EM270 X & W, EM280

COMMUNICATION PROTOCOL

Version 5 Revision 1

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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 EM270 or EM280 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 EM270 and on EM280:

- 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) "**Modicom 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 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 EM270 or EM280 instruction manual)
4) The Modbus electrical values must be considered valid only if the corresponding variables are present on the display of the meter too (as consequence of the set configuration).

1.2.1 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. It is possible to read maximum 18 registers (words) with a single request, when not differently specified.
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 10h (1 to 11)	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		

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 18 register (word) with a single request, when not differently specified.
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 10h (1 to 11)	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		

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 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		

1.2.4 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.
EM270 and EM280 support 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		

1.2.5 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

1.3.1 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 (master side, if not already embedded, by inserting a 120 ohm 1/2W 5% resistor between line B and A) and at the end (by connecting the terminals B+ and T in the last instrument).
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 EM270 or EM280 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.

1.3.2 MODBUS timing

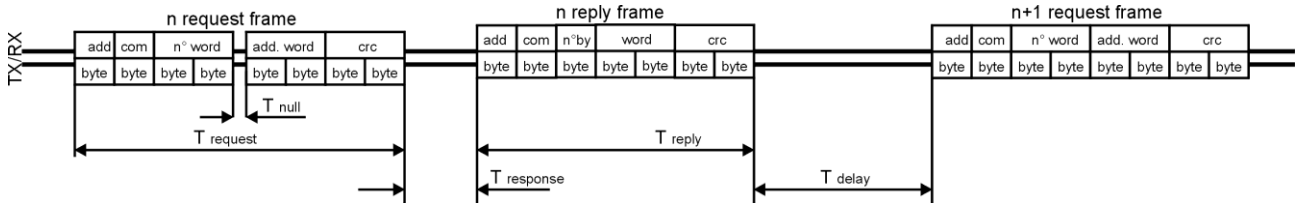


Fig. 1 : 2-wire timing diagram

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

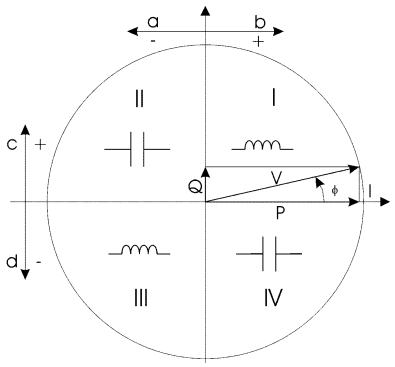
The variables are represented by integers or floating numbers, with 2's complement notation in case of "signed" format, using the following:

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.

2.1.1 Geometric representation

According to the signs of the power factor, the active power P and the reactive power Q, it is possible to obtain a geometric representation of the power vector, as indicated in the drawing below, according to EN 60253-23:



a = Exported active power
b = Imported active power
c = Imported reactive power
d = Exported reactive power

Fig. 2 : Geometric Representation

Modbus representation: negative values correspond to exported active power, positive values correspond to imported active power

2.2 Maximum and minimum electrical values in EM270 and in EM280

The maximum electrical input values are reported in the following table. If the input is above the maximum value the display shows "EEE".

EM270 MV5 MODELS Table 2.1-1

	65A*		160A		250A		630A	
	Min value	**Max value**	**Min value**	**Max value**	**Min value**	**Max value**	**Min value**	**Max value**
VL-N	40VAC	276VAC	40VAC	276VAC	40VAC	276VAC	40VAC	276VAC
A	0A	78A	0A	200A	0A	300A	0A	800A

EM270 MV6 MODELS

	65A*		160A		250A		630A	
	Min value	**Max value**	**Min value**	**Max value**	**Min value**	**Max value**	**Min value**	**Max value**
VL-N	40VAC	160VAC	40VAC	160VAC	40VAC	160VAC	40VAC	160VAC
A	0A	78A	0A	200A	0A	300A	0A	800A

EM280 MV5 MODELS

	TCD06Bx		TCD06Sx	
	Min value	**Max value**	**Min value**	**Max value**
VL-N	40VAC	276VAC	40VAC	276VAC
A	0A	80A	0A	80A

EM280 MV6 MODELS

	TCD06Bx		TCD06Sx	
	Min value	**Max value**	**Min value**	**Max value**
VL-N	40VAC	160VAC	40VAC	160VAC
A	0A	80A	0A	80A

*: available only in EM270 W and in EM270 X with firmware release from r.b4

The overflow indication “EEE“ is displayed when the MSB value of the relevant variable is 7FFFh.
When a variable is not managed by the programmed measuring system, its MSB value is 7FFDh.
When a TCD is missing but the programmed measuring system requires it, the relevant MSB values of variables are 7FFEh. In all these cases, LSB value is FFFFh.

2.3 Instantaneous variables and meters

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

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	SYSTEM						Firmware compatibility		
						3P 1.3P	3P 2.3P	3P 3.1P	3P 6.1P	1P 3.1P	1P 6.1P	EM270 X	EM270 W	EM280
300001	0000h	2	V L1-N (*)	INT32	Volt*10	X	X	X	X	X	X	r.b0	r.C0	r.E0
300003	0002h	2	V L2-N	INT32		X	X	X	X			r.b0	r.C0	r.E0
300005	0004h	2	V L3-N	INT32		X	X	X	X			r.b0	r.C0	r.E0
300007	0006h	2	V L1-L2	INT32		X	X					r.b0	r.C0	r.E0
300009	0008h	2	V L2-L3	INT32		X	X					r.b0	r.C0	r.E0
300011	000Ah	2	V L3-L1	INT32		X	X					r.b0	r.C0	r.E0
300013	000Ch	2	A L1 Σ	INT32	Ampere*1000		S_1	S	S_1			r.b0	r.C0	r.E0
300015	000Eh	2	A L2 Σ	INT32			S_1	S	S_1			r.b0	r.C0	r.E0
300017	0010h	2	A L3 Σ	INT32			S_1	S	S_1			r.b0	r.C0	r.E0
300019	0012h	2	W Σ	INT32	Watt*10		S	S	S	S	S	r.b0	r.C0	r.E0
300021	0014h	2	VA Σ	INT32	VA*10		S	S	S	S	S	r.b0	r.C0	r.E0
300023	0016h	2	VAR Σ	INT32	var*10		S	S	S	S	S	r.b0	r.C0	r.E0
300025	0018h	2	KWh(+)TOT Σ	INT32	kWh*10		S	S	S	S	S	r.b0	r.C0	r.E0
300027	001Ah	2	Kvarh(+)TOT Σ	INT32	kvarh*10		S	S	S	S	S	r.b0	r.C0	r.E0
300029	001Ch	2	W DMD Σ	INT32	Watt*10		S	S	S	S	S	r.b0	r.C0	r.E0
300031	001Eh	2	VA DMD Σ	INT32	VA*10		S	S	S	S	S	r.b0	r.C0	r.E0
300033	0020h	2	W MAXDMD Σ	INT32	Watt*10		S	S	S	S	S	r.b0	r.C0	r.E0
300035	0022h	2	VA MAXDMD Σ	INT32	VA*10		S	S	S	S	S	r.b0	r.C0	r.E0
300037	0024h	2	PF Σ	INT32	PF*1000 Sign: refers to 2.1.1		S	S	S	S	S	r.b4		r.E3
300269	010Ch	2	A L1 TCDA1	INT32	Ampere*1000	X	X	X	X	X	X	r.b0	r.C0	r.E0
300271	010Eh	2	A L2 TCDA1	INT32		X	X	X	X	X	X	r.b0	r.C0	r.E0
300273	0110h	2	A L3 TCDA1	INT32		X	X	X	X	X	X	r.b0	r.C0	r.E0
300275	0112h	2	W L1 TCDA1	INT32	Watt*10			X	X	X	X	r.b0	r.C0	r.E0
300277	0114h	2	W L2 TCDA1	INT32				X	X	X	X	r.b0	r.C0	r.E0
300279	0116h	2	W L3 TCDA1	INT32				X	X	X	X	r.b0	r.C0	r.E0
300281	0118h	2	W TOT TCDA1	INT32	Watt*10	X	X		S		S	r.b0	r.C0	r.E0
300283	011Ah	2	VA TOT TCDA1	INT32	VA*10	X	X					r.b0	r.C0	r.E0
300285	011Ch	2	VAR TOT TCDA1	INT32	var*10	X	X					r.b0	r.C0	r.E0
300287	011Eh	2	KWh(+)TCDA1 TOT	INT32	kWh*10	X	X					r.b0	r.C0	r.E0
300289	0120h	2	Kvarh (+)TCDA1 TOT	INT32	kvarh*10	X	X					r.b0	r.C0	r.E0
300291	0122h	2	W TOT TCDA1 DMD	INT32	Watt*10	X	X					r.b0	r.C0	r.E0
300293	0124h	2	VA TOT TCDA1 DMD	INT32	VA*10	X	X					r.b0	r.C0	r.E0
300295	0126h	2	W TOT TCDA1 MAXDMD	INT32	Watt*10	X	X					r.b0	r.C0	r.E0
300297	0128h	2	VA TOT TCDA1 MAXDMD	INT32	VA*10	X	X					r.b0	r.C0	r.E0

300299	012Ah	2	KWh(+) L1 TCDA1	INT32	kWh*10			X	X	X	X	r.b0	r.C0	r.E0
300301	012Ch	2	KWh(+) L2 TCDA1	INT32				X	X	X	X	r.b0	r.C0	r.E0
300303	012Eh	2	KWh(+) L3 TCDA1	INT32				X	X	X	X	r.b0	r.C0	r.E0
300305	0130h	2	W L1 TCDA1 DMD	INT32	Watt*10			X	X	X	X	r.b0	r.C0	r.E0
300307	0132h	2	W L2 TCDA1 DMD	INT32				X	X	X	X	r.b0	r.C0	r.E0
300309	0134h	2	W L3 TCDA1 DMD	INT32				X	X	X	X	r.b0	r.C0	r.E0
300311	0136h	2	W L1 TCDA1 MAXDMD	INT32				X	X	X	X	r.b0	r.C0	r.E0
300313	0138h	2	W L2 TCDA1 MAXDMD	INT32				X	X	X	X	r.b0	r.C0	r.E0
300315	013Ah	2	W L3 TCDA1 MAXDMD	INT32				X	X	X	X	r.b0	r.C0	r.E0
300317	013Ch	2	VAR L1 TCDA1	INT32	var*10			X	X	X	X	r.b4		r.E3
300319	013Eh	2	VAR L2 TCDA1	INT32				X	X	X	X	r.b4		r.E3
300321	0140h	2	VAR L3 TCDA1	INT32				X	X	X	X	r.b4		r.E3
300323	0142h	2	PF L1 TCDA1	INT32	PF*1000 Sign: refers to 2.1.1			X	X	X	X	r.b4		r.E3
300325	0144h	2	PF L2 TCDA1	INT32				X	X	X	X	r.b4		r.E3
300327	0146h	2	PF L3 TCDA1	INT32				X	X	X	X	r.b4		r.E3
300329	0148h	2	PF TCDA1	INT32		X	X			X	X	r.b4		r.E3
300525	020Ch	2	A L1 TCDA2	INT32	Ampere*1000		X		X		X	r.b0	r.C0	r.E0
300527	020Eh	2	A L2 TCDA2	INT32			X		X		X	r.b0	r.C0	r.E0
300529	0210h	2	A L3 TCDA2	INT32			X		X		X	r.b0	r.C0	r.E0
300531	0212h	2	W L1 TCDA2	INT32	Watt*10				X		X	r.b0	r.C0	r.E0
300533	0214h	2	W L2 TCDA2	INT32					X		X	r.b0	r.C0	r.E0
300535	0216h	2	W L3 TCDA2	INT32					X		X	r.b0	r.C0	r.E0
300537	0218h	2	W TOT TCDA2	INT32	Watt*10		X		S		S	r.b0	r.C0	r.E0
300539	021Ah	2	VA TOT TCDA2	INT32	VA*10		X					r.b0	r.C0	r.E0
300541	021Ch	2	VAR TOT TCDA2	INT32	var*10		X					r.b0	r.C0	r.E0
300543	021Eh	2	KWh(+)TCDA2 TOT	INT32	kWh*10		X					r.b0	r.C0	r.E0
300545	0220h	2	Kvarh (+)TCDA2 TOT	INT32	kvarh*10		X					r.b0	r.C0	r.E0
300547	0222h	2	W TOT TCDA2 DMD	INT32	Watt*10		X					r.b0	r.C0	r.E0
300549	0224h	2	VA TOT TCDA2 DMD	INT32	VA*10		X					r.b0	r.C0	r.E0
300551	0226h	2	W TOT TCDA2 MAXDMD	INT32	Watt*10		X					r.b0	r.C0	r.E0
300553	0228h	2	VA TOT TCDA2 MAXDMD	INT32	VA*10		X					r.b0	r.C0	r.E0
300555	022Ah	2	KWh(+) L1 TCDA2	INT32	kWh*10				X		X	r.b0	r.C0	r.E0
300557	022Ch	2	KWh(+) L2 TCDA2	INT32					X		X	r.b0	r.C0	r.E0
300559	022Eh	2	KWh(+) L3 TCDA2	INT32					X		X	r.b0	r.C0	r.E0
300561	0230h	2	W L1 TCDA2 DMD	INT32	Watt*10				X		X	r.b0	r.C0	r.E0
300563	0232h	2	W L2 TCDA2 DMD	INT32					X		X	r.b0	r.C0	r.E0
300565	0234h	2	W L3 TCDA2 DMD	INT32					X		X	r.b0	r.C0	r.E0
300567	0236h	2	W L1 TCDA2 MAXDMD	INT32					X		X	r.b0	r.C0	r.E0
300569	0238h	2	W L2 TCDA2 MAXDMD	INT32					X		X	r.b0	r.C0	r.E0
300571	023Ah	2	W L3 TCDA2 MAXDMD	INT32					X		X	r.b0	r.C0	r.E0
300573	023Ch	2	VAR L1 TCDA2	INT32	var*10				X		X	r.b4		r.E3
300575	023Eh	2	VAR L2 TCDA2	INT32					X		X	r.b4		r.E3
300577	0240h	2	VAR L3 TCDA2	INT32					X		X	r.b4		r.E3
300579	0242h	2	PF L1 TCDA2	INT32	PF*1000 Sign: refers to 2.1.1				X		X	r.b4		r.E3
300581	0244h	2	PF L2 TCDA2	INT32					X		X	r.b4		r.E3
300583	0246h	2	PF L3 TCDA2	INT32					X		X	r.b4		r.E3
300585	0248h	2	PF TCDA2	INT32			X				X	r.b4		r.E3

(*): this is also the voltage VLN in single-phase system
X: available; S: available only if SUM/Virtual function is on; S_1: available only if SUM/Virtual function is on and TCD phase orders are the same (both “123” or both “321”, see available menu table); Empty: not available.
Note: in EM270 X models, systems “1P/3.1P” and “1P/6.1P” are available only from firmware revision “r.b4”

2.4 Firmware version and revision code

MODBUS: read only mode with functions code 03 and 04 limited to a word at a time Table 2.4

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility		
						EM270 X	EM270 W	EM280
300771	0302h	1	Version code	UINT 16	0= A, 1= B, ...	r.b0	r.C0	r.E0
300772	0303h	1	Revision code	UINT 16		r.b0	r.C0	r.E0

2.5 Program lock status

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

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility		
						EM270 X	EM270 W	EM280
300773	0304h	1	Front selector status	UINT 16	Value=1: keypad locked Value=0: keypad unlocked	r.b0	r.C0	r.E0

2.6 Carlo Gavazzi Controls identification code

MODBUS: read only mode with functions code 03 and 04 limited to a word at a time Table 2.6

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility		
						EM270 X	EM270 W	EM280
300012	000Bh	1	Carlo Gavazzi Controls identification code	UINT 16	Value=270: EM27072DMV53X2SX Value=271: EM27072DMV53XOSX Value=272: EM27072DMV63X2SX Value=273: EM27072DMV63XOSX Value=270: EM27072DMV53X2SW Value=271: EM27072DMV53XOSW Value=272: EM27072DMV63X2SW Value=273: EM27072DMV63XOSW Value=280: EM28072DMV53X2SX Value=281: EM28072DMV53XOSX Value=282: EM28072DMV63X2SX Value=283: EM28072DMV63XOSX	r.b0	r.C0	r.E0

.

2.7 Programming parameter tables

2.7.1 Password configuration menu

MODBUS: read and write mode Table 2.7-1

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility		
						EM270 X	EM270 W	EM280
304097	1000h	1	PASSWORD	UINT 16	Minimum valid value: 0d Maximum valid value: 999d Any other value = 0d	r.b0	r.C0	r.E0

2.7.2 System configuration menu

MODBUS: read and write mode

Table 2.7-2

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility		
						EM270 X	EM270 W	EM280
304099	1002h	1	Measuring system	UINT 16	Value=0: "3P 1.3P" system Value=1: "3P 2.3P" system Value=2: "3P 3.1P" system Value=3: "3P 6.1P" system Any other value = "3P 1.3P" system	r.b0		
					Value=0: "3P 1.3P" system Value=1: "3P 2.3P" system Value=2: "3P 3.1P" system Value=3: "3P 6.1P" system Value=4: "1P 3.1P" system Value=5: "1P 6.1P" system Any other value = "3P 1.3P" system	r.b4	r.C0	r.E0

2.7.3 Current transformer primary value

MODBUS: read only mode

Table 2.7-3

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes		Firmware compatibility		
304100	1003h	1	Current transformer primary value	UINT 16	EM270 X, Y	EM280	EM270 X	EM270 W	EM280
					Value=0:160A Value=1:250A Value=2:630A Value=3:no TCD detected	Value=0: TCD06Bx Value=1: TCD06Sx Value=4: no TCD detected	r.b0		r.E0
					Value=0:160A Value=1:250A Value=2:630A Value=3:65A Value=4:no TCD detected			r.C0	
			Current transformer primary value for TCDA1	UINT 16	Value=0:160A Value=1:250A Value=2:630A Value=3:65A Value=4:no TCD detected		r.b4		
304101	1004h	1	Current transformer primary value for TCDA2	UINT 16			r.b4		

Note: the read value refers to the TCD detected on A1 position in EM280 models.

2.7.4 VT menu

MODBUS: read and write mode in EM270 models, only read mode in EM280 models (value fixed to 10, VT=1.0)

Table 2.7-4

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility		
						EM270 X	EM270 W	EM280
304102	1005h	1	Voltage transformer ratio	UINT 16	Value min = 10 (VT=1.0) Value max = MV5 model, TCD160A: 6200 (VT=620.0) MV5 model, TCD250A: 4100 (VT=410.0) MV5 model, TCD630A: 1500 (VT=150.0) MV6 model, TCD160A: 9990 (VT=999.0) MV6 model, TCD250A: 7200 (VT=720.0) MV6 model, TCD630A: 2700 (VT=270.0) Any other value = 10 (VT=1.0)	r.b0		
					Value min = 10 (VT=1.0) Value max = MV5 model, TCD65A: 9990 (VT=999.0) MV5 model, TCD160A: 6200 (VT=620.0) MV5 model, TCD250A: 4100 (VT=410.0) MV5 model, TCD630A: 1500 (VT=150.0) MV6 model, TCD65A: 9990 (VT=999.0) MV6 model, TCD160A: 9990 (VT=999.0) MV6 model, TCD250A: 7200 (VT=720.0) MV6 model, TCD630A: 2700 (VT=270.0) Any other value = 10 (VT=1.0)		r.C0	
					Value min = 10 (VT=1.0) Value max = See tables below	r.b4		

MV5 model

TCDA1 / TCDA2	TCD65A	TCD160A	TCD250A	TCD630A
TCD65A	9990 (VT = 999.0)	9000 (VT = 900.0)	6600 (VT = 660.0)	2800 (VT = 280.0)
TCD160A	9000 (VT = 900.0)	6200 (VT = 620.0)	5000 (VT = 500.0)	2500 (VT = 250.0)
TCD250A	6600 (VT = 660.0)	5000 (VT = 500.0)	4100 (VT = 410.0)	2200 (VT = 220.0)
TCD630A	2800 (VT = 280.0)	2500 (VT = 250.0)	2200 (VT = 220.0)	1500 (VT = 150.0)

MV6 model

TCDA1 / TCDA2	TCD65A	TCD160A	TCD250A	TCD630A
TCD65A	9990 (VT = 999.0)	9990 (VT = 999.0)	9990 (VT = 999.0)	4900 (VT = 490.0)
TCD160A	9990 (VT = 999.0)	9990 (VT = 999.0)	8600 (VT = 860.0)	4300 (VT = 430.0)
TCD250A	9990 (VT = 999.0)	8600 (VT = 860.0)	7200 (VT = 720.0)	3900 (VT = 390.0)
TCD630A	4900 (VT = 490.0)	4300 (VT = 430.0)	3900 (VT = 390.0)	2700 (VT = 270.0)

If a TCD is missing, it is considered as a TCD65A

2.7.5 "SUM" and "Virtual" menu

MODBUS: read and write mode

Table 2.7-5

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility		
						EM270 X	EM270 W	EM280
304104	1007h	1	Sum mode enabling	UINT 16	Value=0: "SUM" disabled Value=1: "SUM" enabled Any other value = "SUM" enabled	r.b0	r.C0	r.E0
			Virtual meter enabling	UINT 16	Value=0: "Virtual" disabled Value=1: "SUM" enabled Value=2: "DIF" enabled Any other value = "SUM" enabled	r.b4		

Note: in EM270 X from revision r.b4, setting system to "3P 1.3P", parameter "Virtual meter enabling" is automatically forced to "Virtual disabled" (value = 0)

2.7.6 DMD integration time menu

MODBUS: read and write mode

Table 2.7-6

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility		
						EM270 X	EM270 W	EM280
304113	1010h	1	Integration time for DMD power calculation	UINT 16	Minimum valid value: 1d Maximum valid value: 60d Any other value = 15d	r.b0	r.C0	r.E0

2.7.7 Pulse output configuration menu

MODBUS: read and write mode

Table 2.7-7

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility		
						EM270 X	EM270 W	EM280
304115	1012h	1	Ton time	UINT 16	Value 0: 40ms Value 1: 100ms Any other value = 1 (100ms)	r.b0	r.C0	r.E0
304129	1020h	1	KWh per pulse relevant to the OUT1	UINT 16	Min value = 1 (0.01kWh) Max value = 999 (9.99kWh) Any other value = 10 (0.1KWh)	r.b0	r.C0	r.E0
304131	1022h	1	KWh per pulse relevant to the OUT2	UINT 16	Min value = 1 (0.01kWh) Max value = 999 (9.99kWh) Any other value = 10 (0.1KWh)	r.b0	r.C0	r.E0

2.7.8 "EC" menu

MODBUS: read and write mode

Table 2.7-8

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility		
						EM270 X	EM270 W	EM280
304356	1103h	1	Easy connection mode enabling	UINT 16	Value=0: "EC" enabled Value=1: "EC" disabled Any other value = "EC" disabled	r.b0	r.C0	r.E0

2.7.9 TCD phase order menu

MODBUS: read and write mode

Table 2.7-9

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility		
						EM270 X	EM270 W	EM280
304865	1300h	1	TCD A1 phase order	UINT 16	Value=0: "123" mode Value=1: "321" mode Any other value = "123" mode	r.b0	r.C0	
			TCD phase order	UINT 16				r.E0
304867	1302h	1	TCD A2 phase order	UINT 16		r.b0	r.C0	
			*TCD phase order	UINT 16				r.E0

*: in EM280, value in 1302h is only read mode and it is a copy of the value written in 1300h

2.7.10 Serial port configuration menu

MODBUS: read and write mode

Table 2.7-10

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility		
						EM270 X	EM270 W	EM280
308193	2000h	1	RS485 instrument address	UINT 16	Value min = 1 Value max = 247 Any other value = 1	r.b0	r.C0	r.E0
308194	2001h	1	RS485 baud rate	UINT 16	Value 0 = 9.6 kbps Value 1 = 19.2 kbps Value 2 = 38.4 kbps Any other value = 9.6 kbps	r.b0	r.C0	r.E0
308195	2002h	1	RS485 parity	UINT 16	Value 0 = no parity Value 1 = even parity Any other value = no parity	r.b0	r.C0	r.E0

Note: the number of stop bits is fixed to "1"

2.7.11 Reset commands

MODBUS: write only mode

Table 2.7-11

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility		
						EM270 X	EM270 W	EM280
316385	4000h	1	Reset of all partial meters, kWdmd and kWdmdm peak.	UINT 16	Value=1: Command is executed All other values produce no effects	r.b0	r.C0	r.E0
316386	4001h	1	Reset of total energy meters	UINT 16	Value=1: Command is executed All other values produce no effects	r.b0	r.C0	r.E0

2.7.12 Serial number

MODBUS: read only mode

Table 2.7-12

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility		
						EM270 X	EM270 W	EM280
320481	5000h	1	Instrument serial number Letter 1 (from SX) Letter 2 (from SX)	UINT 16	MSB: ASCII code LSB: ASCII code	r.b0	r.C0	r.E0
320482	5001h	1	Letter 3 (from SX) Letter 4 (from SX)	UINT 16	MSB: ASCII code LSB: ASCII code	r.b0	r.C0	r.E0
320483	5002h	1	Letter 5 (from SX) Letter 6 (from SX)	UINT 16	MSB: ASCII code LSB: ASCII code	r.b0	r.C0	r.E0
320484	5003h	1	Letter 7 (from SX) Letter 8 (from SX)	UINT 16	MSB: ASCII code LSB: ASCII code	r.b0	r.C0	r.E0
320485	5004h	1	Letter 9 (from SX) Letter 10 (from SX)	UINT 16	MSB: ASCII code LSB: ASCII code	r.b0	r.C0	r.E0
320486	5005h	1	Letter 11 (from SX) Letter 12 (from SX)	UINT 16	MSB: ASCII code LSB: ASCII code	r.b0	r.C0	r.E0
320487	5006h	1	Letter 13 (from SX)	UINT 16	MSB: ASCII code	r.b0	r.C0	r.E0

2.7.13 Production year

MODBUS: read only mode

Table 2.7-13

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility		
						EM270 X	EM270 W	EM280
320488	5007h	1	Instrument production year	UINT 16		r.b0	r.C0	r.E0

2.7.14 Secondary address

MODBUS: read only mode

Table 2.7-14

Modicom address	Physical address	Length (words)	VARIABLE ENG. UNIT	Data Format	Notes	Firmware compatibility		
						EM270 X	EM270 W	EM280
320737	5100h	2	Instrument secondary address	UINT 32	5100h:LSW 5101h:MSW	r.b3	r.C1	r.E2

3 REVISIONS

3.1 Modifications in Version 1 Revision 0

Added TCD phase order menu table (Table 3.1-9)

3.2 Modifications in Version 2 Revision 0

Added the management of EM270 W models.

3.3 Modifications in Version 3 Revision 0

Added the management of EM280 models.

3.4 Modifications in Version 3 Revision 1

Added note on VLN in single-phase system (table 2.3-1).

3.5 Modifications in Version 3 Revision 2

Added table 2.7-14.

3.6 Modifications in Version 4 Revision 0

Added new variables and relevant “Compatibility” column in Table 2.3-1:
PF ∑, VAR L1, TCDA1, VAR L2 TCDA1, VAR L3 TCDA1, PF L1 TCDA1, PF L2 TCDA1, PF L3 TCDA1, PF TCDA1, VAR L1 TCDA2, VAR L2 TCDA2, VAR L3 TCDA2, PF L1 TCDA2, PF L2 TCDA2, PF L3 TCDA2, PF TCDA2
(these variables are available only via serial port in EM280 and they are not displayed on the meter).

3.7 Modifications in Version 5 Revision 0

Added new measuring variables and programming menus for EM270_X models with firmware release from r.B.04.
Added note (point 4) in 1.2 paragraph.
Removed all references to the special models.

3.8 Modifications in Version 5 Revision 1

Added the reference on selected application in table 2.3
Added column “Firmware compatibility” in all programming parameter tables and instantaneous variable table