

## 1. TECHNICAL DATA

The instruments are equipped, to transfer data to and from a PC, PLC and other supervision systems, with an (optional) insulated serial interface according to RS-485 standard (ANSI/TIA/EIA-485-A-98 R2003).

The data format used is the following:

Baud-rate: 9600 or 19200 bps (programmable, default 9600)  
Start bits: 1  
Data length: 8 bits  
Parity: none or even or odd (programmable, default none)  
Stop bits: 1 (with even or odd parity), 2 (with parity none)

## 2. MODBUS PROTOCOL

The used protocol is the ModBus, in RTU mode

The supported functions are: 03 Read holding registers  
16 (10 Hex) Preset multiple holding registers  
17 (11 Hex) Report slave ID

The instruments act as "slaves"; their logic address can be set from 1 to 247.

In writing operations, the devices can be also addressed with the broadcast address (00h); in this case all the devices connected to the bus will be written and none of them will send a response.

The data field in response to the function 17 (11Hex) "Report slave ID" contains 4 bytes as follow:

Byte 1 Slave ID (see table)  
Byte 2 Run Indicator status (FF = on, 00 = off)  
Byte 3 and 4 Firmware release

Model	Slave ID
C 15/96 ...L	09
MCU/MCUU	0A
Q 15/96 E2X005M	0B
Q 15/96 U2 LX100	0C
Q 96 U4L	0D
Q 96 U4H	0E
	0F
Q 96 B4W	10
C/Q 15/96 U2M	11

Timing:

Minimum interval between the end of a response and the beginning of the next query: 300ms.

Minimum response time-out (to be set on the master): 500ms.

The supported exception responses are:

01 Illegal function (function not supported or writing not enabled)  
02 Illegal data address (the received data address is invalid)  
03 Illegal data value (the received data value is invalid)



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### **3. REGISTERS TABLE**

The following table contains the available variables and the addresses of the registers where they are allocated.

Registers marked with "R" are read only, those marked with "RW" are read and write registers.

All the measurements are expressed in real (primary) values: the CT's and VT's ratios are already included.

Each variable uses two registers; when reading or writing values, both registers must be read or written together using the function 03 "Read Holding registers" or 16 (10 hex) "Preset multiple holding registers"; Reading or writing an odd number of registers, or an even number of registers but across a couple is not allowed and generates an exception response 02 "Illegal data address".

In reading operations, using the function 03 "Read holding registers", the maximum number of registers that can be requested in a single query is 124 (34 for Q96B4W).

Requesting more than 124 (34) registers in a single query generates an exception response 03 "illegal data value"

Writing operations must be preceded by writing the value 0000 00A5h in the Write enable registers (40513 and 40514). Writing remains enabled until this value is changed or the instrument is switched off.

Writing operations performed when the content of the Write enable registers is incorrect generate an exception response 01 "Illegal function"

Data format is hexadecimal, long (32 bits integer), big-endian.

Variables which could be negative are expressed in "two's complement".

The registers of the variables not available for a specific model contain a value equal to zero.

The registers available for the single-phase versions are those of the phase1 (L1) or, in their absence, the system ones (Sys).

REGISTER	ADDRESS (HEX)	VARIABLE	UNIT	R/W	NOTES	AVAILABILITY										
						C 15/96 ...L	MCU/MCUU	Q 15/96 EZ005M	Q 15/96 U2 L/X100	Q96 U4L	Q96 U4H	Q96 B4W	C/Q 15/96 U2M			
40001	0000	RESERVED FOR COMPATIBILITY WITH OLD REGISTERS MAPPING														
...	...															
40256	00FF															
40257	0100	V L1-N	1mV	R			☺	☺	☺	☺	☺		☺			
40258	0101															
40259	0102	V L2-N	1mV	R			☺	☺	☺	☺	☺		☺			
40260	0103															
40261	0104	V L3-N	1mV	R			☺	☺	☺	☺	☺		☺			
40262	0105															
40263	0106	V L1-L2	1mV	R			☺	☺	☺	☺	☺		☺			
40264	0107															
40265	0108	V L2-L3	1mV	R			☺	☺	☺	☺	☺		☺			
40266	0109															
40267	010A	V L3-L1	1mV	R			☺	☺	☺	☺	☺		☺			
40268	010B															
40269	010C	I L1	1mA	R			☺	☺	☺	☺	☺		☺			
40270	010D															
40271	010E	I L2	1mA	R			☺	☺	☺	☺	☺		☺			
40272	010F															
40273	0110	I L3	1mA	R			☺	☺	☺	☺	☺		☺			
40274	0111															
40275	0112	F	1mHz	R	L1		☺	☺	☺	☺	☺		☺			
40276	0113															
40277	0114	P Sys	1W	R	P L1 + P L2 + P L3	☺	☺	☺	☺	☺	☺		☺	☺		
40278	0115															
40279	0116	Q Sys	1VAr	R	Q L1 + Q L2 + Q L3	☺	☺	☺	☺	☺	☺		☺			
40280	0117															
40281	0118	P.F. Sys	0.001	R	P Sys / S Sys		☺	☺	☺	☺	☺					
40282	0119															
40283	011A	kWh+ Sys	1Wh	R/W		☺	☺	☺	☺	☺	☺		☺	☺		
40284	011B															
40285	011C	kVArh+ Sys (Ah+ for C/Q 15/96 U2M)	1VArh (1mAh)	R/W		☺	☺	☺	☺	☺	☺		☺	☺		
40286	011D															
40287	011E	Energy multiplier	1	R		☺	☺	☺	☺	☺	☺		☺	☺		
40288	011F															
40289	0120	V L-L Sys	1mV	R	$(V L1-L2 + V L2-L3 + V L3-L1) / 3$					☺	☺		☺			
40290	0121															
40291	0122	V L-N Sys	1mV	R	$(V L1-N + V L2-N + V L3-N) / 3$						☺			☺		
40292	0123															
40293	0124	I Sys	1mA	R	$(I L1 + I L2 + I L3) / 3$					☺	☺			☺		
40294	0125															
40295	0126	Delta V L-L	%	R	$(V LL max - V LL min) / V LL med$						☺					
40296	0127															
40297	0128	Delta V L-N	%	R	$(V LN max - V LN min) / V LN med$						☺					
40298	0129															
40299	012A	Delta I	%	R	$(I L max - I L min) / I L med$						☺					
40300	012B															
40301	012C	I Neutral	1mA	R	Vector sum $I L1 + I L2 + I L3$						☺					
40302	012D															
40303	012E	Cos Phi Sys	0.001	R	P Sys / S Sys (Fundamentals)						☺					
40304	012F															

REGISTER	ADDRESS (HEX)	VARIABLE	UNIT	R/W	NOTES	AVAILABILITY								
						C15/C96	MCU/MCUU	Q 15/96 E2X005M	Q 15/96 U2 L X100	Q96 U4L	Q96 U4H	Q96 B4W	C/Q 15/96 U2M	
40305	0130	P.F. Avg Sys	0.001	R	Atan kVArh+ / kWh+									
40306	0131													
40307	0132	THDn V L1	% V nom	R	THD / V L nom.									
40308	0133													
40309	0134	THDn V L2	% V nom	R	THD / V L nom.									
40310	0135													
40311	0136	THDn V L3	% V nom	R	THD / V L nom.									
40312	0137													
40313	0138	THDn I L1	% I nom	R	THD / I L nom.									
40314	0139													
40315	013A	THDn I L2	% I nom	R	THD / I L nom.									
40316	013B													
40317	013C	THDn I L3	% I nom	R	THD / I L nom.									
40318	013D													
40319	013E	kWh- Sys	1Wh	R/W		☺	☺	☺	☺	☺	☺		☺	
40320	013F													
40321	0140	kVArh- Sys (Ah- for C/Q 15/96 U2M)	1VArh (1mAh)	R/W		☺	☺	☺	☺	☺	☺		☺	
40322	0141													
40323	0142	S Sys	1VA	R	S L1 + S L2 + S L3									
40324	0143													
40325	0144	P L1	1W	R										
40326	0145													
40327	0146	P L2	1W	R										
40328	0147													
40329	0148	P L3	1W	R										
40330	0149													
40331	014A	Q L1	1VAr	R										
40332	014B													
40333	014C	Q L2	1VAr	R										
40334	014D													
40335	014E	Q L3	1VAr	R										
40336	014F													
40337	0150	S L1	1VA	R	V L1 rms x I L1 rms									
40338	0151													
40339	0152	S L2	1VA	R	V L2 rms x I L2 rms									
40340	0153													
40341	0154	S L3	1VA	R	V L3 rms x I L3 rms									
40342	0155													
40343	0156	P.F. L1	0.001	R	P L1 / S L1	☺	☺	☺	☺	☺	☺		☺	
40344	0157													
40345	0158	P.F. L2	0.001	R	P L2 / S L2	☺	☺	☺	☺	☺	☺		☺	
40346	0159													
40347	015A	P.F. L3	0.001	R	P L3 / S L3	☺	☺	☺	☺	☺	☺		☺	
40348	015B													
40349	015C	Cos Phi L1	0.001	R	P L1 / S L1 (Fundamentals)								☺	
40350	015D													
40351	015E	Cos Phi L2	0.001	R	P L2 / S L2 (Fundamentals)								☺	
40352	015F													
40353	0160	Cos Phi L3	0.001	R	P L3 / S L3 (Fundamentals)								☺	
40354	0161													

REGISTER	ADDRESS (HEX)	VARIABLE	UNIT	R/W	NOTES	AVAILABILITY								
						C15/C96	MCU/MCUU	Q 15/96 E2X005M	Q 15/96 U2 L/X100	Q96 U4L	Q96 U4H	Q96 B4W	C/Q 15/96 U2M	
40355	0162	P max Sys	1W	R/W		☺	☺	☺	☺	☺	☺		☺	☺
40356	0163					☺	☺	☺	☺	☺		☺	☺	
40357	0164	P avg Sys	1W	R/W	Moving average	☺	☺	☺	☺	☺	☺			☺
40358	0165					☺	☺	☺	☺	☺			☺	
40359	0166	I max L1 (I max Sys for C/Q 15/96 U2M)	1mA	R/W			☺	☺	☺	☺	☺		☺	☺
40360	0167					☺	☺	☺	☺		☺	☺		
40361	0168	I max L2	1mA	R/W			☺	☺	☺	☺	☺		☺	
40362	0169					☺	☺	☺	☺		☺			
40363	016A	I max L3	1mA	R/W			☺	☺	☺	☺	☺		☺	
40364	016B					☺	☺	☺	☺		☺			
40365	016C	I avg L1 (I avg Sys for C/Q 15/96 U2M)	1mA	R/W	Moving average		☺	☺	☺	☺	☺		☺	☺
40366	016D					☺	☺	☺	☺		☺	☺		
40367	016E	I avg L2	1mA	R/W	Moving average		☺	☺	☺	☺	☺		☺	
40368	016F					☺	☺	☺	☺		☺			
40369	0170	I avg L3	1mA	R/W	Moving average		☺	☺	☺	☺	☺		☺	
40370	0171					☺	☺	☺	☺		☺			
40371	0172	THDa V L1	1mV	R	Absolute value								☺	
40372	0173					☺								
40373	0174	THDa V L2	1mV	R	Absolute value								☺	
40374	0175					☺								
40375	0176	THDa V L3	1mV	R	Absolute value								☺	
40376	0177					☺								
40377	0178	THDa I L1	1mA	R	Absolute value								☺	
40378	0179					☺								
40379	017A	THDa I L2	1mA	R	Absolute value								☺	
40380	017B					☺								
40381	017C	THDa I L3	1mA	R	Absolute value								☺	
40382	017D					☺								
40383	017E	Phases sequence	0/1	R	1 = Correct								☺	
40384	017F					☺								
40385	0180	Total hours run	0.1h	R/W									☺	
40386	0181					☺								
40387	0182	Partial hours run	0.1h	R/W									☺	
40388	0183					☺								
40389	0184	Hours to maintenance	0.1h	R/W	Stops at 0								☺	
40390	0185					☺								
40391	0186	Temperature	0.1°C	R	Internal switchboard								☺	
40392	0187					☺								
...		RESERVED FOR FUTURE ADDITIONAL VARIABLES												
40512	01FF	RESERVED FOR FUTURE ADDITIONAL VARIABLES												
40513	0200	WRITE ENABLE		R/W	0000 00A5 = Enabled	☺	☺	☺	☺	☺	☺		☺	
40514	0201					☺	☺	☺	☺	☺		☺		
40515	0202	DEVICE LOGIC ADDRESS		R/W		☺	☺	☺	☺	☺	☺		☺	
40516	0203					☺	☺	☺	☺	☺		☺		
...	...	SYSTEM DATA AND SETTINGS (MODEL SPECIFIC)								☺	☺	☺	☺	☺
40768	02FF	SYSTEM DATA AND SETTINGS (MODEL SPECIFIC)								☺	☺	☺	☺	☺