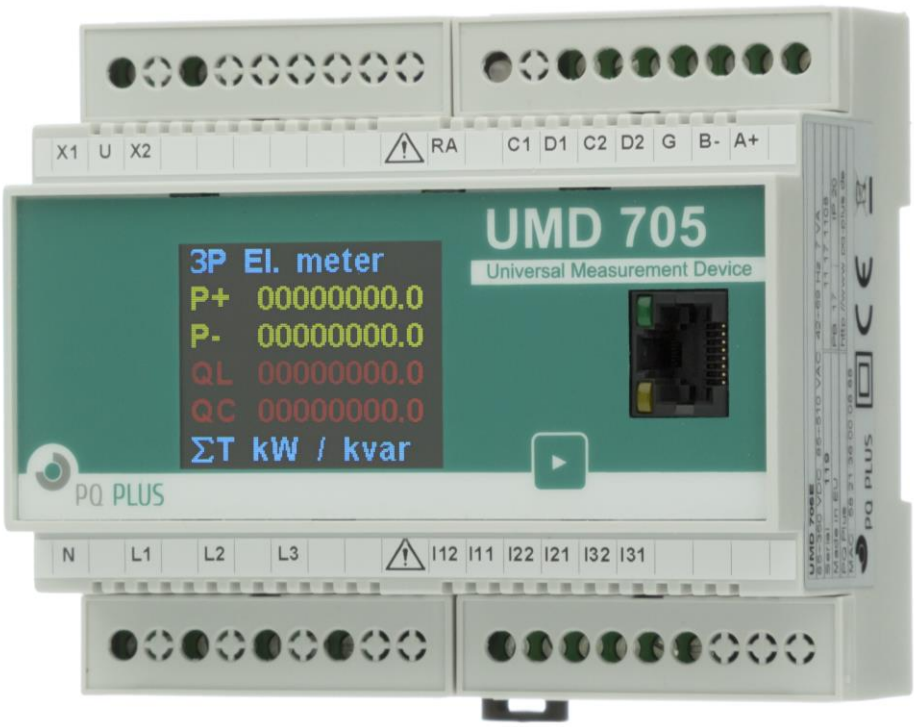
Operating Manual for

UMD 705E / CBM



Contents

1 General Description

The UMD 705 is specially designed for monitoring of energy and power quality in advanced power systems and smart grids. It is intended to be used mostly for DIN rail mounting. This display-less design with multiple communication options is suitable for a wide spectrum of automation tasks in modern buildings, distributed power generation, remote supervision of the infrastructure and also remote load management. Two different user interfaces are offered - UMD 705 D with a small embedded color display on the front panel for simple local value reading and an unobtrusive UMD 705 without display with limited ability for hostile user interaction. To protect the actual setup and collected data each instrument can be locked by a custom pin. It uses standard RS-485 serial line for communication with remote control systems. Optionally it can be equipped with other communication peripherals such as Ethernet, USB.

It is equipped with three voltage inputs and three current inputs.

1.1 Improvements and advanced functions

- new front panel display and control.
- new power supply option U with 85-510 VAC aux voltage and two universal DIO ports
- improved MIN/AVG/MAX measurement and evaluation
- precise four quadrant active and reactive energy measurement with optional 10 ms evaluation period - to record fluctuations and fast changes of power flow direction
- optional push-data function in modbus master - to feed the remote server automatically
- Extended set of conditions and control actions in the IO programming section
- optional Windows and Linux (ARM, x866) library for custom control software development

2 Operating the Meter

2.1 Safety requirements when using UMD 705

Warning !

When working with the instrument it is necessary to perform all necessary measures for the protection of persons and property against injury and electric shock.

- The device must be operated by a person with all required qualifications for such work and this person must know in detail the operation principles of the equipment listed in this description!
- When the device is being connected to the parts which are under dangerous voltage it is necessary to comply with all the necessary measures to protect users and equipment against injury with electrical shock.
- Person, performing the installation or maintenance of the instrument must be equipped with and must use personal protective clothing and tools.
- If the analyzer is used in a manner not specified by the manufacturer, the protection provided by the analyzer may be impaired.
- If the analyzer or its accessories appear to be impaired or not functioning properly, do not use it and send it in for repair.

2.2 Installation of the instrument

Natural air circulation should be provided inside the distribution board cabinet, and in the instrument's neigh- borhood. Especially underneath the instrument, no other instrumentation that is source of heat should be installed or the temperature value measured may be influenced. A connection wire's maximum cross section area is 2.5 mm^2 in case of all screw terminals.

The UMD 705 is primarily intended for DIN-rail mounting. Dimensions of the instrument are on figure 2.

There are also positions marked with dash dot lines of holes for wall-mounting with three screws.

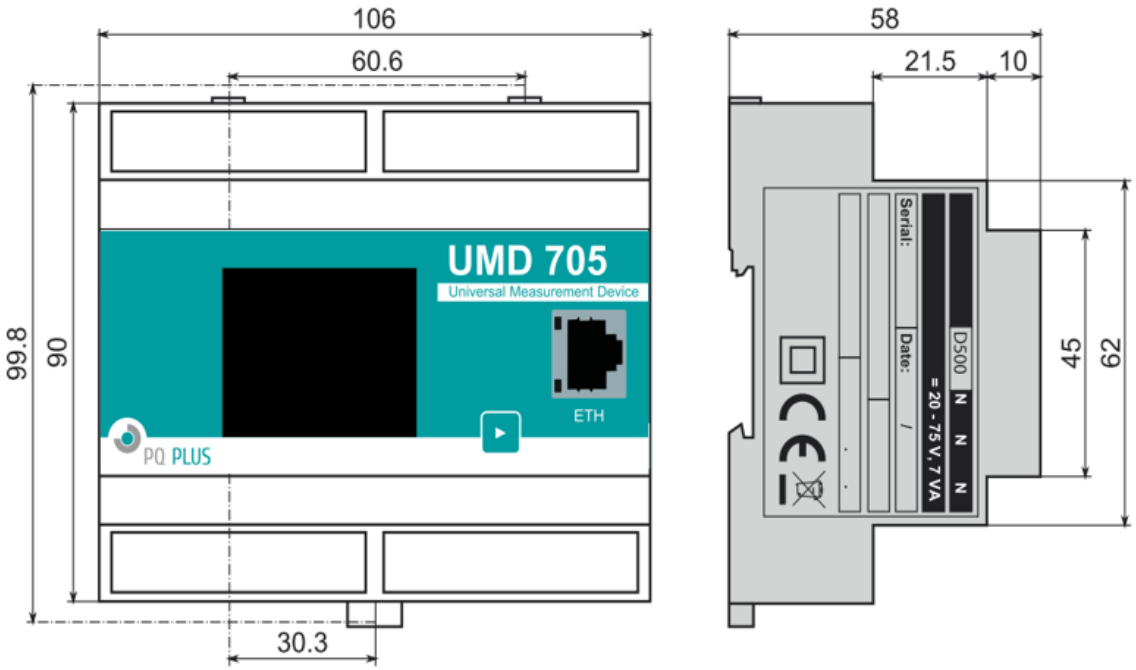


Figure 2: Dimensions of the UMD 705 analyzer.

2.2.1 Supply voltage

The power supply terminal is labeled as X1 and X2. The two terminals are complemented with a symbol (U, L or S), indicating the respective auxiliary voltage option (details in ch. 3). Proper supply voltage must be connected to the terminals X1 and X2 via a circuit breaking device (power switch – see installation diagram on figure 3). It has to be located left to the instrument and easily reachable by the operator. The circuit breaking device must be identified as the equipment power disconnection switch. A circuit breaker of the nominal value 1 *A* is a convenient circuit breaking device. Its function and position has to be clearly identified (symbols '0' and 'I' acc. to IEC EN 61010-1). Internal power supply is galvanically isolated from internal circuits.

2.2.2 Measured voltage

The measured voltages are connected to the terminals L1, L2 and L3. Connect the neutral wire to the terminal
N. With delta or Aaron connections terminal N remains unused. Voltage measurement inputs are connected with internal circuits over high impedance.

It is suitable to protect the measured voltage lines for example with 1A fuses of the required rating. Measured voltages can also be connected via instrument voltage transformers. A connection cable maximum cross section area is 2.5 mm^2 for voltage terminals.

2.2.3 Measured currents

The instruments are designed for indirect current measurement via external CT only. Proper current signal polarity (S1 or S2 terminals, k or l in the older notation) must be observed. You can check the polarity by the sign of phase active powers on the instrument display, its web pages or in the ENVIS.Daq application.

X/5A current input option The current signals from 5A or 1A instrument current transformers must be connected to the terminal pairs I11, I12, I21, I22, I31, I32 with a cable of maximum cross section area 2.5 mm^2.

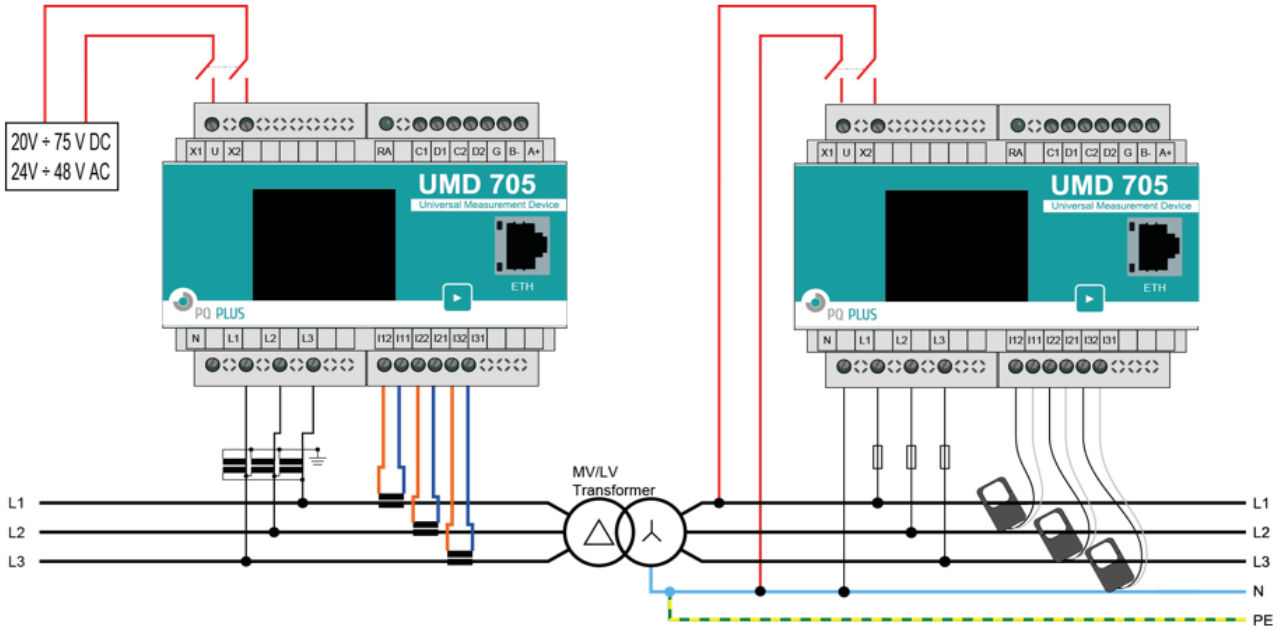


Figure 3: An example of typical installation of UMD 705 instrument in a low voltage network — options L or S for various LVDC power supplies. Typical connection options for voltage measurements: star, delta and single phase feeders. Option E for Ethernet port remote communication, option U for local USB communication port (all instruments provide RS485 serial line).

2.2.4 Communication peripherals

All peripherals stated below are galvanically isolated from the rest of the instrument and from each other:

Ethernet interface (variant "E")
100 Mbit Ethernet interface with RJ-45 connector (100Base-TX) labeled as *ETH* is situated on a top panel of the device. Ethernet interface can be used as substitution for the primary RS-485 for connection of the device to LAN and for easy connection of remote control PC.

USB (variant "CBM")
Communication port for USB slave is located on the front panel. This communication port is intended for easy local configuration and fast download of archived data to the local PC. For correct operation it needs a driver installed in your operating system (see the ENVIS user guide for more info).

RS-485 serial line

Serves usually as a remote communication for reading of actual data, archive downloading and device configuration. Serial RS-485 line uses terminals *A+*, *B-* with shielding at terminal *G* of *COM1* block (fig. 4). The end point of the communication line must be properly terminated with ˜120n resistor.

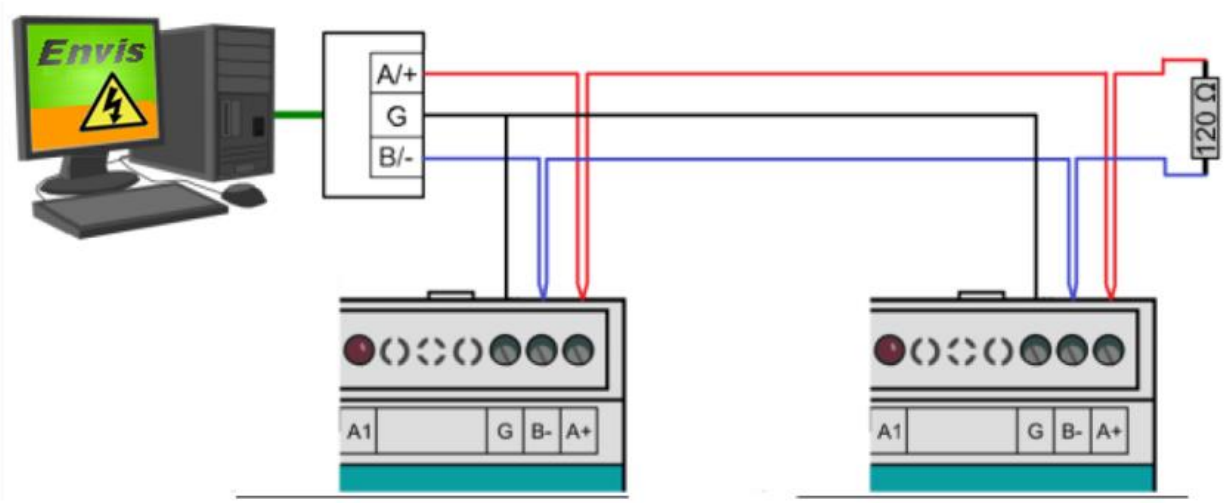


Figure 4: Typical wiring of the RS-485 communication line terminals in UMD 705

2.2.5 Outputs and inputs

Instrument provides two separate universal I/O ports with terminals C1,D1 and C2,D2. Each DI/O port can be used individually as an input or an output function. For a correct operation of the I/O it is necessary to use an external power supply with nominal voltage 12 to 24 VDC. Appropriate polarity of supply voltage for input resp. output function must be kept.

⚠ ***Warning !***

Digital I/Os are unipolar. Right polarity must be kept for a proper operation of the terminal. Incorrectly connected external power supply can damage the instrument.

DI/O as a digital input DI is connected to the selected I/O terminal (D1 or D2) and a common terminal (C1 or C2) with external power supply in the following way: the current flows from positive terminal of the supply through the external input contact to a DI terminal (D1 or D2) and than from the common terminal (C1 or C2) back to the negative terminal of the external power supply.

DI/O as a digital output DO is connected to the selected I/O terminal (D1 or D2) and a common terminal (C1 or C2) with external power supply in the following way: the current flows from positive terminal of the supply to the C1 or C2 terminal and from a DI terminal (D1 or D2) through the controlled load to the negative terminal of the supply. If an I/O port is used as an output (its behavior is controlled by an internal logic function) the instrument also indicates its activation with the respective input register.

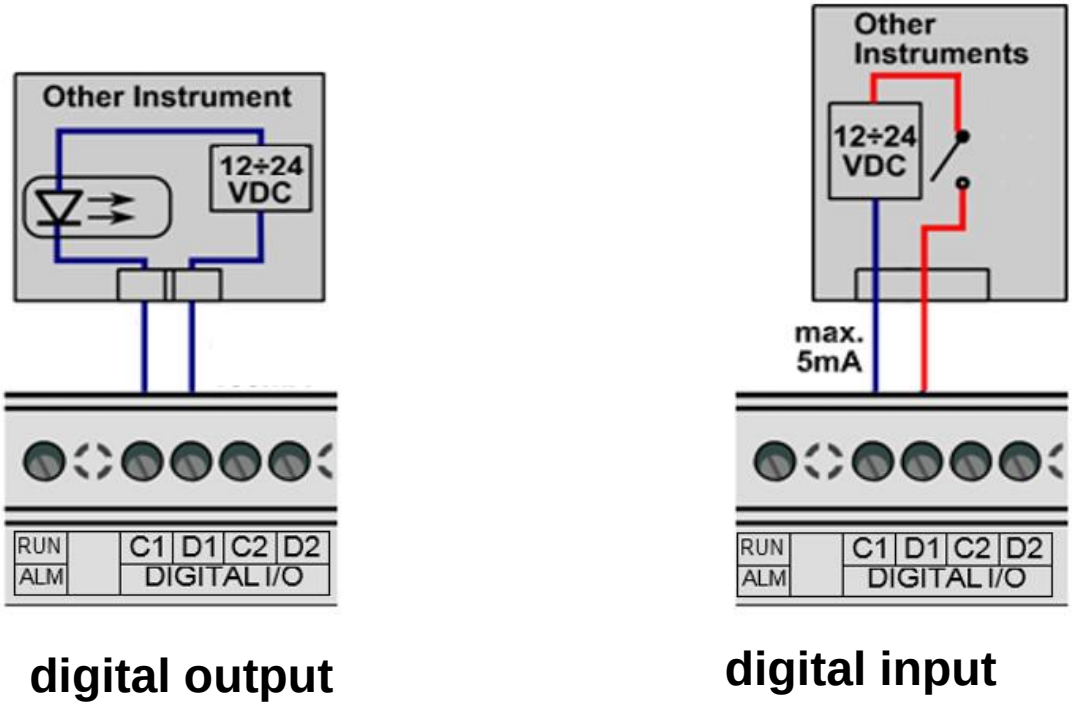


Figure 5: An example of output and input of UMD 705.

2.3 Downloading data to PC

Connect the instrument to the PC and run ENVIS.Daq application. Select the appropriate communication option and connect to the instrument. In the next screen press *Refresh All*. This will load and display the actual status of each supported archive.

Device Information section contains editable description and name under which the actual record is stored. *Time Frame for Other Archives* tab allows you to limit the date ranges of all archives by the time interval of the main archive. In the *Destination* section the actual storage can be selected - either to the SQL database or to the file. The check boxes in *Archives to Download* determines which specific archive(s) you want to download.

The actual download will start by pressing the *Download All* button. progress is displayed on screen. When finished the archive can be viewed in the ENVIS application. User can open the downloaded file directly from ENVIS.Daq.

2.4 Energy meter readings

UMD 705 has an embedded three phase, four-quadrant energy meter with automatic meter reading functions and multiple programmable tariffs (Time-of-Use, TOU). The instrument registers active energy (EP, EP+, EP-) and reactive energy (EQL, EQC or EQC+, EQC-, EQL+, EQL-). According to the configuration of meter readings are shuffled to the respective tariffs. It automatically provides summaries per phase. For star connections and single phase measurements it can also register energy for each phase separately.

Meter data readings can be downloaded and analyzed in ENVIS or via the standard ModBus protocol in any other system.

3 Technical Specifications

3.1 Basic Parameters

Auxiliary Voltage		
	model „230V“	model „24V"
aux. voltage range	85 ÷ 510 VAC 85 ÷ 350 VDC	20 ÷ 75 VDC
power supply	7 VA / 3 W	3,5 VA / 3,5 W
overvoltage category	III (300V)	II (100V)
pollution degree	2	
connection	isolated, polarity free	

Other Specifications	
operational temperature	- 20 to 60°C
storage temperature	- 40 to 80°C
operational and storage humidity	< 95 % - non-condensable environment
EMC – immunity	EN 61000 – 4 - 2 (6 kV / 8 kV) EN 61000 – 4 - 3 (10 V/m up to 3 GHz) EN 61000 – 4 - 4 (4 kV) EN 61000 – 4 - 5 (2 kV_{LL} / 4 kV_{LG}) EN 61000 – 4 - 6 (10 V) EN 61000 - 4 - 8 (100 A / 1000 A) EN 61000 – 4 - 11 (250 periods)
EMC – emissions	EN 55011, class A EN 55022, class A (not for home use)
communication ports	RS-485 (2400 ÷ 921600 Bd), optional USB, Ethernet 10Base-T
communication protocols	KMB, Modbus RTU and TCP, web server, DHCP
accuracy of RTC	± 2 seconds per day
capacity of RTC backup battery	> 5 years (without supply voltage applied)
protection class front panel whole instrument	 IP 40 IP 20
dimensions front panel whole instrument	 106 x 45 mm 106 x 90 x 58 mm
weight	max. 0.25 kg

3.2 Measured Quantities

Measured Quantities – Voltage	
Frequency	
f_{NOM} – nominal frequency	50 / 60 Hz
measuring range	40 ÷ 70 Hz
uncertainty	± 10 mHz
Voltage	
voltage input option	**standard variant („230 V“)**
U_{NOM} (U_{DIN}) – rated voltage	180 ÷ 280 VAC
measuring range line-to-neutral	4 ÷ 420 VAC
measuring range line-to-line	7 ÷ 720 VAC
intrinsic uncertainty (t_A=23±2ºC)	+/- 0.05 % of rdg ± +/- 0.05 % of rng
temperature drift	+/- 0.03 % of rdg ± +/- 0.01 % of rng / 10 ºC
measurement category	300V CAT III
permanent overload	1820 VAC (UL–N)
peak overload, 1 second	2730 VAC (UL–N)
burden power (impedance)	< 0.05 VA (Ri = 3.78 MΩ)
Voltrage Unbalance	
measuring range	0 ÷ 10 %
measuring uncertainty	± 0.3% of rdg or ± 0.3
THDU	
measuring range	0 ÷ 20 %
measuring uncertainty	± 0.5
Harmonics (up to 50th order)	
reference conditions	other harmonics up to 200 % of class 3 acc. to IEC 61000–2-4 ed.2
measuring range	10 ÷ 100 % of class 3 acc. to IEC 61000–2-4 ed.2
measuring uncertainty	twice the levels of class II acc. to IEC 61000–4-7 ed.2

Measured Quantities – Current, Temperature			
Current			
current input option	**„X/100mA“**	**„X/5A“**	
I_{NOM} (I_B) – rated (basic) current	0.1 A_{AC}	5 A_{AC}	
measuring range	0.00025 ÷ 0.15 A_{AC}	0.0125 ÷ 7.5 A_{AC}	
intrinsic uncertainty (t_A=23 ±2 ºC)	+/- 0.05 % of rdg ± +/- 0.05 % of rng		
temperature drift	+/- 0.03 % of rdg ± +/- 0.01 % of rng / 10 ºC		
measurement category	600V CAT III	600V CAT III	
permanent overload	1 A_{AC}	10 A_{AC}	
peak overload 1 second, maximum repetition frequency > 5 minutes	10 A_{AC}	90 A_{AC}	
burden power (impedance)	< 0.001 VA (Ri < 0.1 Ω)	< 0.5 VA (Ri <10mΩ)	
Current Unbalance			
measuring range	0 ÷ 100 %		
measuring uncertainty	± 1 % of rdg or ± 0.5		
Harmonics & Interharmonics (up to 50th order)			
reference conditions	other harmonics up to 1000 % of class 3 acc. to IEC 61000–2-4 ed.2		
measuring range	500 % of class 3 acc. to IEC 61000–2-4 ed.2		
measuring uncertainty	Ih <= 10 % I_{NOM} : ± 1 % I_{NOM}		
	Ih > 10 % I_{NOM} : ± 1 % of rdg		
THDI			
measuring range	0 ÷ 200 %		
measuring uncertainty	THDI <= 100 % : ± 0.6		
	THDI > 100 % : ± 0.6 % of rdg		
Temperature (internal sensor, measured value affected by the instrument power dissipation)			
measuring range	- 40 ÷ 80°C		
measuring uncertainty	± 2 ºC		

Measured Quantities – Power, Power Factor, Energy	
Active / Reactive Power, Power Factor (PF), cos φ ($P_{NOM} = U_{NOM} \times I_{NOM}$)	
reference conditions "A": ambient temperature (t_A) U, I for active power, PF, cos φ for reactive power	23 ± 2 ºC U = 80 ÷ 120 % U_{NOM}, I = 1 ÷ 120 % I_{NOM} PF = 1.00 PF = 0.00
act. / react. power uncertainty	± 0.5 % of rdg ± 0.005 % P_{NOM}
PF & cos φ uncertainty	± 0.005
reference conditions "B": ambient temperature (t_A) U, I for active power, PF, cos φ for reactive	23 ± 2 ºC U = 80 ÷ 120 % U_{NOM}, I = 2 ÷ 120 % I_{NOM} PF >= 0.5 PF <= 0.87
act. / react. power uncertainty	± 1 % of rdg ± 0.01 % P_{NOM}
PF & cos φ uncertainty	± 0.005
temperature drift of powers	± 0.05 % od rdg ± 0.02 % P_{NOM} / 10 ºC
Energy	
measuring range	corresponds to U & I measuring ranges 4 quadrant energy counters for both active and reactive energies
active energy uncertainty	class 1 acc. to EN 62053 – 21
reactive energy uncertainty	class 2 acc. to EN 62053 – 23

3.3 Inputs and Outputs

Digital Outputs & Digital Inputs: universal 1+1 DIO (only models with „U“ auxiliary voltage)	
Digital Outputs	
type	Opto-transistor, unipolar (Cx +, Dx -)
load rating	35 V_{DC}, 30 mA_{DC}
dynamic parameters (pulse output): - pulse duration - gap duration - maximum frequency	S0 - compatible 50 ms >= 50 ms 10 Hz
Digital Inputs	
type	Opticaly isolated, unipolar (Cx -, Dx +)
maximum voltage	30 V_{DC}
voltage for “logical 1“	> 7 V_{DC}
voltage for “logical 0“	< 3 V_{DC}
input current	5 mA @ 12V / 13 mA @ 24V
dynamic par. (pulse counter): - pulse/gap duration - maximum frequency	>= 0.5 / 0.5 ms 1 kHz

4 Maintenance, Service, Warranty

Maintenance: the UMD 705 power analyzer does not require any additional maintenance during its operation besides the regular maintenance processes for the whole cabinet. For reliable operation it is only necessary to meet the operating conditions specified and not expose the instrument to violent handling and contact with water or chemicals which could cause mechanical damage.

The lithium cell built in the instrument can backup a real time circuit for more than 5 years without power supply, at average temperature 20➡*C* and load current in the instrument less than 10 μA. If the cell is empty, it is necessary to ship the instrument to the manufacturer for battery replacement.

The 18350 rechargable Li-ion battery cell for the instrument operation backup is also optionally installed inside the UMD 705 option S or L. If the battery malfunctions it is necessary to ship the instrument to the manufacturer for battery replacement.

Service: In the case of failure or a breakdown of the product, you should contact the PQ Plus GmbH:

PQ PLUS GmbH
Hagenauer Str. 6
91094 Langensendelbach
info@pq-plus.de
+49 9133-60640-0
www.pq-plus.de

The product must be in proper packaging to prevent damage during transit. A description of the problem or its symptoms must be delivered together with the product.

If a warranty repair is claimed, the warranty certificate must be sent in. In case of an out-of-warranty repair you have to enclose an order for the repair.

Warranty certificate: warranty period of 24 months from the date of purchase is provided for the instrument, however, no longer than 30 months from the day of dispatch from the manufacturer. Problems in the warranty period, provably because of faulty workmanship, design or inconvenient material, will be repaired free of charge by the manufacturer or an authorized servicing organization.

The warranty ceases even within the warranty period if the user makes unauthorized modifications or changes to the instrument, connects it to out-of-range quantities, if the instrument is damaged due to ineligible or improper handling by the user, or when it is operated in contradiction with the technical specifications presented.

Type of product: UMD 705 ……	Serial Number: ……
Date of dispatch: ……..	Final quality: ……
Inspection: ……...	manufacutrer's deal: ……
Date of purchase: ……	supplier's deal: ……