIAGNOSTIC 4	OFF	10
REMOTE 1	ON	11
REMOTE 2	ON	12
REMOTE 3	ON	13
REMOTE 4	ON	14
REMOTE 1	OFF	15
REMOTE 2	OFF	16
REMOTE 3	OFF	17
REMOTE 4	OFF	18
ALARM 1	ON	19
ALARM 2	ON	20
ALARM 3	ON	21
ALARM 4	ON	22
ALARM 1	OFF	23
ALARM 2	OFF	24
ALARM 3	OFF	25
ALARM 4	OFF	26

MONTHLY ENERGY COUNTERS

The reading of the values of the energy counters relevant to the previous three months is feasible by reading the data stored in the three tables described below. The tables have the same structure: they are composed of 14 32-bytes pages where the total and partial counter values are stored on the first day of the month at 0.00.00. The storing order of the table is the following (assuming, for example, to begin the WM3 use in January): January data = table A, February data = table B, March data = table C, April data = table A (overwriting the January data), and so on.

Pages structure:

Page 1: the initial 16 bytes, grouped 4 by 4, are the four-total counter LSB part
(KWh+ ,KWh-, Kvarh+, Kvarh-)
Page 2: the initial 20 bytes, grouped 5 by 5, are the four-winter tariff 1 partial counters values
Page 3: the initial 20 bytes, grouped 5 by 5, are the four-winter tariff 2 partial counters values
Page 4: the initial 20 bytes, grouped 5 by 5, are the four-winter tariff 3 partial counters values
Page 5: the initial 20 bytes, grouped 5 by 5, are the four-winter tariff 4 partial counters values
Page 6: the initial 20 bytes, grouped 5 by 5, are the four-summer tariff 1 partial counters values
Page 7: the initial 20 bytes, grouped 5 by 5, are the four-summer tariff 2 partial counters values
Page 8: the initial 20 bytes, grouped 5 by 5, are the four-summer tariff 3 partial counters values
Page 9: the initial 20 bytes, grouped 5 by 5, are the four-summer tariff 4 partial counters values
Page 10: the initial 20 bytes, grouped 5 by 5, are the four-holiday tariff 1 partial counters values
Page 11: the initial 20 bytes, grouped 5 by 5, are the four-holiday tariff 2 partial counters values
Page 12: the initial 20 bytes, grouped 5 by 5, are the four-holiday tariff 3 partial counters values
Page 13: the initial 20 bytes, grouped 5 by 5, are the four-holiday tariff 4 partial counters values
Page 14: the initial 4 bytes are the four-total counter MSB part, then 10 not used bytes follow, then the following two bytes are relevant respectively to the year and month when the table were stored.

How to reconstruct the energy counter values:

The energy values have to be reconstructed according to the procedure described at page 11. The value of byte 5, multiplied by 1000000000, must be added to the byte1-byte2-byte3-byte4 value and the sum divided by 100.

- Total counters: byte5 is stored at page 14 of the relevant monthly table. byte1-byte2-byte3-byte4 are stored at page 1 (byte 1 has the lower address).

- Partial counters: byte5 and byte1-byte2-byte3-byte4 are consecutively stored starting from the address of the required counter (byte 5 has the lower address, then byte 1 is stored, etc.).

To obtain the energy consuption relevant to a given month, the tables relevant to the end and the beginning of that month must be read, and the difference between the respective values must be carried out.

Monthly energy counters map

ADDRESS	BYTE	SEASON	PERIOD	COUNTER TYPE
3220 (page 1)	4	TOTAL		Kwh+ (LSB)
3224	4			Kwh- (LSB)
3228	4			KVARh+ (LSB)
322C	4			KVARh- (LSB)
	4			
	4			
	4			
	4			
3240 (page 2)	4	WINTER	1	Kwh+ (LSB)
3244	1			Kwh+ (MSB)
3245	4			KVARh+ (LSB)
3249	1			KVARh+ (MSB)
324A	4			Kwh- (LSB)
324E	1			Kwh- (MSB)
324F	4			KVARh- (LSB)
3253	1			KVARh- (MSB)
3254	12			
3260 (page 3)	4	WINTER	2	Kwh+ (LSB)
3264	1			Kwh+ (MSB)
3265	4			KVARh+ (LSB)
3269	1			KVARh+ (MSB)
326A	4			Kwh- (LSB)
326E	1			Kwh- (MSB)
326F	4			KVARh- (LSB)
3263	1			KVARh- (MSB)
3264	12			
…	…	…	…	…
…	…	…	…	…
…	…	…	…	…
33A0 (page 13)	4	HOLIDAY	4	Kwh+ (LSB)
33A4	1			Kwh+ (MSB)
33A5	4			KVARh+ (LSB)
33A9	1			KVARh+ (MSB)
33AA	4			Kwh- (LSB)
33AE	1			Kwh- (MSB)
33AF	4			KVARh- (LSB)
33B3	1			KVARh- (MSB)
33B4	12			
33C0 (page 14)	1	YEAR/MONTH		Kwh+ (MSB)
33C1	1			Kwh- (MSB)
33C2	1			KVARh+ (MSB)
33C3	1			KVARh- (MSB)
33C4	10			
33CE	1			YEAR
33CF	1			MONTH
33D0	16			

Table A

Monthly energy counters map

ADDRESS	BYTE	SEASON	PERIOD	COUNTER TYPE
33E0 (page 1)	4	TOTAL		Kwh+ (LSB)
33E4	4			Kwh- (LSB)
33E8	4			KVARh+ (LSB)
33EC	4			KVARh- (LSB)
	4			
	4			
	4			
	4			
3400 (page 2)	4	WINTER	1	Kwh+ (LSB)
3404	1			Kwh+ (MSB)
3405	4			KVARh+ (LSB)
3409	1			KVARh+ (MSB)
340A	4			Kwh- (LSB)
340E	1			Kwh- (MSB)
340F	4			KVARh- (LSB)
3413	1			KVARh- (MSB)
3414	12			
3420 (page 3)	4	WINTER	2	Kwh+ (LSB)
3424	1			Kwh+ (MSB)
3425	4			KVARh+ (LSB)
3429	1			KVARh+ (MSB)
342A	4			Kwh- (LSB)
342E	1			Kwh- (MSB)
342F	4			KVARh- (LSB)
3433	1			KVARh- (MSB)
3434	12			
…	…	…	…	….
…	…	…	…	…
…	…	…	…	…
3540 (page 13)	4	HOLIDAY	4	Kwh+ (LSB)
3544	1			Kwh+ (MSB)
3545	4			KVARh+ (LSB)
3549	1			KVARh+ (MSB)
354A	4			Kwh- (LSB)
354E	1			Kwh- (MSB)
354F	4			KVARh- (LSB)
3553	1			KVARh- (MSB)
3554	12			
3560 (page 14)	1	YEAR/MONTH		Kwh+ (MSB)
3561	1			Kwh- (MSB)
3562	1			KVARh+ (MSB)
3563	1			KVARh- (MSB)
3564	10			
356E	1			YEAR
356F	1			MONTH
3570	16			

Table B

Monthly energy counters map

ADDRESS	BYTE	SEASON	PERIOD	COUNTER TYPE
35A0 (page 1)	4	TOTALE		Kwh+ (LSB)
35A4	4			Kwh- (LSB)
35A8	4			KVARh+ (LSB)
35AC	4			KVARh- (LSB)
	4			
	4			
	4			
	4			
35C0 (page 2)	4	WINTER	1	Kwh+ (LSB)
35C4	1			Kwh+ (MSB)
35C5	4			KVARh+ (LSB)
35C9	1			KVARh+ (MSB)
35CA	4			Kwh- (LSB)
35CE	1			Kwh- (MSB)
35CF	4			KVARh- (LSB)
35C3	1			KVARh- (MSB)
35C4	12			
35E0 (page 3)	4	WINTER	2	Kwh+ (LSB)
35E4	1			Kwh+ (MSB)
35E5	4			KVARh+ (LSB)
35E9	1			KVARh+ (MSB)
35EA	4			Kwh- (LSB)
35EE	1			Kwh- (MSB)
35EF	4			KVARh- (LSB)
35E3	1			KVARh- (MSB)
35E4	12			
…	…	…	…	…
…	…	…	…	…
…	…	…	…	…
3720 (page 13)	4	HOLIDAY	4	Kwh+ (LSB)
3724	1			Kwh+ (MSB)
3725	4			KVARh+ (LSB)
3729	1			KVARh+ (MSB)
372A	4			Kwh- (LSB)
372E	1			Kwh- (MSB)
372F	4			KVARh- (LSB)
3733	1			KVARh- (MSB)
3734	12			
3740 (page 14)	1	YEAR/MONTH		Kwh+ (MSB)
3741	1			Kwh- (MSB)
3742	1			KVARh+ (MSB)
3743	1			KVARh- (MSB)
3744	10			
374E	1			YEAR
374F	1			MONTH
3750	16			

Table C

EEPROM CONFIGURATION DATA FORMAT

Variable type coding

VARIABLE	CODE	VARIABLE	CODE
V L1-N	0	PF L3	26
V L2-N	1	PF ∑	27
V L3-N	2	Hz	28
VL-N ∑	3	THD V1	29
V L1	4	THDe V1	30
V L2	5	THDo V1	31
V L3	6	THD V2	32
V ∑	7	THDe V2	33
A L1	8	THDo V2	34
A L2	9	THD V3	35
A L3	10	THDe V3	36
A n	11	THDo V3	37
W L1	12	THD A1	38
W L2	13	THDe A1	39
W L3	14	THDo A1	40
W ∑	15	THD A2	41
var L1	16	THDe A2	42
var L2	17	THDo A2	43
var L3	18	THD A3	44
VAR ∑	19	THDe A3	45
VA L1	20	THDo A3	46
VA L2	21	A dmd	47
VA L3	22	VA dmd	48
VA ∑	23	TPF avg	49
PF L1	24	W dmd	50
PF L2	25	ASY	51

System coding

system	selection
010XXXXX XXXXX000	1-phase
010XXXXX XXXXX001	3+N phases bal
010XXXXX XXXXX010	3+N phases unbal
010XXXXX XXXXX011	3 phases bal
010XXXXX XXXXX100	3 phases unbal

Average type coding

Average type	selection
XXXXXXXX XXXXXXX0	avg fixed
XXXXXXXX XXXXXXX1	avg float
0101XXXX XXXXXXXX	bit check

Info out (1,2,3,4) coding

info out	selection
XXXXXXXX XX000000	variable type(from 000000 to 110011, default 110011)
XXXXXX00 00XXXXXX	control type «up» (default)
XXXXXX00 01XXXXXX	control type «up.l»
XXXXXX00 10XXXXXX	control type «do»
XXXXXX00 11XXXXXX	control type «do.l»
XXXXX0XX XXXXXXXX	normally de-energized relay
XXXXX1XX XXXXXXXX	normally energized relay

Field n coding

The field n (n = 0, 1, 2, 3) variables are the variables chosen by the user to be shown on page 0 of the WM3 display.

Field (1 and 2) coding

Field	selection
XXXXXXXX XX000000	field 1 variable
XXXX0000 00XXXXXX	field 2 variable
0101XXXX XXXXXXXX	bit check

Field (3 and 4) coding

Field	selection
XXXXXXXX XX000000	field 3 variable
XXXX0000 00XXXXXX	field 4 variable
0101XXXX XXXXXXXX	bit check

MAX and MIN type coding

MAX and MIN type	selection
XXXXXXXX XX000000	field 1 variable (from 000000 to 110011, see TABLE «A»)
0101XXXX XXXXXXXX	bit check

Digit type coding

digit type	Selection
XXXXXXXX XXXXXXX0	4 digit visualization
XXXXXXXX XXXXXXX1	3½ digit visualization
0101XXXX XXXXXXXX	bit check

RS485 baud rate coding

RS485 baud rate	selection
XXXXXXXX XXXXXX00	1200b
XXXXXXXX XXXXXX01	2400b
XXXXXXXX XXXXXX10	4800b
XXXXXXXX XXXXXX11	9600b

FFT enable coding

FFT enable	selection
XXXXXXXX XXXXXXX1	fft V1-I1 disable
XXXXXXXX XXXXXXX0	fft V1-I1 enable
XXXXXXXX XXXXXX1X	fft V2-I2 disable
XXXXXXXX XXXXXX0X	fft V2-I2 enable
XXXXXXXX XXXXX1XX	fft V3-I3 disable
XXXXXXXX XXXXX0XX	fft V3-I3 enable

USA/EURO clock format

Clock format	Selection
XXXXXXXX XXXXXXX0	USA clock format
XXXXXXXX XXXXXXX1	European clock format
0101XXXX XXXXXXXX	bit check

Language

Language format	Selection
XXXXXXXX XXXXX000	English
XXXXXXXX XXXXX001	Italian
XXXXXXXX XXXXX010	German
XXXXXXXX XXXXX011	French
XXXXXXXX XXXXX100	Spanish
0101XXXX XXXXXXXX	bit check

Pulse type selection

Pulse type selection	Selection
XXXXXXXX XXXXX000	Out 1 pulses related to: total energy counter
XXXXXXXX XXXXX001	Out 1 pulses related to: period 1 energy counter
XXXXXXXX XXXXX010	Out 1 pulses related to: period 2 energy counter
XXXXXXXX XXXXX011	Out 1 pulses related to: period 3 energy counter
XXXXXXXX XXXXX100	Out 1 pulses related to: period 4 energy counter
XXXXXXXX XX000XXX	Out 2 pulses related to: total energy counter
XXXXXXXX XX001XXX	Out 2 pulses related to: period 1 energy counter
XXXXXXXX XX010XXX	Out 2 pulses related to: period 2 energy counter
XXXXXXXX XX011XXX	Out 2 pulses related to: period 3 energy counter
XXXXXXXX XX100XXX	Out 2 pulses related to: period 4 energy counter
XXXXXXX0 00XXXXXX	Out 3 pulses related to: total energy counter
XXXXXXX0 01XXXXXX	Out 3 pulses related to: period 1 energy counter
XXXXXXX0 10XXXXXX	Out 3 pulses related to: period 2 energy counter
XXXXXXX0 11XXXXXX	Out 3 pulses related to: period 3 energy counter
XXXXXXX1 00XXXXXX	Out 3 pulses related to: period 4 energy counter
XXXX000X XXXXXXXX	Out 4 pulses related to: total energy counter
XXXX001X XXXXXXXX	Out 4 pulses related to: period 1 energy counter
XXXX010X XXXXXXXX	Out 4 pulses related to: period 2 energy counter
XXXX011X XXXXXXXX	Out 4 pulses related to: period 3 energy counter
XXXX100X XXXXXXXX	Out 4 pulses related to: period 4 energy counter

Info ang (analogue output 1, 2, 3, 4) coding

info ang	Selection
XXXXXXXX XX000000	Ang X variable (from 000000 to 110011, see TABLE «A»)

Digital output type coding

type dig out	selection
XXXXXXXX XXXXXX00	dig out 1 pulse (default type out 1)
XXXXXXXX XXXXXX01	dig out 1 control
XXXXXXXX XXXXXX10	dig out 1 alarm
XXXXXXXX XXXX00XX	dig out 2 pulse (default type out 2)
XXXXXXXX XXXX01XX	dig out 2 control
XXXXXXXX XXXX10XX	dig out 2 alarm
XXXXXXXX XX00XXXX	dig out 3 pulse (default type out 3)
XXXXXXXX XX01XXXX	dig out 3 control
XXXXXXXX XX10XXXX	dig out 3 alarm
XXXXXXXX 00XXXXXX	dig out 4 pulse (default type out 4)
XXXXXXXX 01XXXXXX	dig out 4 control
XXXXXXXX 10XXXXXX	dig out 4 alarm
XXXXXX00 XXXXXXXX	pulse 1 Kwh+ (default) (see note 1)
XXXXXX01 XXXXXXXX	pulse 1 Kwh- (see note 1)
XXXXXX10 XXXXXXXX	pulse 1 KVARh+ (see note 1)
XXXXXX11 XXXXXXXX	pulse 1 KVARh- (see note 1)
XXXX00XX XXXXXXXX	pulse 2 Kwh+ (default) (see note 1)
XXXX01XX XXXXXXXX	pulse 2 Kwh- (see note 1)
XXXX10XX XXXXXXXX	pulse 2 KVARh+ (see note 1)
XXXX11XX XXXXXXXX	pulse 2 KVARh- (see note 1)
XX00XXXX XXXXXXXX	pulse 3 Kwh+ (default) (see note 1)
XX01XXXX XXXXXXXX	pulse 3 Kwh- (see note 1)
XX10XXXX XXXXXXXX	pulse 3 KVARh+ (see note 1)
XX11XXXX XXXXXXXX	pulse 3 KVARh- (see note 1)
00XXXXXX XXXXXXXX	pulse 4 Kwh+ (default) (see note 1)
01XXXXXX XXXXXXXX	pulse 4 Kwh- (see note 1)
10XXXXXX XXXXXXXX	pulse 4 KVARh+ (see note 1)
11XXXXXX XXXXXXXX	pulse 4 KVARh- (see note 1)

NOTE 1: the multiplier type depends on the “info P” variable (refer to the instantaneous variables map).

EXAMPLES: HOW TO READ THE DATA FROM EEPROM

NOTE: EEPROM is structured in word (if not differently advised) which are sent in the order MSB, LSB (contrary to what happens during the INTERNAL RAM reading).

The value of the variables stored in EEPROM are 4-byte integer except from the values of the power which are stored in a different way. Refer to example 21 to know how to read the power values.

READING AND RESETTING MAXIMUM AND MINUMUM

*Example 18*: "12th MAXIMUM variable type" read command

4-word read command request frame (8 byte):

01h	04h	20h	D6h	00h	01h	CRC	CRC

read command answer frame (7 byte):

01h	04h	02h	**50h**	**0Ah**	CRC	CRC

12th MAX-variable type address: 20D6h
Stored variable value: 0Ah = 10 (decimal)
Variable type: A L3 (phase 3 current)

*Example 19*: "Current info" read command

"Info A" read request frame (frame 8 byte):

01h	04h	00h	E8h	00h	01h	CRC	CRC

"Info A" read answer frame (frame 7 byte):

01h	04h	02h	06h	04h	CRC	CRC

Info V value: 06h decimal point position: 1111
Info A value: 04h decimal point position: 11.11

*Example 20*: value of the "12th MAXIMUM" read command

1-word read request command (8 byte):

01h	04h	21h	16h	00h	01h	CRC	CRC

read answer frame (7 byte):

01h	04h	02h	**03h**	**6Ch**	CRC	CRC

Address of 12th MAX value: 2116h
Stored value: 036Ch = 876 (decimal)
Taking into account the results of the previous examples:
A L3 value: 8.76 A

***Example 21*: value of the "12^{th} MAXIMUM" read command in case of "power type" variable**

The structure of the value of the power stored in EEPROM is the following:

Word 1		Word 2	
2116h		2117h	
MSB	…	LSB	d.p.

1-word read request command (8 byte):

01h	04h	21h	16h	00h	01h	CRC	CRC

read answer frame (7 byte):

01h	04h	02h	**19h**	**E8h**	CRC	CRC

Value		**d.p.**
1 9	**Eh**	**8h**

Address of 12^{th} MAX value: 2116h
Stored value: 19E8h ➔ value = 19Eh = 414 (decimal);
decimal point position code = 8h = 111.1 k
Considering that, for example, the variable code is 12 (W L1):

W L1 value: 4.14 kW

***Example 22*: "12^{th} MAXIMUM" reset command**

1-word write request command (8 byte):

01h	06h	21h	16h	00h	00h	CRC	CRC

Write answer command (8 byte):

01h	06h	21h	16h	00h	00h	CRC	CRC

EVENTS READING

***Example 23*: read command of the event stored at address 2240h**

The reading of the information regarding an event is carried out by transferring 4 words starting from the first address of the selected event location, according to the Event Logging Map table (page 24). The description of the event is obtained by decoding the data contained in the 4 words, according to "n^{th} event coding" table.

In accordance to the above listed procedure, before reading a MAX or MIN event, the variable associated to the MAX or MIN must be known. Then the info of the variable (decimal point position) must be acquired. Finally the stored value must be read.

4-word read command frame (8 byte):

01h	04h	22h	40h	00h	04h	FAh	65h

read command answer frame (13 byte):

01h	04h	08h	**7Bh**	**C1h**	**61h**	**80h**	**5Bh**	**42h**	**00h**	**36h**	88h	DFh

Word 1:	7BC1h = 01111 011110 00001
Word 2:	6180h = 0110 00011 0000000
Word 3:	5B42h = 0101 101101 000010
Word 4:	0036h = 0000000000110110

Event type	0001	1	MAX
Minutes	011110	30	
Hour	01111	15	
Year	0000000	00	
Day	00011	03	
Month	0110	06	
Variable type	001000	08	A L1
Seconds	101101	45	
Value	110110	54	

The engineering unit and the decimal point position of the variable are obtained by reading the "info" value in the instantaneous variables area (see example 2).

RTC DATA READING

The reading of the information regarding the RTC is carried out by transferring 4 words starting from address 4000h as described in the following example.

***Example 24*: RTC data read command**

4-word read command frame (8 byte):

01	04h	40h	00h	00h	04h	E4h	09h

read command answer frame (13 byte):

			Sec.	**Min.**	**Hour**	**Week day .**	**Month day**	**Month**	**Year**			
01h	04h	08h	**12h**	**08h**	**11h**	**01h**	**08h**	**0Ah**	**01h**	**00h**	30h	6Bh

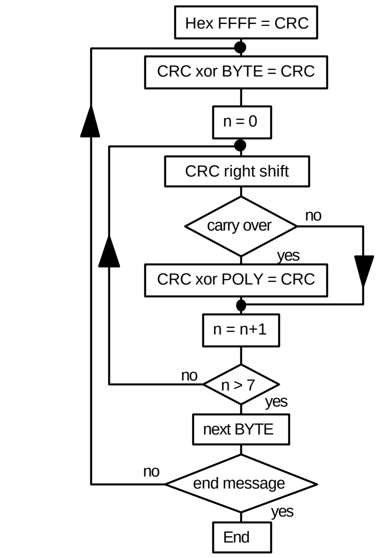
Seconds:	12h = 18
Minutes:	08h = 8
Hour:	11h = 17
Day of the week	01h = 1 (Monday)
Day of the month:	08h = 8
Month:	0Ah = 10
Year:	0001h= 1 (2001)

CRC CALCULATION ALGORITHM

CRC is calculated according to the relevant flow diagram (see below). An explanatory example will follow.

***Example 25*: calculation of CRC starting from frame 0207h**

CRC Inizialization	1111	1111	1111	1111	
Load 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	
Execute XOR with the polynomial	1000	0001	0011	1110	



POLY = crc calculation polynominal: A001h

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 5° right Shift	0011	0010	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**	**0010**	**0100**	**0001**	
		12h		**41h**	

NOTE: the byte 41h is sent first (even if it's the LSB), then byte 12h is sent.