EosArray

COMMUNICATION PROTOCOL "Extended"

rev. 1.0.1

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1 COMMUNICATION PROTOCOL

1.1 Introduction

For a complete description of the MODBUS protocol refer to “Modbus_Application_Protocol_V1_1a.pdf” and “Modbus_Messaging_Implementation_Guide_V1_0a.pdf” documents that can be download from the www.modbus.org web site.

1.2 MODBUS functions

These functions are available on VMU-M:

- Reading of n “Holding Registers” (code 03h)
- Reading of n “Input Register” (code 04h)
- Writing of one “Holding Registers” (code 06h)
- Writing of multiple register (code 10h)
- Diagnostic (code 08h with sub-function code 00h)
- Reading of “record file” (code 14h with sub-code 06h)
- Broadcast mode (writing instruction on address 00h)

IMPORTANT:

1) In this document the “Modbus address” field is indicated in two mode:
   1.1) “**Modicon address**” : it is the “6 digit Modicom” representation with Modbus function code 04 (Read Input Registers) . It is possible to read the same values with function code 03 (Read Holding Register) substituting the first digit with number “4”.
   1.2) “**Physical address**”: it is the “word address” value included in the communication frame.
2) The functions 03h and 04h have exactly the same effect.
3) The communication parameters must be set in according to the configuration of the instrument (refer to VMU instruction manual)

1.2.1 Function 03h (Read holding registers)

This function code is used to read the contents of a contiguous block of holding registers (word). The Request frame specifies the starting register address and the number of registers to be read. It is possible to read maximum 125 register (word) with a single request.
The register data in the response message are packed as two bytes per register (word), with the binary contents right justified within each byte. For each register, the first byte contains the high order bits (MSB) and the second contains the low order bits (LSB).

Request frame

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 255)	
Function code	1 byte	03h	
Starting Address	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
Quantity of Registers (N word)	2 bytes	1 to 7Dh (1 to 125)	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (correct action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 255)	
Function code	1 byte	03h	
Byte count	1 byte	N word * 2	
Register value	N*2 bytes		Byte order: MSB, LSB
CRC	2 bytes		

Response frame (incorrect action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 255)	Possible exception : 01h: illegal function 02h: illegal data address 03h: illegal data value 04h: slave device failure
Function code	1 byte	83h	
Exception code	1 byte	01h, 02h, 03h, 04h	
CRC	2 bytes		

1.2.2 Function 04h (Read input registers)

This function code is used to read the contents of a contiguous block of input registers (word). The Request frame specifies the starting register address and the number of registers to be read. It is possible to read maximum 125 register (word) with a single request.
The register data in the response message are packed as two bytes per register (word), with the binary contents right justified within each byte. For each register, the first byte contains the high order bits (MSB) and the second contains the low order bits (LSB).

Request frame

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 255)	
Function code	1 byte	04h	
Starting Address	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
Quantity of Registers (N word)	2 bytes	1 to 7Dh (1 to 125)	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (correct action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 255)	
Function code	1 byte	04h	
Byte count	1 byte	N word * 2	
Register value	N*2 bytes		Byte order: MSB, LSB
CRC	2 bytes		

Response frame (incorrect action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 255)	Possible exception : 01h: illegal function 02h: illegal data address 03h: illegal data value 04h: slave device failure
Function code	1 byte	84h	
Exception code	1 byte	01h, 02h, 03h, 04h	
CRC	2 bytes		

1.2.3 Function 06h (Write single holding register)

This function code is used to write a single holding register. The Request frame specifies the address of the register (word) to be written and its contents.
The correct response is an echo of the request, returned after the register contents have been written.

Request frame

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 255)	
Function code	1 byte	06h	
Starting Address	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
Register value	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (correct action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 255)	
Function code	1 byte	06h	
Starting Address	2 bytes	0000h to FFFFh	
Register value	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (incorrect action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 255)	Possible exception : 01h: illegal function 02h: illegal data address 03h: illegal data value 04h: slave device failure
Function code	1 byte	86h	
Exception code	1 byte	01h, 02h, 03h, 04h	
CRC	2 bytes		

1.2.4 Function 10h (Write multiple register)

This function code is used to write a block of contiguous registers (maximum 120). The requested values to be written are specified in the request data field. Data is packed as two bytes per register.
The correct response returns the function code, starting address, and the quantity of written registers.

Request frame

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 255)	
Function code	1 byte	10h	
Starting Address	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
Quantity of Registers (N word)	2 bytes	0001h to 0078h	Byte order: MSB, LSB
Byte count	1 byte	N word * 2	
Register value	N * 2 bytes	value	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (correct action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 255)	
Function code	1 byte	10h	
Starting Address	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
Quantity of Registers (N word)	2 bytes	0001h to 0078h	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (incorrect action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 255)	Possible exception : 01h: illegal function 02h: illegal data address 03h: illegal data value 04h: slave device failure
Function code	1 byte	90h	
Exception code	1 byte	01h, 02h, 03h, 04h	
CRC	2 bytes		

1.2.5 Function 08h (Diagnostic with sub-function code 00h)

MODBUS function code 08h provides a series of tests to check the communication system between a client (Master) device and a server (Slave), or to check various internal error conditions within a server.
VMU supports only 0000h sub-function code (Return Query Data). With this sub-function the data passed in the request data field is to be returned (looped back) in the response. The entire response message should be identical to the request.

Request frame

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 255)	
Function code	1 byte	08h	
Sub-function	2 bytes	0000h	
Data (N word)	2 bytes	N word * 2	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (correct action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 255)	
Function code	1 byte	08h	
Sub-function	2 bytes	0000h	
Data (N word)	2 bytes	N word * 2	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (incorrect action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 255)	Possible exception : 01h: illegal function 02h: illegal data address 03h: illegal data value 04h: slave device failure
Function code	1 byte	88h	
Exception code	1 byte	01h, 02h, 03h, 04h	
CRC	2 bytes		

1.2.6 Function 14h with sub-function 06h (Reading of record file)

This function code is used to perform a record file read. All Request Data Lengths are provided in terms of number of bytes and all Record Lengths are provided in terms of registers.
A file is set of records. Each file contains 10000 records, addressed from 0 to 9999.
The function can read multiple groups of references. The groups can be separated (non-contiguous), but the references within each group must be sequential. Each group is defined in a separate 'sub-request' field that contains 7 bytes:
The reference type: 1 byte (must be specified as 6)
The file number: 2 bytes
The starting record number within the file: 2 bytes
The length of the record to be read: 2 bytes.
The quantity of registers to be read, combined with all other fields in the expected response, must not exceed the allowable length of the MODBUS PDU: 253 bytes.
The normal response is a series of 'sub-responses', one for each 'sub-request'. The byte count field is the total combined count of bytes in all 'sub-responses'. In addition, each 'sub-response'contains a field that shows its own byte count.

Request frame

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 255)	
Function code	1 byte	14h	
Byte count	1 byte	07h to F5h bytes	
1°Sub-function code	1 byte	06h	
1°Sub-function file number	2 bytes	0h to FFFFh	Byte order: MSB, LSB
1°Sub-function record number	2 bytes	0h to 270Fh	Byte order: MSB, LSB
1°Sub-function number of word (**N**)	2 bytes	**N**	Byte order: MSB, LSB
2°Sub-function code	1 byte	06h	
2°Sub-function file number	2 bytes	0h to FFFFh	Byte order: MSB, LSB
2°Sub-function record number	2 bytes	0h to 270Fh	Byte order: MSB, LSB
2°Sub-function number of word (**N**1)	2 bytes	**N**1	Byte order: MSB, LSB
….			
CRC	2 bytes		

Response frame (correct action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 255)	
Function code	1 byte	14h	
Resp. Data length	1 byte	0x07 to 0xF5	
1°Sub-func. response data length	1 byte	07h to 0F5h	
1°Sub-function code	1 byte	06h	
1°Sub-func. Data (**N** word)	2 bytes	**N** word * 2	Byte order: MSB, LSB
2°Sub-func. response data length	1 byte	07h to 0F5h	
2°Sub-function code	1 byte	06h	
2°Sub-func. Data (**N**1 word)	2 bytes	**N**1 word * 2	Byte order: MSB, LSB
….			
CRC	2 bytes		

Response frame (incorrect action)

Description	Length	Value	Note
Physical Address	1 byte	1 to F7 (1 to 255)	Possible exception : 01h: illegal function 02h: illegal data address 03h: illegal data value 04h: slave device failure
Function code	1 byte	88h	
Exception code	1 byte	01h, 02h, 03h, 04h	
CRC	2 bytes		

1.2.7 Broadcast mode

In broadcast mode the master can send a request (command) to all the slaves. No response is returned to broadcast requests sent by the master. It is possible to send the broadcast message only with function code 06h and 10h and using address 00h.

1.3 Application notes

1.3.1 General consideration

1. To avoid errors due to the signal reflections or line coupling, it is necessary to terminate the input of the last instrument on the network, and also the reception of the Host. The termination on both the instrument and the host is necessary even in case of point-to-point connection, within short distances.
2. The GND connection is optional if a shielded cable is used.
3. For connections longer than 1000m, a line amplifier is necessary.
4. If an instrument does not answer within the “max answering time”, it is necessary to repeat the query. If the instrument does not answer after 2 or 3 consecutive queries, it must be considered as not connected, faulty or with wrong address. The same consideration is valid in case of CRC errors or incomplete frames.

1.3.2 MODBUS timing

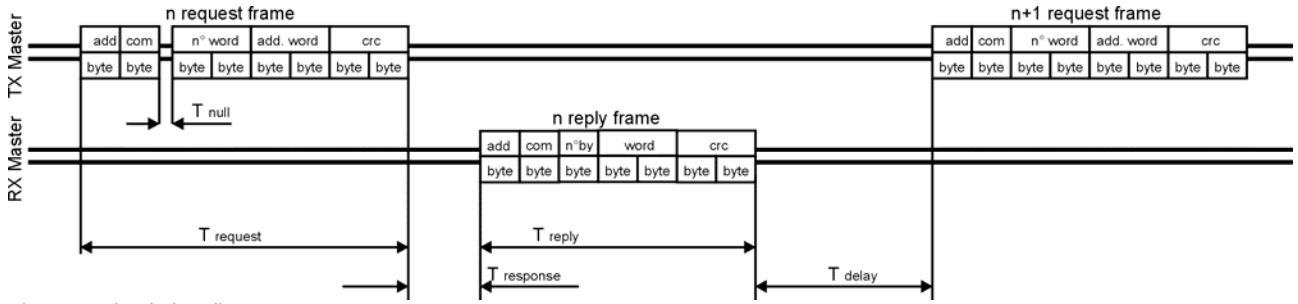


Fig. 1 : 4-wire timing diagram

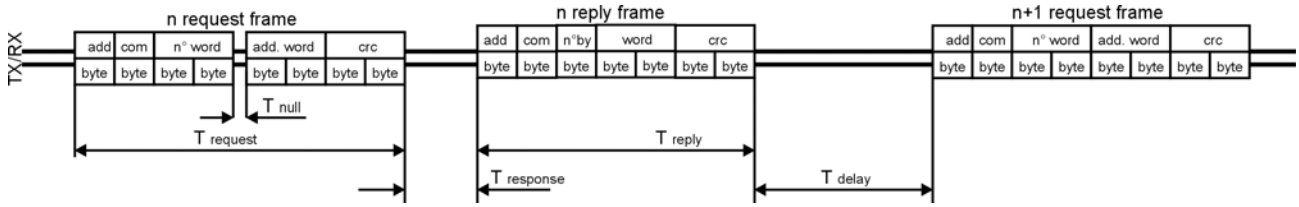


Fig. 2 : 2-wire timing diagram

Timing characteristics of reading function:	msec
T response: Max answering time	500ms
T response: Typical answering time	40ms
T delay: Minimum time for a new query	9600 baud-rate: 3,5 char 19200 baud-rate: 3,5 char 38400 baud-rate: 1,75 ms 115200 baud-rate: 1,75 ms
T null: Max interruption time on the request frame	9600 baud-rate: 2,5 char 19200 baud-rate: 2,5 char 38400 baud-rate: 1,75 ms 115200 baud-rate: 1,75 ms

Where: n char = n*10/baud rate

2 TABLES

2.1 Data format representation

The variables are represented by integers, with 2's complement notation in case of "signed" format.

Format	IEC data type	Description	Bits	Range
INT16	INT	Integer	16	-32768 .. 32767
UINT16	UINT	Unsigned integer	16	0 .. 65535
INT32	DINT	Double integer	32	-2^{31} .. 2^{31}

All the decimal points present in this document are indicated in virtual mode. The real value in the memory has not any decimal point.

2.2 Short description of the modules

Maximum total number of modules: 16 (with VMU-M)
Sub-address of the module: depend by the position from 0 to 15.

Possible configuration are following:

1. VMU-M Master module: always in position (sub-address) 0
2. VMU-S String module: maximum 15 in any position (sub-address) starting from 1
3. VMU-P Process signal module: only one in any position (sub-address) starting from 1
4. VMU-O I/O module: 15 in any position (sub-address) starting from 1

2.3 Table of instantaneous variable

VMU-M is a concentrator equipment that can read information from maximum 15 sub-slave devices. The device that is connected on the VMU-M local bus uses a sub-address that depends by its position. The device closed to VMU-M has sub-address 1. VMU-M has always sub-address 0.
The instantaneous variables are organ sated in 16 areas of 8 words each. Each area corresponds to a module. The first word of the area indicates the type of module, the others words have different structure in function of the module (see Table 2.2-2).

Table 2.3-1 - Instantaneous variables: read only mode with functions code 03 and 04

	Description	Modicom address	Physical address	Length (words)
Module sub-address=0 (it is always the VMU-M)	Module code	300769	0300h	1
	Module status	300770	0301h	1
	Word 1	300771	0302h	1
	Word 2	300772	0303h	1
	Word 3	300773	0304h	1
	Word 4	300774	0305h	1
	Word 5	300775	0306h	1
	Word 6	300776	0307h	1
Module sub-address=1	Module code	300777	0308h	1
	Module status	300778	0309h	1
	Word 1	300779	030Ah	1
	Word 2	300780	030Bh	1
	Word 3	300781	030Ch	1
	Word 4	300782	030Dh	1
	Word 5	300783	030Eh	1
	Word 6	300784	030Fh	1
Module sub-address=2	Module code	300785	0310h	1
	Module status	300786	0311h	1
	Word 1	300787	0312h	1
	Word 2	300788	0313h	1
	Word 3	300789	0314h	1
	Word 4	300790	0315h	1
	Word 5	300791	0316h	1
	Word 6	300792	0317h	1
Module sub-address=3	Module code	300793	0318h	1
	Module status	300794	0319h	1
	Word 1	300795	031Ah	1
	Word 2	300796	031Bh	1
	Word 3	300797	031Ch	1
	Word 4	300798	031Dh	1
	Word 5	300799	031Eh	1
	Word 6	300800	031Fh	1
Module sub-address=4	Module code	300801	0320h	1
	Module status	300802	0321h	1
	Word 1	300803	0322h	1
	Word 2	300804	0323h	1
	Word 3	300805	0324h	1
	Word 4	300806	0325h	1
	Word 5	300807	0326h	1
	Word 6	300808	0327h	1
Module sub-address=5	Module code	300809	0328h	1
	Module status	300810	0329h	1
	Word 1	300811	032Ah	1
	Word 2	300812	032Bh	1
	Word 3	300813	032Ch	1
	Word 4	300814	032Dh	1
	Word 5	300815	032Eh	1
	Word 6	300816	032Fh	1
Module sub-address=6	Module code	300817	0330h	1
	Module status	300818	0331h	1
	Word 1	300819	0332h	1
	Word 2	300820	0333h	1
	Word 3	300821	0334h	1
	Word 4	300822	0335h	1
	Word 5	300823	0336h	1
	Word 6	300824	0337h	1

…. Table 2.3-1

Module sub-address=7	Module code	300825	0338h	1
	Module status	300826	0339h	1
	Word 1	300827	033Ah	1
	Word 2	300828	033Bh	1
	Word 3	300829	033Ch	1
	Word 4	300830	033Dh	1
	Word 5	300831	033Eh	1
	Word 6	300832	033Fh	1
Module sub-address=8	Module code	300833	0340h	1
	Module status	300834	0341h	1
	Word 1	300835	0342h	1
	Word 2	300836	0343h	1
	Word 3	300837	0344h	1
	Word 4	300838	0345h	1
	Word 5	300839	0346h	1
	Word 6	300840	0347h	1
Module sub-address=9	Module code	300841	0348h	1
	Module status	300842	0349h	1
	Word 1	300843	034Ah	1
	Word 2	300844	034Bh	1
	Word 3	300845	034Ch	1
	Word 4	300846	034Dh	1
	Word 5	300847	034Eh	1
	Word 6	300848	034Fh	1
Module sub-address=10	Module code	300849	0350h	1
	Module status	300850	0351h	1
	Word 1	300851	0352h	1
	Word 2	300852	0353h	1
	Word 3	300853	0354h	1
	Word 4	300854	0355h	1
	Word 5	300855	0356h	1
	Word 6	300856	0357h	1
Module sub-address=11	Module code	300857	0358h	1
	Module status	300858	0359h	1
	Word 1	300859	035Ah	1
	Word 2	300860	035Bh	1
	Word 3	300861	035Ch	1
	Word 4	300862	035Dh	1
	Word 5	300863	035Eh	1
	Word 6	300864	035Fh	1
Module sub-address=12	Module code	300865	0360h	1
	Module status	300866	0361h	1
	Word 1	300867	0362h	1
	Word 2	300868	0363h	1
	Word 3	300869	0364h	1
	Word 4	300870	0365h	1
	Word 5	300871	0366h	1
	Word 6	300872	0367h	1
Module sub-address=13	Module code	300873	0368h	1
	Module status	300874	0369h	1
	Word 1	300875	036Ah	1
	Word 2	300876	036Bh	1
	Word 3	300877	036Ch	1
	Word 4	300878	036Dh	1
	Word 5	300879	036Eh	1
	Word 6	300880	036Fh	1
Module sub-address=14	Module code	300881	0370h	1
	Module status	300882	0370h	1
	Word 1	300883	0370h	1
	Word 2	300884	0370h	1
	Word 3	300885	0370h	1
	Word 4	300886	0370h	1
	Word 5	300887	0370h	1
	Word 6	300888	0370h	1
Module sub-address=15	Module code	300889	0378h	1
	Module status	300890	0379h	1
	Word 1	300891	037Ah	1
	Word 2	300892	037Bh	1
	Word 3	300893	037Ch	1
	Word 4	300894	037Dh	1
	Word 5	300895	037Eh	1
	Word 6	300896	037Fh	1

Table 2.3-2 - Organisation of the instantaneous variable vs. module type

Module Type	Description	Address	Length (words)	Data Format	Notes
VMU-M	Module code	Base+0h	1	UINT16	(*)1=VMU-M
	Module VMU-M status	Base+1h	1	UINT16	See table 2.3.3
	Temperature channel 1	Base+2h	1	INT16	(**)-60.0 to 400.0 (°C or °F)
	Temperature channel 2	Base+3h	1	INT16	(**)-60.0 to 400.0 (°C or °F)
	BOS efficiency	Base+4h	1	INT16	(**)0.0 to 999.9 %
	Digital input ch.1	Base+5h	1		1(OFF)=ch1 open, 0(ON)=ch1 close
	AC energy value	Base+6h	2	INT32	(***)0.0 to 99999.9 kWh
VMU-S	Module code	Base+0h	1	UINT16	(*)2=VMU-S
	Module VMU-S status	Base+1h	1	UINT16	See table 2.3.3
	Voltage	Base+2h	1	INT16	(**)0.0 to 999.9 V
	Current	Base+3h	1	INT16	(**)0.0 to 20.00 A
	Power	Base+4h	1	INT16	(**)0.0 to 99.99 kW
	String efficiency	Base+5h	1	INT16	(**)0.0 to 999.9 %
	Energy	Base+6h	2	INT32	(***)0.0 to 99999.9 kWh
VMU-P	Module code	Base+0h	1	UINT16	(*)3=VMU-P
	Module VMU-P status	Base+1h	1	UINT16	See table 2.3.3
	Temperature channel 1	Base+2h	1	INT16	(**)-60.0 to 400.0 (°C or °F)
	Temperature channel 2	Base+3h	1	INT16	(**)-60.0 to 400.0 (°C or °F)
	Solar irradiation	Base+4h	1	INT16	(**)0.0 to 9.999 kW/m^2 or kW/ft^2
	Wind speed	Base+5h	1	INT16	(**)0.0 to 299.9 m/s or f/s
VMU-O	Module code	Base+0h	1	UINT16	(*)4=VMU-O
	Module VMU-O status	Base+1h	1	UINT16	See table 2.3.3
	Input status: “IN1”	Base+2h	1	UINT16	1(OFF)=open, 0(ON)=close
	Input status: “IN2”	Base+3h	1	UINT16	1(OFF)=open, 0(ON) =close
	Output status: “OUT1”	Base+4h	1	UINT16	0(OFF)=deactivate, 1(ON) =activate
	Output status: “OUT2”	Base+5h	1	UINT16	0(OFF)=deactivate, 1(ON) =activate

(*) If the value is 0, the module is not present.
(**) If the value is equal to 7FFFh (32767), the measurement is not enabled (not present).
(**) If the value is equal to 7FFEh (32766), the measurement is in over-range condition.
(**) If the value is equal to 7FFDh (32765), the measurement is in under-range condition.
(***) If the value is equal to 7FFF7FFFh (2147450879), the measurement is not enabled (not present).

Table 2.3-3 - Module status representation

Module Type	Module status word	Description	Notes
VMU-M	Bit0	Error status: local bus is not ok	Bit=0 no error, Bit=1 error
	Bit1	Error status: module configuration is changed	Bit=0 no error, Bit=1 error
	Bit2	Programming parameters are incoherent	Bit=0 par. ok; Bit=1 par. error
	Bit3	Error status: short circuit on probe channel 1	Bit=0 not short, Bit=1 short
	Bit4	Error status: open circuit on probe channel 1	Bit=0 not open, Bit=1 open
	Bit5	Error status: short circuit on probe channel 2	Bit=0 not short, Bit=1 short
	Bit6	Error status: open circuit on probe channel 2	Bit=0 not open, Bit=1 open
	Bit7	Alarm status: temperature channel 1	Bit=0 no alarm, Bit=1 alarm
	Bit8	Alarm status: temperature channel 2	Bit=0 no alarm, Bit=1 alarm
	Bit9	Alarm status: BOS efficiency	Bit=0 no alarm, Bit=1 alarm
	Bit10	Error status: there are 2 o more module VMU-P connected	Bit=0 no error, Bit=1 error
VMU-S	Bit0	Programming parameters are incoherent	Bit=0 par. ok; Bit=1 par. error
	Bit1	Error status: solar string is not connected	Bit=0 connected, Bit=1 not connected
	Bit2	Error status: negative current or voltage string	Bit=0 not negative, Bit=1 negative
	Bit3	Error status: high temperature inside module	Bit=0 normal, Bit=1 high temperature
	Bit4	Alarm status: voltage	Bit=0 no alarm, Bit=1 alarm
	Bit5	Alarm status: current	Bit=0 no alarm, Bit=1 alarm
	Bit6	Alarm status: power	Bit=0 no alarm, Bit=1 alarm
	Bit7	Alarm status: solar string efficiency	Bit=0 no alarm, Bit=1 alarm
	Bit8	Alarm status: solar string control	Bit=0 no alarm, Bit=1 alarm
	Bit9	Virtual	Bit=0 real module, Bit=1 virtual module (*)
VMU-P	Bit0	Programming parameters are incoherent	Bit=0 par. ok; Bit=1 par. error
	Bit1	Error status: short circuit on probe channel 1	Bit=0 not short, Bit=1 short
	Bit2	Error status: open circuit on probe channel 1	Bit=0 not open, Bit=1 open
	Bit3	Error status: short circuit on probe channel 2	Bit=0 not short, Bit=1 short
	Bit4	Error status: open circuit on probe channel 2	Bit=0 not open, Bit=1 open
	Bit5	Error status: high temperature inside module	Bit=0 normal, Bit=1 high temperature
	Bit6	Alarm status: temperature channel 1	Bit=0 no alarm, Bit=1 alarm
	Bit7	Alarm status: temperature channel 1	Bit=0 no alarm, Bit=1 alarm
	Bit8	Alarm status: solar irradiation	Bit=0 no alarm, Bit=1 alarm
	Bit9	Alarm status: wind speed	Bit=0 no alarm, Bit=1 alarm
	Bit10	Virtual	Bit=0 real module, Bit=1 virtual module (*)
VMU-O	Bit0	Programming parameters are incoherent	Bit=0 par. ok; Bit=1 par. error
	Bit1	Error status: high temperature inside module	Bit=0 normal, Bit=1 high temperature
	Bit2	Virtual	Bit=0 real module, Bit=1 virtual module (*)

(*) If the module is available in the system, it is called “Real Module”. If the module is programmed but unavailable, it is called “Virtual Module”.

2.4 Table of programming parameters

Table 2.4-1 – Programming parameter: read and write mode

Modicon address	HEX Physical address	Description	Data Format	Notes
	0050h	Password	UINT16	0 ... 9999
	0051h	Digital Input Type (valid for ch1 and ch2)	UINT16	0=Digital; 1=Temperature
	0052h	Digital Input 2 prescaler	INT16	0,001 ... 10,000 kWh/pulse
	0053h	Temperature Engineering unit	UINT16	0=Celsius; 1=Fahrenheit
	0054h	Temperature Probe	UINT16	0=Pt100 3W; 1= Pt100 2W; 2=Pt1000 3W; 3=Pt1000 2W
	0055h	PV parameters - Engineering unit	UINT16	0=m; 1=ft
	0056h	PV parameters - Reference power (Pref)	INT16	1 ... 1000 Wp/m^2 or 0.1 ... 100.0 Wp/ft^2
	0057h	PV parameters - Total string area (TSA)	INT16	0.1 ... 1000.0 m^2 or1 ... 10000 ft^2
	0058h	PV parameters – Power temperature coefficient (γ)	INT16	-1.000 .... 1.000 %/°C or %/°F
	0059h	PV parameters – Nominal work cell temperature (NOCT)	INT16	-60.0 ... 400.0 °C or °F
	005Ah	PV parameters – Other power loss (OPL)	INT16	0.0 ... 999.9 %
	005Bh	PV module efficiency measurement Enabling	UINT16	NO=0; YES =1
	005Ch	PV module efficiency calculation type	UINT16	0= Using string comparison 1= Using Tcell 2=Using Tamb
	005Dh	String control Enabling	UINT16	NO=0; Max. match =1; Median match=2
	005Eh	String window Alarm	INT16	0.1 ... 999.9 %
	005Fh	Data and Event logger Enabling	UINT16	NO=0; YES =1
	0060h	Data logger Time interval	UINT16	0=1min; 1=5min; 2=10min; 3=15min; 4=30min; 5=60 min
	0062h	(**) RS485 Address	UINT16	1 ... 247
	0063h	(**) RS485 BaudRate	UINT16	0=9600; 1=19200; 2=38400; 3=115200
	0064h	(**) RS485 Parity	UINT16	0=none; 1=odd; 2=even
	0065h	Clock Time format	UINT16	0=24h/12h ; 1=AM-PM
	0066h	Clock Daylight-saving:	UINT16	NO=0; YES =1
	0067h	(*) Clock Calendar: Year	UINT16	2008 ... 2050
	0068h	(*) Clock Calendar: Month	UINT16	1 ... 12
	0069h	(*) Clock Calendar: Day	UINT16	1 ... 31
	006Ah	(*) Clock Time: hour	UINT16	0 ...23
	006Bh	(*) Clock Time: minutes	UINT16	0 ...59
	006Ch	(*) Clock Time: seconds	UINT16	0 ... 59
	006Dh	Temperature channel 1: Alarm link	UINT16	See “Alarm link codes” ”, Table 2.5-5
	006Eh	Temperature channel 1: Set point 1	INT16	-60.0 ... 400.0 °C or °F
	006Fh	Temperature channel 1: Set point 2	INT16	-60.0 ... 400.0 °C or °F
	0070h	Temperature channel 1: Delay	UINT16	0 ... 3600 sec
	0071h	Temperature channel 2: Alarm link	UINT16	See “Alarm link codes” ”, Table 2.5-5
	0072h	Temperature channel 2: Set point 1	INT16	-60.0 ... 400.0 °C or °F
	0073h	Temperature channel 2: Set point 2	INT16	-60.0 ... 400.0 °C or °F
	0074h	Temperature channel 2: Delay	UINT16	0 ... 3600 sec
	0075h	BOS efficiency: Alarm link	UINT16	See “Alarm link codes”, Table 2.5-5
	0076h	BOS efficiency: Set point 1	INT16	0.0 ... 999.9 %
	0077h	BOS efficiency: Set point 2	INT16	0.0 ... 999.9 %
	0078h	BOS efficiency: Delay	UINT16	0 ... 3600 sec
	0079h	Daylight Saving Month to increase hour (+1H)	UINT16	1 ... 12 month
	007Ah	Daylight Saving Number of Sunday to increase hour (+1H)	UINT16	0 ... 4 (if 0 is last Sunday on month)
	007Bh	Daylight Saving Hour to increase hour (+1H)	UINT16	0 ... 23 (only in 24h format)
	007Ch	Daylight Saving Month to decrease hour (-1H)	UINT16	1 ... 12 month
	007Dh	Daylight Saving Number of Sunday to decrease hour (-1H)	UINT16	0 ... 4 (if 0 is last Sunday on month)
	007Eh	Daylight Saving Hour to decrease hour (-1H)	UINT16	0 ... 23 (only in 24h format)
	From 0100h to 011Fh	Programming parameter area for module with sub-address=1		
	From 0120h to 013Fh	Programming parameter area for module with sub-address=2		
	From 0140h to 015Fh	Programming parameter area for module with sub-address=3		
	From 0160h to 00BFh	Programming parameter area for module with sub-address=4		
	From 180h to 019Fh	Programming parameter area for module with sub-address=5		
	From 01A0h to 01BFh	Programming parameter area for module with sub-address=6		
	From 01C0h to 01DFh	Programming parameter area for module with sub-address=7		
	From 01E0h to 01FFh	Programming parameter area for module with sub-address=8		
	From 0200h to 021Fh	Programming parameter area for module with sub-address=9		
	From 0220h to 023Fh	Programming parameter area for module with sub-address=10		
	From 0240h to 025Fh	Programming parameter area for module with sub-address=11		
	From 0260h to 027Fh	Programming parameter area for module with sub-address=12		
	From 0280h to 029Fh	Programming parameter area for module with sub-address=13		

... Table 2.4-2

	From 02A0h to 02BFh	Programming parameter area for module with sub-address=14		
	From 02C0h to 02DFh	Programming parameter area for module with sub-address=15		

(*) Values are update only when the command “update clock” is sent.
(**) Values are update only when the command “update serial communication setting” is sent or switch off and on the instrument.

Table 2.4-3 Programming parameter: organisation for VMU-S module

Modicon address	HEX Physical address	Description	Data Format	Notes
Base + 0	Base + 0h	Type of module	UINT16	2=VMU-S
Base + 1	Base + 1h	Voltage: Alarm link	UINT16	See “Alarm link codes”, Table 2.5-5
Base + 2	Base + 2h	Voltage: Set point 1	INT16	0.0 ... 999.9 V
Base + 3	Base + 3h	Voltage: Set point 2	INT16	0.0 ... 999.9 V
Base + 4	Base + 4h	Voltage: Delay	UINT16	0 ... 3600 sec
Base + 5	Base + 5h	Current: Alarm link	UINT16	See “Alarm link codes” , Table 2.5-5
Base + 6	Base + 6h	Current: Set point 1	INT16	0.0 ... 20.00 A
Base + 7	Base + 7h	Current: Set point 2	INT16	0.0 ... 20.00 A
Base + 8	Base + 8h	Current: Delay	UINT16	0 ... 3600 sec
Base + 9	Base + 9h	Power: Alarm link	UINT16	See “Alarm link codes” , Table 2.5-5
Base + 10	Base + Ah	Power: Set point 1	INT16	0.00 ... 99,99 Kw
Base + 11	Base + Bh	Power: Set point 2	INT16	0.00 ... 99,99 Kw
Base + 12	Base + Ch	Power: Delay	UINT16	0 ... 3600 sec
Base + 13	Base + Dh	String efficiency: Alarm link	UINT16	See “Alarm link codes”, Table 2.5-5
Base + 14	Base + Eh	String efficiency: Set point 1	INT16	0.0 ... 999.9 %
Base + 15	Base + Fh	String efficiency: Set point 2	INT16	0.0 ... 999.9 %
Base + 16	Base + 10h	String efficiency: Delay	UINT16	0 ... 3600 sec
Base + 17	Base + 11h	String control: Alarm link	UINT16	See “Alarm link codes”, Table 2.5-5
Base + 18	Base + 12h	String control: Delay	UINT16	0 ... 3600 sec

Table 2.4-4 Programming parameter: organisation for VMU-P module

Modicon address	HEX Physical address	Description	Data Format	Notes
Base + 0	Base + 0h	Type of module	UINT16	3=VMU-P
Base + 1	Base + 1h	Temperature Engineering unit: °C/°F	UINT16	0=Celsius; 1=Fahrenheit
Base + 2	Base + 2h	Temperature Probe P	UINT16	0=Pt100 3W; 1= Pt100 2W; 2=Pt1000 3W; 3=Pt1000 2W
Base + 3	Base + 3h	Irradiation input Engineering unit	UINT16	0=kW/m2; 1=kW/ft2
Base + 4	Base + 4h	Irradiation: input Electrical scale LOW	INT16	0.0 ... 999.9 mV
Base + 5	Base + 5h	Irradiation: input Electrical scale HIGH	INT16	0.0 ... 999.9 mV
Base + 6	Base + 6h	Irradiation: input Display scale LOW	INT16	0.000 ... 9.999 kW/m2 or kW/ft2
Base + 7	Base + 7h	Irradiation: input Display scale HIGH	INT16	0.000 ... 9.999 kW/m2 or kW/ft2
Base + 8	Base + 8h	Wind speed signal input	INT16	0.0 ... 999.9 Hz
Base + 9	Base + 9h	Wind speed scale input	INT16	0.01 ... 99.99 m/s or 0.01 ... 299.9 ft/s
Base + 10	Base + Ah	Temperature channel 1: Alarm link	UINT16	See “Alarm link codes”, Table 2.5-5
Base + 11	Base + Bh	Temperature channel 1: Set point 1	INT16	-60.0 ... 400.0 °C or °F
Base + 12	Base + Ch	Temperature channel 1: Set point 2	INT16	-60.0 ... 400.0 °C or °F
Base + 13	Base + Dh	Temperature channel 1: Delay	UINT16	0 ... 3600 sec
Base + 14	Base + Eh	Temperature channel 2: Alarm link	INT16	See “Alarm link codes”, Table 2.5-5
Base + 15	Base + Fh	Temperature channel 2: Set point 1	INT16	-60.0 ... 400.0 °C or °F
Base + 16	Base + 10h	Temperature channel 2: Set point 2	INT16	-60.0 ... 400.0 °C or °F
Base + 17	Base + 11h	Temperature channel 2: Delay	UINT16	0 ... 3600 sec
Base + 18	Base + 12h	Solar irradiation: Alarm link	UINT16	See “Alarm link codes”, Table 2.5-5
Base + 19	Base + 13h	Solar irradiation: Set point 1	INT16	0.0 to 9.999 kW/m^2 or kW/ft^2
Base + 20	Base + 14h	Solar irradiation: Set point 2	INT16	0.0 to 9.999 kW/m^2 or kW/ft^2
Base + 21	Base + 15h	Solar irradiation: Delay	UINT16	0 ... 3600 sec
Base + 22	Base + 16h	Wind speed: Alarm link	UINT16	See “Alarm link codes”, Table 2.5-5
Base + 23	Base + 17h	Wind speed: Set point 1	INT16	0.0 ... 299.9 m/s or ft/s
Base + 24	Base + 18h	Wind speed: Set point 2	INT16	0.0 ... 299.9 m/s or ft/s
Base + 25	Base + 19h	Wind speed: Delay	UINT16	0 ... 3600 sec

Table 2.4-5 Programming parameter: organisation for VMU-O module

Modicon address	HEX Physical address	Description	Data Format	Notes
Base + 0	Base + 0h	Type of module	UINT16	4=VMU-O
Base + 1	Base + 1h	Digital output channel 1: Enabling	UINT16	0=Remote; 1=Alarm; 2=Clock
Base + 2	Base + 2h	Digital output channel 1: Output status	UINT16	0=NO; 1=NC (only if selected “Alarm” type)
Base + 3	Base + 3h	Digital output channel 1: Time activation hour	UINT16	0 ... 23
Base + 4	Base + 4h	Digital output channel 1: Time activation minutes	UINT16	0 ... 59
Base + 5	Base + 5h	Digital output channel 1: Time deactivation hour	UINT16	0 ... 23
Base + 6	Base + 6h	Digital output channel 1: Time deactivation minutes	UINT16	0 ... 59
Base + 7	Base + 7h	Digital output channel 2: Enabling	UINT16	0=Remote; 1=Alarm; 2=Clock
Base + 8	Base + 8h	Digital output channel 2: Output status	UINT16	0=NO; 1=NC (only if selected “Alarm” type)
Base + 9	Base + 9h	Digital output channel 2: Time activation: hour	UINT16	0 ... 23
Base + 10	Base + Ah	Digital output channel 2: Time activation: minutes	UINT16	0 ... 59
Base + 11	Base + Bh	Digital output channel 2: Time deactivation: hour	UINT16	0 ... 23
Base + 12	Base + Ch	Digital output channel 2: Time deactivation: minutes	UINT16	0 ... 59

Table 2.4-6 Programming parameter: Alarm link codes

Word value	Link	Word value	Link	Word value	Link	Word value	Link
0	No alarm	8	Module 4, ch.1	16	Module 8, ch.1	24	Module 12, ch.1
1	Virtual alarm	9	Module 4, ch.2	17	Module 8, ch.2	25	Module 12, ch.2
2	Module 1, ch.1	10	Module 5, ch.1	18	Module 9, ch.1	26	Module 13, ch.1
3	Module 1, ch.2	11	Module 5, ch.2	19	Module 9, ch.2	27	Module 13, ch.2
4	Module 2, ch.1	12	Module 6, ch.1	20	Module 10, ch.1	28	Module 14, ch.1
5	Module 2, ch.2	13	Module 6, ch.2	21	Module 10, ch.2	29	Module 14, ch.2
6	Module 3, ch.1	14	Module 7, ch.1	22	Module 11, ch.1	30	Module 15, ch.1
7	Module 3, ch.2	15	Module 7, ch.2	23	Module 11, ch.2	31	Module 15, ch.2

2.4.1 Application Note: How to program modules

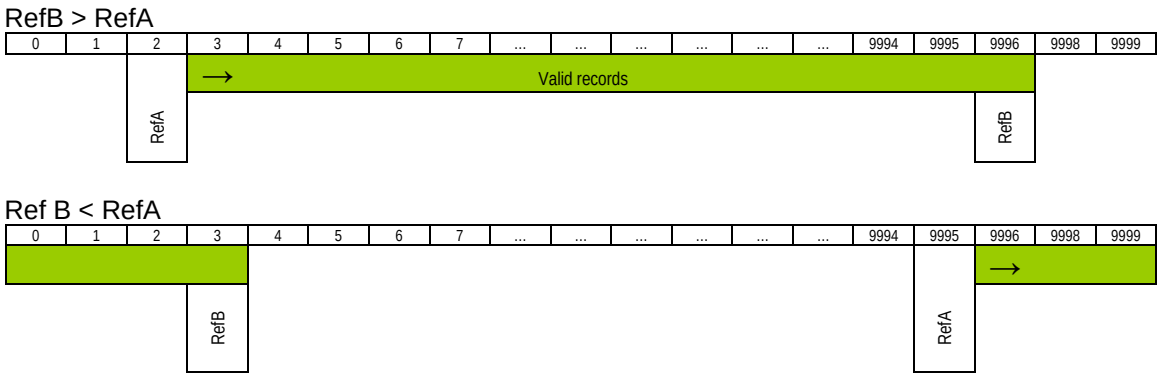
If module is connected to the system, is called **Real Module**. If module is programmed but doesn't connect, is called **Virtual Module**.

If **Real Module** is connected, for protection, it's impossible change "Type of module" parameter at address *Base + 0h*. It's allowed re-write with the same type for maintain Modbus compatibility.
If there is **Virtual Module** connected or is **Empty Module**, it's possible change the "Type of module" but it's mandatory write module sub code (at address *Base + 0h*) before other parameters because when module change, the system re-init it.

The system uses only **Real Module** in all calculation algorithm (such as energy, string control… and more).
If there is one or more **Virtual Module** the system generates "Error status: module configuration is changed" a flag which disables the database system (if it's active). It is possible to temporarily clear the former flag with the 3000h command.

2.5 Table of “Data base” file

The “Data base” (also known as “DB”) is a file with 10000 records (from index 0000 to 9999). The record is organised in 116 words as illustrated in table 2.5.2. The “data base” file is readable with Modbus function code 14h using file number 0.
The “data base” has a circular management system and uses two reference record numbers to identify the first record available (RefA) and the last record stored (RefB). If RefB > RefA, the records valid are from RefA+1 to RefB, if RefA > RefB, the records valid are from RefA+1 to 9999 and from 0 to RefB.



To read the “data base” file it is necessary to execute the following actions:

1) Read the reference of the first record available (RefA) and the reference of the last record stored (RefB) using Modbus function code 04h or 03h.
2) Read the valid records using Modbus function code 14h and sub-function code 06h. The identification file number for the data base is 0.
3) When all records are read, write the reference number RefA with the value of RefB (Modbus function code 06h). This action executes an equivalent reset function.

Table 2.5-1 “Data base” file: reference record numbers

Modicon address	HEX Physical address	Description	Data Format	Notes
	02E0h	“Data base” file: First record available (RefA)	INT16	0 ... 9999 (it is possible the write and read mode access)
	02E1h	“Data base” file: Last record stored (RefB)	INT16	0 ... 9999 (it is possible only the read mode access)

Table 2.5-2 “Data base” file: record organisation

HEX Physical address	Description	Data Format	Notes
Base+0h	Record index	INT16	0 ... 9999
Base+1h	Date: Year and Month	INT16	Lsb=Month (1...12); MSB=Year (08...50)
Base+2h	Date: Day and Hour	INT16	Lsb=Hour (0 ... 23); MSB=Day (01 ... 31)
Base+3h	Date: Minute and Second	INT16	Lsb=Second (0 ... 59); Msb=Minute (0 ...59)
From Base+004h to Base+00Ah	Record fields module with sub-address 0 (VMU-M)	7 word	See “ organisation of the record field”, table 2.6.3
From Base+00Bh to Base+011h	Record fields module with sub-address 1	7 word	
From Base+012h to Base+018h	Record fields module with sub-address 2	7 word	
From Base+019h to Base+01Fh	Record fields module with sub-address 3	7 word	
From Base+020h to Base+026h	Record fields module with sub-address 4	7 word	
From Base+027h to Base+02Dh	Record fields module with sub-address 5	7 word	
From Base+02Eh to Base+034h	Record fields module with sub-address 6	7 word	
From Base+035h to Base+03Bh	Record fields module with sub-address 7	7 word	
From Base+03Ch to Base+042h	Record fields module with sub-address 8	7 word	
From Base+043h to Base+049h	Record fields module with sub-address 9	7 word	
From Base+04Ah to Base+050h	Record fields module with sub-address 10	7 word	
From Base+051h to Base+057h	Record fields module with sub-address 11	7 word	
From Base+058h to Base+05Eh	Record fields module with sub-address 12	7 word	
From Base+05Fh to Base+065h	Record fields module with sub-address 13	7 word	
From Base+064h to Base+06Ch	Record fields module with sub-address 14	7 word	
From Base+06Dh to Base+073h	Record fields module with sub-address 15	7 word	

Table 2.5-3 – “Data base” file: organisation of the record field vs. module type

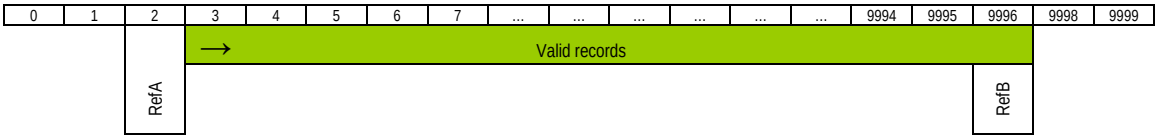
Module Type	Description	Address	Length (words)	Data Format	Notes
VMU-M	Module code	Base+0h	1	UINT16	(*)1=VMU-M
	Temperature channel 1	Base+1h	1	INT16	(**)-60.0 to 400.0 (°C or °F)
	Temperature channel 2	Base+2h	1	INT16	(**)-60.0 to 400.0 (°C or °F)
	BOS efficiency	Base+3h	1	INT16	(**)0.0 to 999.9 %
	AC energy value	Base+5h	2	INT32	(**)0.0 to 99999.9 kWh
VMU-S	Module code	Base+0h	1	UINT16	(*)2=VMU-S
	Voltage	Base+1h	1	INT16	(**)0.0 to 999.9 V
	Current	Base+2h	1	INT16	(**)0.0 to 20.00 A
	Power	Base+3h	1	INT16	(**)0.0 to 99.99 kW
	String efficiency	Base+4h	1	INT16	(**)0.0 to 999.9 %
	Energy	Base+5h	2	INT32	0.0 to 99999.9 kWh
VMU-P	Module code	Base+0h	1	UINT16	(*)3=VMU-P
	Temperature channel 1	Base+1h	1	INT16	(**)-60.0 to 400.0 (°C or °F)
	Temperature channel 2	Base+2h	1	INT16	(**)-60.0 to 400.0 (°C or °F)
	Solar irradiation	Base+3h	1	INT16	(**)0.0 to 9.999 kW/m^2 or kW/ft^2
	Wind speed	Base+4h	1	INT16	(**)0.0 to 299.9 m/s or f/s

(*) If the value is 0, the module is not present.
(**) If the value is equal to 7FFFh (32767), the measurement is not enabled (not present).
(**) If the value is equal to 7FFEh (32766), the measurement is in over-range condition.
(**) If the value is equal to 7FFDh (32765), the measurement is in under-range condition.

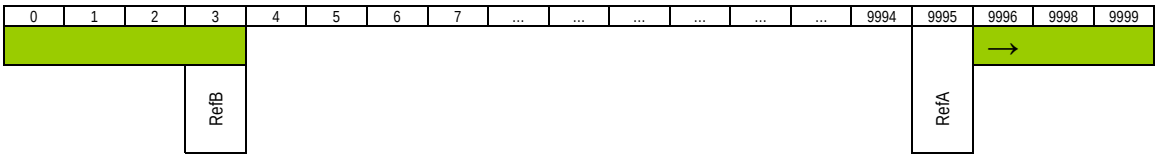
2.6 Table of “Data event” file

The “Data event” (also known as “DE”) is a file with 10000 records (from index 0000 to 9999). The record is organised in 11 rds as illustrated in table 2.6.2. The “data event” file is readable whith Modbus function code 14h using file number 1.
The “data event” has a FIFO management system and uses two reference record numbers to identify the first record available (RefA) and the last record stored (RefB). If RefB > RefA, the records valid are from RefA+1 to RefB, if RefA > RefB, the records valid are from RefA+1 to 9999 and from 0 to RefB.

RefB > RefA



Ref B < RefA



To read the “data event” file it is necessary to execute the following actions:

4) Read the reference of the first record available (RefA) and the reference of the last record stored (RefB) using Modbus function code 04h or 03h.
5) Read the valid records using Modbus function code 14h and sub-function code 06h. The identification file number for the data base is 1.
6) When all records are read, write the reference number RefA with the value of RefB (Modbus function code 06h). This action executes an equivalent reset function.

Table 2.6-1 “Data event” file: reference record numbers

Modicon address	HEX Physical address	Description	Data Format	Notes
	02E2h	“Data event” file: First record available (RefA)	INT16	0 ... 9999 (it is possible the write and read mode access)
	02E3h	“Data event” file: Last record stored (RefB)	INT16	0 ... 9999 (it is possible only the read mode access)

Table 2.6-2 “Data event” file: record organisation

HEX Physical address	Description	Data Format	Notes
Base+0h	Record index	INT16	0 ... 9999
Base+1h	Date: Year and Month	INT16	Lsb=Month (1...12); MSB=Year (08...50)
Base+2h	Date: Day and Hour	INT16	Lsb=Hour (0 ... 23); MSB=Day (01 ... 31)
Base+3h	Date: Minute and Second	INT16	Lsb=Second (0 ... 59); Msb=Minute (0 ...59)
From Base+004h to Base+00Fh	Record fields	7 word	See “ Data event record field”, table 2.7-3

Table 2.6-3 – “Data event” file: organisation of the record field vs. event type

Event Type	Description	Address	Length (words)	Data Format	Notes
0=Alarm	Type of event	Base+4h	1	UINT16	See “Event type” on this table
	Module sub-address code	Base+5h	1	UINT16	0 ...15
	Type of variable	Base+6h	1	UINT16	See Table “Variable code”, table 2.7-4
	Variable value	Base+7h	1	INT16	Depend by the type of variable
	Set point 1 value	Base+8h	1	INT16	Depend by the type of variable
	Set point 2 value	Base+9h	1	INT16	Depend by the type of variable
	Alarm link code	Base+Ah	1	UINT16	See “Alarm link codes” Table 2.5-5
1=Digital input	Type of event	Base+4h	1	UINT16	See “Event type” on this table
	Module sub-address code	Base+5h	1	UINT16	0 ...15
	Number of channel input	Base+6h	1	UINT16	0=channel 1; 1=Channel 2
	New status	Base+7h	1	UINT16	1(OFF)=open, 0(ON)=close

… Table 2.6-3

2=Digital output	Type of event	Base+4h	1	UINT16	See “Event type” on this table”
	Module sub-address code	Base+5h	1	UINT16	0 …15
	Number of channel output	Base+6h	1	UINT16	0=channel 1; 1=Channel 2
	Type of output	Base+7h		UINT16	0=Remote; 1=Alarm; 2=Clock
	New status	Base+8h	1	UINT16	0(OFF)=deactivate, 1(ON) =activate
3=Command	Type of event	Base+4h	1	UINT16	See “Event type” on this table”
	Module sub-address code	Base+5h	1	UINT16	0 …15
	Type of command	Base+6h	1	UINT16	The value is the “physical address” of the command frame
4=Error	Type of event	Base+4h	1	UINT16	See “Event type” on this table”
	Module sub-address code	Base+5h	1	UINT16	0 …15
	Type of error	Base+6h	1	UINT16	See “Error type” on Table 2.7-5
	New status	Base+7h	1	UINT16	0=activate; 1=deactivate

Table 2.6-4 “Data event” file: variable code

Word value	Link
0	VMU-M Temperature ch. 1
1	VMU-M Temperature ch. 2
2	VMU-M BOS efficiency
3	VMU-S Voltage
4	VMU-S Current
5	VMU-S Power
6	VMU-S String efficiency
7	VMU-P Temperature ch. 1
8	VMU-P Temperature ch. 2
9	VMU-P solar irradiation
10	VMU-P wind speed

Table 2.6-5 “Data event” file: error type

Word value	Link
0	Local bus in not ok
1	Module configuration is changed
2	Programming parameters are incoherent
3	Solar string is not connected
4	Negative current or voltage string
5	High temperature inside module
6	Short circuit on probe channel 1
7	Open circuit on probe channel 1
8	Short circuit on probe channel 2
9	Open circuit on probe channel 2
10	Local access to programming mode
11	Power off
12	Power on
13	There are 2 o more module VMU-P connected
14	Module M parameters was stored
15	One of Module’s Parameters was stored

2.7 Table of commands

Table 2.7-1 - write only mode

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
	3000h	1	Reset error "module configuration changed"	UINT 16	Value=1: command is executed; other values: no effect
	3001h	1	Reset AC energy value	UINT 16	Value=1: command is executed; other values: no effect
	3002h	1	Reset DC energy value on all VMU-S	UINT 16	Value=1: command is executed; other values: no effect
	3003h	1	Reset DC energy value on module 1	UINT 16	Value=1: command is executed; other values: no effect
	3004h	1	Reset DC energy value on module 2	UINT 16	Value=1: command is executed; other values: no effect
	3005h	1	Reset DC energy value on module 3	UINT 16	Value=1: command is executed; other values: no effect
	3006h	1	Reset DC energy value on module 4	UINT 16	Value=1: command is executed; other values: no effect
	3007h	1	Reset DC energy value on module 5	UINT 16	Value=1: command is executed; other values: no effect
	3008h	1	Reset DC energy value on module 6	UINT 16	Value=1: command is executed; other values: no effect
	3009h	1	Reset DC energy value on module 7	UINT 16	Value=1: command is executed; other values: no effect
	300Ah	1	Reset DC energy value on module 8	UINT 16	Value=1: command is executed; other values: no effect
	300Bh	1	Reset DC energy value on module 9	UINT 16	Value=1: command is executed; other values: no effect
	300Ch	1	Reset DC energy value on module 10	UINT 16	Value=1: command is executed; other values: no effect
	300Dh	1	Reset DC energy value on module 11	UINT 16	Value=1: command is executed; other values: no effect
	300Eh	1	Reset DC energy value on module 12	UINT 16	Value=1: command is executed; other values: no effect
	300Fh	1	Reset DC energy value on module 13	UINT 16	Value=1: command is executed; other values: no effect
	3010h	1	Reset DC energy value on module 14	UINT 16	Value=1: command is executed; other values: no effect
	3011h	1	Reset DC energy value on module 15	UINT 16	Value=1: command is executed; other values: no effect
	3050h	1	Update clock values	UINT 16	Value=1: command is executed; other values: no effect
	3051h	1	Clock settings updating	UINT 16	Value=1: command is executed; other values: no effect
	3052h	1	(*) Serial communication configuration updating	UINT 16	Value=1: command is executed; other values: no effect
	4000h	1	Reset all Remote outputs	UINT 16	Value=1: command is executed; other values: no effect
	4001h	1	Remote output command on VMU-O with sub-address=1	UINT 16	Bit0: channel 1 (0= Output is open; 1= Output is close) Bit1: channel 2 (0= Output is open; 1= Output is close) Bit2: Command enable for Bit0 Bit3: Command enable for Bit1 Note: If Bit2 is 0, Bit0 is not considered If Bit3 is 0, Bit1 is not considered
	4002h	1	Remote output command on VMU-O with sub-address=2	UINT 16	
	4003h	1	Remote output command on VMU-O with sub-address=3	UINT 16	
	4004h	1	Remote output command on VMU-O with sub-address=4	UINT 16	
	4005h	1	Remote output command on VMU-O with sub-address=5	UINT 16	
	4006h	1	Remote output command on VMU-O with sub-address=6	UINT 16	
	4007h	1	Remote output command on VMU-O with sub-address=7	UINT 16	
	4008h	1	Remote output command on VMU-O with sub-address=8	UINT 16	
	4009h	1	Remote output command on VMU-O with sub-address=9	UINT 16	
	400Ah	1	Remote output command on VMU-O with sub-address=10	UINT 16	
	400Bh	1	Remote output command on VMU-O with sub-address=11	UINT 16	
	400Ch	1	Remote output command on VMU-O with sub-address=12	UINT 16	
	400Dh	1	Remote output command on VMU-O with sub-address=13	UINT 16	
	400Eh	1	Remote output command on VMU-O with sub-address=14	UINT 16	
	400Fh	1	Remote output command on VMU-O with sub-address=15	UINT 16	
	4010h	1	Set all Remote outputs	UINT	Value=1: command is executed; other values: no effect

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(*) Wait at least 6 seconds before communicate with the new parameters

2.8 Table of firmware version and revision

Table 2.8-1 - MODBUS: read only mode with functions code 03 and 04

Module Sub-address	Modicom address	Physical address	Length (words)	Data Format	Notes
0 (VMU-M)	301025	0400h	1	INT16	Byte msb: ASCII code for Version letter Byte lsb : numeric number for Revision If the value is FFFFh the module it is not present.
1	301026	0401h	1	INT16	
2	301027	0402h	1	INT16	
3	301028	0403h	1	INT16	
4	301029	0404h	1	INT16	
5	301030	0405h	1	INT16	
6	301031	0406h	1	INT16	
7	301032	0407h	1	INT16	
8	301033	0408h	1	INT16	
9	301034	0409h	1	INT16	
10	301035	040Ah	1	INT16	
11	301036	040Bh	1	INT16	
12	301037	040Ch	1	INT16	
13	301038	040Dh	1	INT16	
14	301039	040Eh	1	INT16	
15	301040	040Fh	1	INT16	

2.9 Table of Carlo Gavazzi Controls identification code

Table 2.9-1 – Carlo Gavazzi identification code (read only mode)

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
300768	000Bh	1		UINT16	Value=62d (3Eh) VMUM4AS1T2X