VMU-MC

COMMUNICATION PROTOCOL

Version 1 Revision 2

February 15th, 2018

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1.1 Introduction

The RS485 serial interface supports the MODBUS/JBUS (RTU) protocol. In this document only the information necessary to read/write from/to VMU-MC has been reported (not all the parts of the protocol have been implemented).
For a complete description of the MODBUS protocol please refer to the "Modbus_Application_Protocol_V1_1a.pdf" document that is downloadable from the www.modbus.org web site.

1.2 MODBUS functions

These functions are available on VMU-MC:

- Reading of n "Holding Registers" (code 03h)
- Reading of n "Input Register" (code 04h)
- Writing of one "Holding Registers" (code 06h)
- Diagnostic (code 08h with sub-function code 00h)
- Broadcast mode (writing instruction on address 00h)

IMPORTANT:

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

Function 03h (Read Holding Registers)

This function 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. 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 F7h (1 to 247)	
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 F7h (1 to 247)	
Function code	1 byte	03h	
Quantity of requested bytes	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 F7h (1 to 247)	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 (see note)	
CRC	2 bytes		

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.
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 F7h (1 to 247)	
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 F7h (1 to 247)	
Function code	1 byte	04h	
Quantity of requested bytes	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 F7h (1 to 247)	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		

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 content.
The correct response is an echo of the request, returned after the register content has been written.

Request frame

Description	Length	Value	Note
Physical address	1 byte	1 to F7h (1 to 247)	
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 F7h (1 to 247)	
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 (incorrect action)

Description	Length	Value	Note
Physical address	1 byte	1 to F7h (1 to 247)	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		

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		

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

MODBUS function 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 in a server.
VMU-MC 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 F7h (1 to 247)	
Function code	1 byte	08h	
Sub-function	2 bytes	0000h	
Data (**N** word)	**N** *2 bytes	Data	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (correct action)

Description	Length	Value	Note
Physical address	1 byte	1 to F7 (1 to 247)	
Function code	1 byte	08h	
Sub-function	2 bytes	0000h	

Data (**N** word)	**N** *2 bytes	Data	Byte order: MSB, LSB
CRC	2 bytes		

Response frame (incorrect action)

Description	Length	Value	Note
Physical address	1 byte	1 to F7h (1 to 247)	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		

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 using address 00h.

1.3 Application notes

RS485 general considerations

1. To avoid errors due to the signal reflections or line coupling, it is necessary to terminate the bus at the beginning and at the end (inserting a 120 ohm 1/2W 5% resistor between line B and A in the last instrument and in the Host interface or by using the accessory terminal block provided with the product).
2. The network termination is necessary even in case of point-to-point connection and/or of short distances.
3. For connections longer than 1000m or if in the network there are more than 160 instruments (with 1/5 unit load as used in VMU-MC interface), a signal repeater is necessary.
4. For bus connection it is suggested to use an AWG24 balanced pair cable and to add a third wire for GND connection. Connect GND to the shield if a shielded cable is used.
5. The GND is to be connected to ground only at the host side.
6. 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 is to be considered as not connected, faulty or reached with a wrong address. The same consideration is valid in case of CRC errors or incomplete response frames.

MODBUS timing

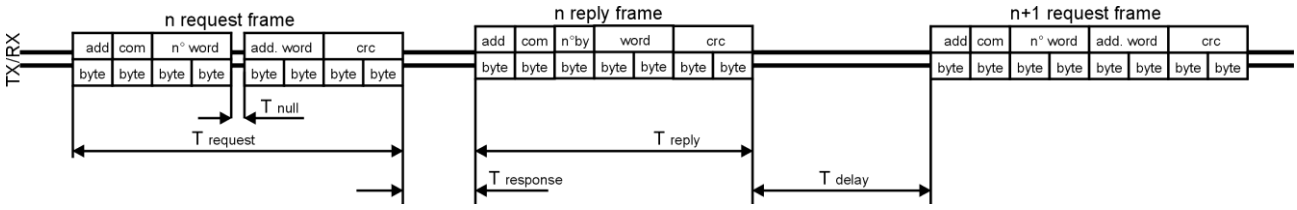

Fig. 1 : 2-wire timing diagram

Timing characteristics of reading function:	msec
T response: Max answering time	500ms
T response: Typical answering time	40ms
T delay: Minimum time before a new query	3.5char
T null: Max interruption time during the request frame	2.5char

2 TABLES

2.1 Data format representation In Carlo Gavazzi instruments

The variables are represented by integers or floating numbers, with 2's complement notation in case of "signed" format, using the following:

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}
UINT32	UDINT	Unsigned double int	32	0 .. $2^{32}-1$
UINT64	ULINT	Unsigned long integer	64	0 .. $2^{64}-1$
IEEE754 SP		Single-precision floating-point	32	$-(1+[1-2^{-23}])x2^{127}$ .. 2^{128}

For all the formats the byte order (inside the single word) is MSB->LSB. In INT32, UINT32 and UINT64 formats, the word order is LSW-> MSW.

2.2 Totalizers

The totalizers values are given as unsigned integer without the decimal point; to obtain the correct value the number has to be divided by the relevant factor.
Each totalizer can be overwritten after the operation has been enabled with the appropriate command (see 2.10).

MODBUS: read and write mode with functions code 0x03, 0x04, 0x06, 0x10 Table 2.2-1

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
300001	0000h	2	VMU-MC: Cnt_tot_In1	UINT32	Totalizers: total Decimal point position: See Table 2.9-1
300003	0002h	2	VMU-MC: Cnt_tot_In2	UINT32	
300005	0004h	2	VMU-OC, pos. 1: Cnt_tot_In1	UINT32	
300007	0006h	2	VMU-OC, pos. 1: Cnt_tot_In2	UINT32	
300009	0008h	2	VMU-OC, pos. 1: Cnt_tot_In3	UINT32	
300011	000Ah	2	VMU-OC, pos. 2: Cnt_tot_In1	UINT32	
300013	000Ch	2	VMU-OC, pos. 2: Cnt_tot_In2	UINT32	
300015	000Eh	2	VMU-OC, pos. 2: Cnt_tot_In3	UINT32	
300017	0010h	2	VMU-OC, pos. 3: Cnt_tot_In1	UINT32	
300019	0012h	2	VMU-OC, pos. 3: Cnt_tot_In2	UINT32	
300021	0014h	2	VMU-OC, pos. 3: Cnt_tot_In3	UINT32	
300023	0016h	2	VMU-MC: Cnt_T1_In1	UINT32	Totalizers: tariff (T1, T2, T3, T4) Decimal point position: See Table 2.9-1
300025	0018h	2	VMU-MC: Cnt_T2_In1	UINT32	
300027	001Ah	2	VMU-MC: Cnt_T3_In1	UINT32	
300029	001Ch	2	VMU-MC: Cnt_T4_In1	UINT32	
300031	001Eh	2	VMU-MC: Cnt_T1_In2	UINT32	
300033	0020h	2	VMU-MC: Cnt_T2_In2	UINT32	
300035	0022h	2	VMU-MC: Cnt_T3_In2	UINT32	
300037	0024h	2	VMU-MC: Cnt_T4_In2	UINT32	
300039	0026h	2	VMU-OC, pos. 1: Cnt_T1_In1	UINT32	
300041	0028h	2	VMU-OC, pos. 1: Cnt_T2_In1	UINT32	
300043	002Ah	2	VMU-OC, pos. 1: Cnt_T3_In1	UINT32	
300045	002Ch	2	VMU-OC, pos. 1: Cnt_T4_In1	UINT32	
300047	002Eh	2	VMU-OC, pos. 1: Cnt_T1_In2	UINT32	
300049	0030h	2	VMU-OC, pos. 1: Cnt_T2_In2	UINT32	
300051	0032h	2	VMU-OC, pos. 1: Cnt_T3_In2	UINT32	
300053	0034h	2	VMU-OC, pos. 1: Cnt_T4_In2	UINT32	
300055	0036h	2	VMU-OC, pos. 1: Cnt_T1_In3	UINT32	
300057	0038h	2	VMU-OC, pos. 1: Cnt_T2_In3	UINT32	
300059	003Ah	2	VMU-OC, pos. 1: Cnt_T3_In3	UINT32	
300061	003Ch	2	VMU-OC, pos. 1: Cnt_T4_In3	UINT32	
300063	003Eh	2	VMU-OC, pos. 2: Cnt_T1_In1	UINT32	
300065	0040h	2	VMU-OC, pos. 2: Cnt_T2_In1	UINT32	
300067	0042h	2	VMU-OC, pos. 2: Cnt_T3_In1	UINT32	
300069	0044h	2	VMU-OC, pos. 2: Cnt_T4_In1	UINT32	
300071	0046h	2	VMU-OC, pos. 2: Cnt_T1_In2	UINT32	
300073	0048h	2	VMU-OC, pos. 2: Cnt_T2_In2	UINT32	
300075	004Ah	2	VMU-OC, pos. 2: Cnt_T3_In2	UINT32	
300077	004Ch	2	VMU-OC, pos. 2: Cnt_T4_In2	UINT32	
300079	004Eh	2	VMU-OC, pos. 2: Cnt_T1_In3	UINT32	
300081	0050h	2	VMU-OC, pos. 2: Cnt_T2_In3	UINT32	
300083	0052h	2	VMU-OC, pos. 2: Cnt_T3_In3	UINT32	
300085	0054h	2	VMU-OC, pos. 2: Cnt_T4_In3	UINT32	
300087	0056h	2	VMU-OC, pos. 3: Cnt_T1_In1	UINT32	
300089	0058h	2	VMU-OC, pos. 3: Cnt_T2_In1	UINT32	
300091	005Ah	2	VMU-OC, pos. 3: Cnt_T3_In1	UINT32	
300093	005Ch	2	VMU-OC, pos. 3: Cnt_T4_In1	UINT32	
300095	005Eh	2	VMU-OC, pos. 3: Cnt_T1_In2	UINT32	
300097	0060h	2	VMU-OC, pos. 3: Cnt_T2_In2	UINT32	
300087	0062h	2	VMU-OC, pos. 3: Cnt_T3_In2	UINT32	
300089	0064h	2	VMU-OC, pos. 3: Cnt_T4_In2	UINT32	
300091	0066h	2	VMU-OC, pos. 3: Cnt_T1_In3	UINT32	
300093	0068h	2	VMU-OC, pos. 3: Cnt_T2_In3	UINT32	
300095	006Ah	2	VMU-OC, pos. 3: Cnt_T3_In3	UINT32	
300097	006Ch	2	VMU-OC, pos. 3: Cnt_T4_In3	UINT32	

2.3 Input status / Active tariff / System status

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

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
300257	0100h	1	Digital input status	UINT16	Bit 0: VMU-MC, In1 Bit 1: VMU-MC, In2 Bit 2: VMU-OC pos. 1, In1 Bit 3: VMU-OC pos. 1, In2 Bit 4: VMU-OC pos. 1, In3 Bit 5: VMU-OC pos. 2, In1 Bit 6: VMU-OC pos. 2, In2 Bit 7: VMU-OC pos. 2, In3 Bit 8: VMU-OC pos. 3, In1 Bit 9: VMU-OC pos. 3, In2 Bit 10: VMU-OC pos. 3, In3 Bit 11 – Bit 15: unused 0 = input not active 1 = input active (see also input HW configuration)
300258	0101h	1	Overrun status Input, VMU-MC, In1	UINT16	The bit sequence indicates the overrun read condition of the last 16 input changes (bit15 the furthest): Bit = 0: no overrun Bit = 1: overrun Bit overrun detect when polling frequency protocol from PC is too low if compared with the input status change frequency. Bit overrun is set when the input status is change and PC has not been updated with information of the change.
300259	0102h	1	Overrun status Input, VMU-MC, In2	UINT16	
300260	0103h	1	Overrun status Input, VMU-OC pos. 1, In1	UINT16	
300261	0104h	1	Overrun status Input, VMU-OC pos. 1, In2	UINT16	
300262	0105h	1	Overrun status Input, VMU-OC pos. 1, In3	UINT16	
300263	0106h	1	Overrun status Input, VMU-OC pos. 2, In1	UINT16	
300264	0107h	1	Overrun status Input, VMU-OC pos. 2, In2	UINT16	
300265	0108h	1	Overrun status Input, VMU-OC pos. 2, In3	UINT16	
300266	0109h	1	Overrun status Input, VMU-OC pos. 3, In1	UINT16	
300267	010Ah	1	Overrun status Input, VMU-OC pos. 3, In2	UINT16	
300268	010Bh	1	Overrun status Input, VMU-OC pos. 3, In3	UINT16	
300269	010Ch	1	Active tariff	UINT16	0 = T1 1 = T2 2 = T3 3 = T4 FFFF = No tariff If no inputs is configured as tariff, and no tariff selected via serial, the value is 0xFFFF.
300270	010Dh	1	System status	UINT16	Bit 0: 0 Bit 1: VMU-OC pos. 1 Bit 2: VMU-OC pos. 2 Bit 3: VMU-OC pos. 3 Bit 4 – 15: 0 (unused) Bit = 1: module error (configured but not detected or detected but not configured) Bit = 0: module ok (configured and detected or not configured and not detected).

2.4 Firmware version and revision code

MODBUS: read only mode with functions code 03 and 04 Table 2.4-1

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
300771	0300h	1	Version code VMU-MC	UINT 16	Value= 65: Version "A" (ASCI table) Value=66: Version "B" ... First standard release is "A"(value = 65)
300772	0301h	1	Revision code VMU-MC	UINT 16	Value=0: Revision 0 Value=1: Revision 1 ... First standard release is 0 (value = 0)
300773	0302h	1	Version code Module pos 1	UINT 16	Value= 65: Version "A" (ASCI table) Value=66: Version "B" ... First standard release is "A"(value = 65)
300774	0303h	1	Revision code Module pos 1	UINT 16	Value=0: Revision 0 Value=1: Revision 1 ... First standard release is 0 (value = 0)
300775	0304h	1	Version code Module pos 2	UINT 16	Value= 65: Version "A" (ASCI table) Value=66: Version "B" ... First standard release is "A"(value = 65)
300776	0305h	1	Revision code Module pos 2	UINT 16	Value=0: Revision 0 Value=1: Revision 1 ... First standard release is 0 (value = 0)
300777	0306h	1	Version code Module pos 3	UINT 16	Value= 65: Version "A" (ASCI table) Value=66: Version "B" ... First standard release is "A"(value = 65)
300778	0307h	1	Revision code Module pos 3	UINT 16	Value=0: Revision 0 Value=1: Revision 1 ... First standard release is 0 (value = 0)

2.5 Carlo Gavazzi Controls identification code

MODBUS: read only mode with functions code 03 and 04 limited to a word at a time Table 2.5-1

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
300012	000Bh	1	Carlo Gavazzi Controls identification code	UINT 16	Value = 105 (69h)

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2.6 Password (to locally enter programming menu)

MODBUS: read and write mode Table 2.6-1

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
304097	1000h	1	PASSWORD	UINT 16	Minimum valid value: 0d Maximum valid value: 9999d Default: 0d

2.7 Serial port configuration

MODBUS: read and write mode

Table 2.7-1

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
308193	2000h	1	RS485 instrument address	UINT 16	Value min = 1 Value max = 247 Default: 1
308194	2001h	1	RS485 baud rate	UINT 16	Value 0 = 9.6 kbps (default) Value 1 = 19.2 kbps Value 2 = 38.4 kbps Default: 0 (9.6 kbps)
308195	2002h	1	RS485 parity	UINT 16	Value 0 = no parity (default) Value 1 = even parity Value 2 = odd parity Default: 0 (no parity)
308196	2003h	1	RS485 Stop bit	UINT 16	Value 0 = 1 stop bit (default) Value 1 = 2 stop bit Default: 0 (1 stop bit)

The values are updated after a power on or after a “serial configuration update” command (ref. tab command)

2.8 Modules configuration

MODBUS: read and write mode

Table 2.8-1

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
308449	2100h	1	Working Mode	UINT 16	Bit 0-1: VMU-MC input configuration 0 = In1 and In2 as counter/status AND tariff by serial communication DISABLED 1 = In1 as Tariff, In2 as counter/status 2 = In1 and In2 as Tariff 3 = In1 and In2 as counter/status AND tariff by serial communication ENABLED Bit 2-3: VMU-OC modules connect 0 .. 3 Default: 0000h
308705	2200h	1	Tariff managed via serial communication	UINT 16 located in RAM	From Power ON value is 0xFFFF (no tariff) Valid Values from 0 to 3 (Tariff setting) always writeable valid only if Working Mode Bits 0-1 = 11 VMU-MC configuration = 3 (no input configured as tariff but tariff by serial ENABLED)

2.9 Input configuration

MODBUS: read and write mode

Table 2.9-1

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
312289	3000h	1	Pulse Weight VMU-MC In1	UINT 16	Pulse Weight: 0..65535 Each pulse counted is multiplied by the relevant Pulse Weight and added to the Totalizer (total and tariff) Default = 1
312290	3001h	1	Pulse Weight VMU-MC In2	UINT 16	
312291	3002h	1	Pulse Weight VMU-OC pos.1, In1	UINT 16	
312292	3003h	1	Pulse Weight VMU-OC pos.1, In2	UINT 16	
312293	3004h	1	Pulse Weight VMU-OC pos.1, In3	UINT 16	
312294	3005h	1	Pulse Weight VMU-OC pos.2, In1	UINT 16	

312295	3006h	1	Pulse Weight VMU-OC pos.2, In2	UINT 16	
312296	3007h	1	Pulse Weight VMU-OC pos.2, In3	UINT 16	
312297	3008h	1	Pulse Weight VMU-OC pos.3, In1	UINT 16	
312298	3009h	1	Pulse Weight VMU-OC pos.3, In2	UINT 16	
312299	300Ah	1	Pulse Weight VMU-OC pos.3, In3	UINT 16	
312305	3010h	1	Decimal Point position VMU-MC, In1	UINT 16	Values: 0: no decimals (integer) 1: 0,1 2: 0,01 3: 0,001 … 9: 0,000000001 10 and above: Reserved Default: 0 Note: these values are only for external data interpretation, not internally applied and/or displayed
312306	3011h	1	Decimal Point position VMU-MC, In2	UINT 16	
312307	3012h	1	Decimal Point position VMU-OC, pos. 1, In1	UINT 16	
312308	3013h	1	Decimal Point position VMU-OC, pos. 1, In2	UINT 16	
312309	3014h	1	Decimal Point position VMU-OC, pos. 1, In3	UINT 16	
312310	3015h	1	Decimal Point position VMU-OC, pos. 2, In1	UINT 16	
312311	3016h	1	Decimal Point position VMU-OC, pos. 2, In2	UINT 16	
312312	3017h	1	Decimal Point position VMU-OC, pos. 2, In3	UINT 16	
312313	3018h	1	Decimal Point position VMU-OC, pos. 3, In1	UINT 16	
312314	3019h	1	Decimal Point position VMU-OC, pos. 3, In2	UINT 16	
312315	301Ah	1	Decimal Point position VMU-OC, pos. 3, In3	UINT 16	
312321	3020h	1	Totalizer Base Unit VMU-MC, In1	UINT 16	Values: 0: kWh 1: kVarh 2: kVAh 3: kJ 4: kcal 5: m^3 (cubic meter) 6: Nm^3 (Normal cubic meter) 7: hr (hour counter) 8: pcs (pieces) 9: kg 10 : Reserved … 999: Reserved 1000 and above: Free Default = 0 Note: these units are only for external data interpretation, not internally applied and/or displayed
312322	3021h	1	Totalizer Base Unit VMU-MC, In2	UINT 16	
312323	3022h	1	Totalizer Base Unit VMU-OC, pos. 1, In1	UINT 16	
312324	3023h	1	Totalizer Base Unit VMU-OC, pos. 1, In2	UINT 16	
312325	3024h	1	Totalizer Base Unit VMU-OC, pos. 1, In3	UINT 16	
312326	3025h	1	Totalizer Base Unit VMU-OC, pos. 2, In1	UINT 16	
312327	3026h	1	Totalizer Base Unit VMU-OC, pos. 2, In2	UINT 16	
312328	3027h	1	Totalizer Base Unit VMU-OC, pos. 2, In3	UINT 16	
312329	3028h	1	Totalizer Base Unit VMU-OC, pos. 3, In1	UINT 16	
312330	3029h	1	Totalizer Base Unit VMU-OC, pos. 3, In2	UINT 16	
312331	302Ah	1	Totalizer Base Unit VMU-OC, pos. 3, In3	UINT 16	
312337	3030h	1	Input filter setting VMU-MC	UINT 16	Filtering apply to all the inputs belonging to the specified module. LSB: Ton filter MSB: Toff filter Value: 0: min 1: 10ms 2: 20ms 3: 30ms 4: 40ms 5: 50ms 6: 100ms 7: 200ms 8: 300ms Default: 0303h (30ms/30ms)
312338	3031h	1	Input filter setting VMU-OC, pos. 1	UINT 16	
312339	3032h	1	Input filter setting VMU-OC, pos. 2	UINT 16	
312340	3033h	1	Input filter setting VMU-OC, pos. 3	UINT 16	
312353	3040h	1	Digital input HW logic	UINT16	Bit 0: VMU-MC, In1

					Bit 1: VMU-MC, In2 Bit 2: VMU-OC pos. 1, In1 Bit 3: VMU-OC pos. 1, In2 Bit 4: VMU-OC pos. 1, In3 Bit 5: VMU-OC pos. 2, In1 Bit 6: VMU-OC pos. 2, In2 Bit 7: VMU-OC pos. 2, In3 Bit 8: VMU-OC pos. 3, In1 Bit 9: VMU-OC pos. 3, In2 Bit 10: VMU-OC pos. 3, In3 Bit 11 – Bit 15: unused Bit = 0: logic not inverted Bit = 1: inverted logic Default: 0000h
312369	3050h	1	Totalizers Reset/Overwrite Enable Mask	UINT16	Bit 0: VMU-MC, In1 Bit 1: VMU-MC, In2 Bit 2: VMU-OC pos. 1, In1 totalizers Bit 3: VMU-OC pos. 1, In2 totalizers Bit 4: VMU-OC pos. 1, In3 totalizers Bit 5: VMU-OC pos. 2, In1 totalizers Bit 6: VMU-OC pos. 2, In2 totalizers Bit 7: VMU-OC pos. 2, In3 totalizers Bit 8: VMU-OC pos. 3, In1 totalizers Bit 9: VMU-OC pos. 3, In2 totalizers Bit 10: VMU-OC pos. 3, In3 totalizers Bit 11 – Bit 15: unused Bit = 0: Reset/Overwrite Disabled for the totalizers correspondent to the bit position Bit = 1: Reset/Overwrite Enabled for the totalizers correspondent to the bit position The enable/disable flag is valid for both total and tariff totalizers. Default: 0000h (reset/overwrite commands are disabled for all totalizers)

2.10 Totalizers “Reset” and “Reset/Overwrite Enable” commands

Reset/Overwrite enable commands:
If allowed by the “Totalizers Reset/Overwrite Enable Mask” settings, after writing 1 in the bit corresponding to a totalizer (total or tariff), it can be reset or overwrite within a fixed timeout of 3 s (see 2.2).
The commands are read/write mode.
After the timeout expires or once the totalizer has been reset or written, the command bits are automatically reset (Bit = 0).

Reset commands:
If allowed by the “Totalizers Reset/Overwrite Enable Mask” settings, write 1, within the timeout after the Reset/Overwrite command, in the bit corresponding to a totalizer (total or tariff) cause its immediate reset (totalizer = 0). If the bit is 0, the relevant totalizer is not affected.
The commands are read/write mode.
After the execution of the reset, the command bits are automatically reset (Bit = 0).

MODBUS: read and write mode

Table 2.10-1

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
316385	4000h	1	Reset totalizers - Total	UINT 16	Bit 0: VMU-MC, Cnt_tot_In1 Bit 1: VMU-MC, Cnt_tot_In2 Bit 2: VMU-OC pos.1, Cnt_tot_In1 Bit 3: VMU-OC pos.1, Cnt_tot_In2 Bit 4: VMU-OC pos.1, Cnt_tot_In3 Bit 5: VMU-OC pos.1, Cnt_tot_In4 Bit 6: VMU-OC pos.2, Cnt_tot_In1 Bit 7: VMU-OC pos.2, Cnt_tot_In2 Bit 8: VMU-OC pos.2, Cnt_tot_In3 Bit 9: VMU-OC pos.2, Cnt_tot_In4 Bit 10: VMU-OC pos.3, Cnt_tot_In1 Bit 11: VMU-OC pos.3, Cnt_tot_In2 Bit 12: VMU-OC pos.3, Cnt_tot_In3 Bit 13: VMU-OC pos.3, Cnt_tot_In4 Bit 14 – 15: Not used Bit = 1, reset totalizer command Bit = 0, no reset command Bits automatically reset after command execution
316386	4001h	1	Reset totalizers – Tariff T1	UINT 16	Bit 0: VMU-MC, Cnt_T1_In1 Bit 1: VMU-MC, Cnt_T1_In2 Bit 2: VMU-OC pos.1, Cnt_T1_In1 Bit 3: VMU-OC pos.1, Cnt_T1_In2 Bit 4: VMU-OC pos.1, Cnt_T1_In3 Bit 5: VMU-OC pos.1, Cnt_T1_In4 Bit 6: VMU-OC pos.2, Cnt_T1_In1 Bit 7: VMU-OC pos.2, Cnt_T1_In2 Bit 8: VMU-OC pos.2, Cnt_T1_In3 Bit 9: VMU-OC pos.2, Cnt_T1_In4 Bit 10: VMU-OC pos.3, Cnt_T1_In1 Bit 11: VMU-OC pos.3, Cnt_T1_In2 Bit 12: VMU-OC pos.3, Cnt_T1_In3 Bit 13: VMU-OC pos.3, Cnt_T1_In4 Bit 14 – 15: Not used Bit = 1 reset totalizer command Bit = 0, no reset command Bits automatically reset after command execution
316387	4002h	1	Reset totalizers – Tariff T2	UINT 16	Bit 0: VMU-MC, Cnt_T2_In1 Bit 1: VMU-MC, Cnt_T2_In2 Bit 2: VMU-OC pos.1, Cnt_T2_In1 Bit 3: VMU-OC pos.1, Cnt_T2_In2 Bit 4: VMU-OC pos.1, Cnt_T2_In3 Bit 5: VMU-OC pos.1, Cnt_T2_In4 Bit 6: VMU-OC pos.2, Cnt_T2_In1 Bit 7: VMU-OC pos.2, Cnt_T2_In2 Bit 8: VMU-OC pos.2, Cnt_T2_In3 Bit 9: VMU-OC pos.2, Cnt_T2_In4 Bit 10: VMU-OC pos.3, Cnt_T2_In1 Bit 11: VMU-OC pos.3, Cnt_T2_In2 Bit 12: VMU-OC pos.3, Cnt_T2_In3 Bit 13: VMU-OC pos.3, Cnt_T2_In4 Bit 14 – 15: Not used Bit = 1 reset totalizer command Bit = 0, no reset command Bits automatically reset after command execution

316388	4003h	1	Reset totalizers – Tariff T3	UINT 16	Bit 0: VMU-MC, Cnt_T3_In1 Bit 1: VMU-MC, Cnt_T3_In2 Bit 2: VMU-OC pos.1, Cnt_T3_In1 Bit 3: VMU-OC pos.1, Cnt_T3_In2 Bit 4: VMU-OC pos.1, Cnt_T3_In3 Bit 5: VMU-OC pos.1, Cnt_T3_In4 Bit 6: VMU-OC pos.2, Cnt_T3_In1 Bit 7: VMU-OC pos.2, Cnt_T3_In2 Bit 8: VMU-OC pos.2, Cnt_T3_In3 Bit 9: VMU-OC pos.2, Cnt_T3_In4 Bit 10: VMU-OC pos.3, Cnt_T3_In1 Bit 11: VMU-OC pos.3, Cnt_T3_In2 Bit 12: VMU-OC pos.3, Cnt_T3_In3 Bit 13: VMU-OC pos.3, Cnt_T3_In4 Bit 14 – 15: Not used Bit = 1, reset totalizer command Bit = 0, no reset command Bits automatically reset after command execution
316389	4004h	1	Reset totalizers – Tariff T4	UINT 16	Bit 0: VMU-MC, Cnt_T4_In1 Bit 1: VMU-MC, Cnt_T4_In1 Bit 2: VMU-OC pos.1, Cnt_T4_In1 Bit 3: VMU-OC pos.1, Cnt_T4_In2 Bit 4: VMU-OC pos.1, Cnt_T4_In3 Bit 5: VMU-OC pos.1, Cnt_T4_In4 Bit 6: VMU-OC pos.2, Cnt_T4_In1 Bit 7: VMU-OC pos.2, Cnt_T4_In2 Bit 8: VMU-OC pos.2, Cnt_T4_In3 Bit 9: VMU-OC pos.2, Cnt_T4_In4 Bit 10: VMU-OC pos.3, Cnt_T4_In1 Bit 11: VMU-OC pos.3, Cnt_T4_In2 Bit 12: VMU-OC pos.3, Cnt_T4_In3 Bit 13: VMU-OC pos.3, Cnt_T4_In4 Bit 14 – 15: Not used Bit = 1, reset totalizer command Bit = 0, no reset command Bits automatically reset after command execution

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
316390	4100h	1	Reset/Overwrite totalizers enable – Total	UINT 16	Bit 0: VMU-MC, Cnt_tot_In1 Bit 1: VMU-MC, Cnt_tot_In2 Bit 2: VMU-OC pos.1, Cnt_tot_In1 Bit 3: VMU-OC pos.1, Cnt_tot_In2 Bit 4: VMU-OC pos.1, Cnt_tot_In3 Bit 5: VMU-OC pos.1, Cnt_tot_In4 Bit 6: VMU-OC pos.2, Cnt_tot_In1 Bit 7: VMU-OC pos.2, Cnt_tot_In2 Bit 8: VMU-OC pos.2, Cnt_tot_In3 Bit 9: VMU-OC pos.2, Cnt_tot_In4 Bit 10: VMU-OC pos.3, Cnt_tot_In1 Bit 11: VMU-OC pos.3, Cnt_tot_In2 Bit 12: VMU-OC pos.3, Cnt_tot_In3 Bit 13: VMU-OC pos.3, Cnt_tot_In4 Bit 14 – 15: Not used Bit = 1, enable reset/overwrite Bit = 0, reset/overwrite disabled Bits automatically reset after timeout expires (3 s)

316391	4101h	1	Reset/Overwrite totalizers enable – Tariff T1	UINT 16	Bit 0: VMU-MC, Cnt_T1_In1 Bit 1: VMU-MC, Cnt_T1_In2 Bit 2: VMU-OC pos.1, Cnt_T1_In1 Bit 3: VMU-OC pos.1, Cnt_T1_In2 Bit 4: VMU-OC pos.1, Cnt_T1_In3 Bit 5: VMU-OC pos.1, Cnt_T1_In4 Bit 6: VMU-OC pos.2, Cnt_T1_In1 Bit 7: VMU-OC pos.2, Cnt_T1_In2 Bit 8: VMU-OC pos.2, Cnt_T1_In3 Bit 9: VMU-OC pos.2, Cnt_T1_In4 Bit 10: VMU-OC pos.3, Cnt_T1_In1 Bit 11: VMU-OC pos.3, Cnt_T1_In2 Bit 12: VMU-OC pos.3, Cnt_T1_In3 Bit 13: VMU-OC pos.3, Cnt_T1_In4 Bit 14 – 15: Not used Bit = 1, enable reset/overwrite Bit = 0, reset/overwrite disabled Bits automatically reset after timeout expires (3 s)
316392	4102h	1	Reset/Overwrite totalizers enable – Tariff T2	UINT 16	Bit 0: VMU-MC, Cnt_T2_In1 Bit 1: VMU-MC, Cnt_T2_In2 Bit 2: VMU-OC pos.1, Cnt_T2_In1 Bit 3: VMU-OC pos.1, Cnt_T2_In2 Bit 4: VMU-OC pos.1, Cnt_T2_In3 Bit 5: VMU-OC pos.1, Cnt_T2_In4 Bit 6: VMU-OC pos.2, Cnt_T2_In1 Bit 7: VMU-OC pos.2, Cnt_T2_In2 Bit 8: VMU-OC pos.2, Cnt_T2_In3 Bit 9: VMU-OC pos.2, Cnt_T2_In4 Bit 10: VMU-OC pos.3, Cnt_T2_In1 Bit 11: VMU-OC pos.3, Cnt_T2_In2 Bit 12: VMU-OC pos.3, Cnt_T2_In3 Bit 13: VMU-OC pos.3, Cnt_T2_In4 Bit 14 – 15: Not used Bit = 1, enable reset/overwrite Bit = 0, reset/overwrite disabled Bits automatically reset after timeout expires (3 s)
316393	4103h	1	Reset/Overwrite totalizers enable – Tariff T3	UINT 16	Bit 0: VMU-MC, Cnt_T3_In1 Bit 1: VMU-MC, Cnt_T3_In2 Bit 2: VMU-OC pos.1, Cnt_T3_In1 Bit 3: VMU-OC pos.1, Cnt_T3_In2 Bit 4: VMU-OC pos.1, Cnt_T3_In3 Bit 5: VMU-OC pos.1, Cnt_T3_In4 Bit 6: VMU-OC pos.2, Cnt_T3_In1 Bit 7: VMU-OC pos.2, Cnt_T3_In2 Bit 8: VMU-OC pos.2, Cnt_T3_In3 Bit 9: VMU-OC pos.2, Cnt_T3_In4 Bit 10: VMU-OC pos.3, Cnt_T3_In1 Bit 11: VMU-OC pos.3, Cnt_T3_In2 Bit 12: VMU-OC pos.3, Cnt_T3_In3 Bit 13: VMU-OC pos.3, Cnt_T3_In4 Bit 14 – 15: Not used Bit = 1, enable reset/overwrite Bit = 0, reset/overwrite disabled Bits automatically reset after timeout expires (3 s)

316394	4104h	1	Reset/Overwrite totalizers enable – Tariff T4	UINT 16	Bit 0: VMU-MC, Cnt_T4_In1 Bit 1: VMU-MC, Cnt_T4_In2 Bit 2: VMU-OC pos.1, Cnt_T4_In1 Bit 3: VMU-OC pos.1, Cnt_T4_In2 Bit 4: VMU-OC pos.1, Cnt_T4_In3 Bit 5: VMU-OC pos.1, Cnt_T4_In4 Bit 6: VMU-OC pos.2, Cnt_T4_In1 Bit 7: VMU-OC pos.2, Cnt_T4_In2 Bit 8: VMU-OC pos.2, Cnt_T4_In3 Bit 9: VMU-OC pos.2, Cnt_T4_In4 Bit 10: VMU-OC pos.3, Cnt_T4_In1 Bit 11: VMU-OC pos.3, Cnt_T4_In2 Bit 12: VMU-OC pos.3, Cnt_T4_In3 Bit 13: VMU-OC pos.3, Cnt_T4_In4 Bit 14 – 15: Not used Bit = 1, enable reset/overwrite Bit = 0, reset/overwrite disabled Bits automatically reset after timeout expires (3 s)

2.11 "Serial configuration update" command

MODBUS: read and write mode

Table 2.11-1

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
317665	4500h	1	Update serial configuration	UINT 16	Bit 0: write 1 to update serial configuration Bit 1 – 15: Not used Bits automatically reset after command execution

2.12 Serial number and production year

MODBUS: read only mode

Table 2.12-1

Modicon address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes
320481	5000h	1	Letter 1 (from SX) Letter 2 (from SX)	UINT 16	MSB: ASCII code LSB: ASCII code
320482	5001h	1	Letter 3 (from SX) Letter 4 (from SX)	UINT 16	MSB: ASCII code LSB: ASCII code
320483	5002h	1	Letter 5 (from SX) Letter 6 (from SX)	UINT 16	MSB: ASCII code LSB: ASCII code
320484	5003h	1	Letter 7 (from SX) Letter 8 (from SX)	UINT 16	MSB: ASCII code LSB: ASCII code
320485	5004h	1	Letter 9 (from SX) Letter 10 (from SX)	UINT 16	MSB: ASCII code LSB: ASCII code
320486	5005h	1	Letter 11 (from SX) Letter 12 (from SX)	UINT 16	MSB: ASCII code LSB: ASCII code
320487	5006h	1	Letter 13 (from SX)	UINT 16	MSB: ASCII code LSB: Not Used
320488	5007h	1	Instrument production year	UINT 16	Value = year (e.g. 2016)

3 Revisions

Ver 1, rev 1 (2017-10-30): Corrected totalizers table because there was a gap of addresses between VMU-MC: Cnt_T4_In1 and VMU-MC: Cnt_T1_In2
Ver 1, rev 2 (2018-02-15): Corrected some labels.