PQ PLUS GmbH

Operating Manual for

UMD 701

Short version 2.0

Contents

1 General Description

The UMD 701 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. Absence of local panel controls (display and keyboard) limits possibilities for hostile user interaction. To protect the actual setup and collected data each instrument can be locked by a custom pin. Inputs and outputs can be custum programmed for basic local control applications. It uses standard RS-485 serial line for communication with remote control systems. Optionally it can be equipped with other communication peripherals such as secondary RS-485 or M-Bus communication line, or USB, WiFi and Ethernet interface.

It is equipped with one voltage input and two, four or eight current inputs. The instrument can be also supplied with for current transformers with X/100 mA ratio, for special Hall probes (to measure DC or AC+DC currents) with ±4 V output, or Sxxx and Pxxx option for external through-hole or clamp-on current sensors for direct measuring up to 2400 A nominal current according to the type of the current transformer.

Warning ! The X/100mA, Sxxx and Pxxx, X/±4 V options are specially designed to be used only in combination with provided external current sensors which are supported with the respective option.

The UMD 701 is available in several configurations according to the customer requirements[1]. See the ordering scheme on figure 1.

[1] Complete and most up to date list of optional and other accessories are available on request from the device vendor.

UMD 701

Instrument model

UMD = Universal Meassering Device

Measuring inputs
1 voltage + 8 current inputs

Auxiliary power supply
U = 75 V ÷ 275 VAC, 75 V ÷ 350 VDC

Current inputs
X/100mA = 100mA AC (indirect measurement

Optional digital output
pulse output

Optional peripheral
two digital inputs

Optional expanding module
E = Ethernet interface

Figure 1: Schematics of the UMD 701 ordering options and variants. It includes special codes for proper current and voltage rating options.

2 Operating the Meter

2.1 Safety requirements when using UMD 701

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 neighborhood. 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 701 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.

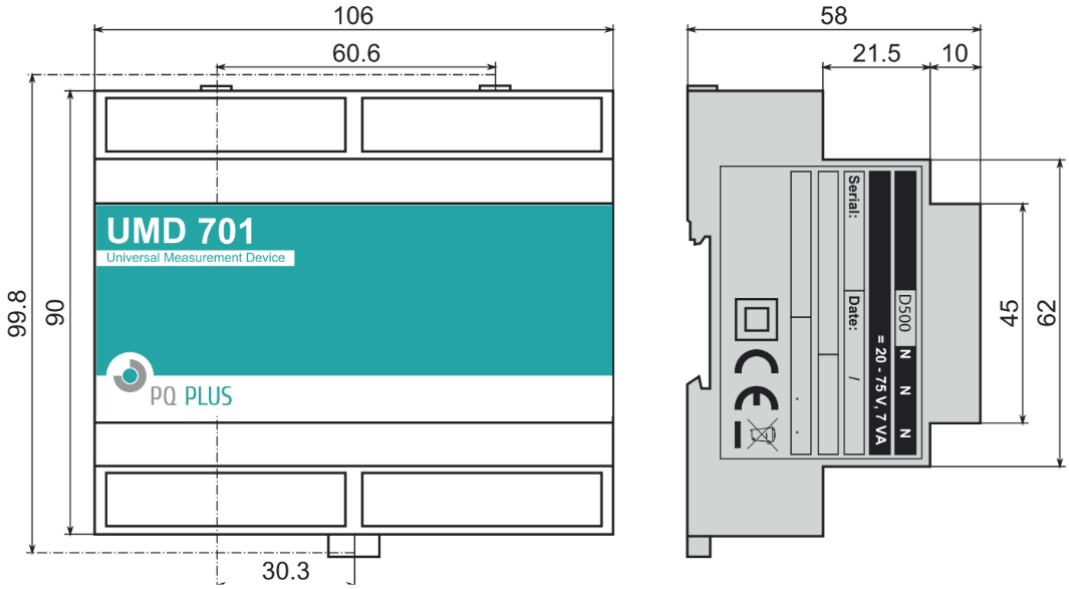

Figure 2: Dimensions of the UMD 701 analyzer.

2.2.1 Supply voltage

Power supply voltage (options in ch. 3) 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 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 voltage is connected to the terminal L1. Connect the neutral wire to the terminal N. 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.

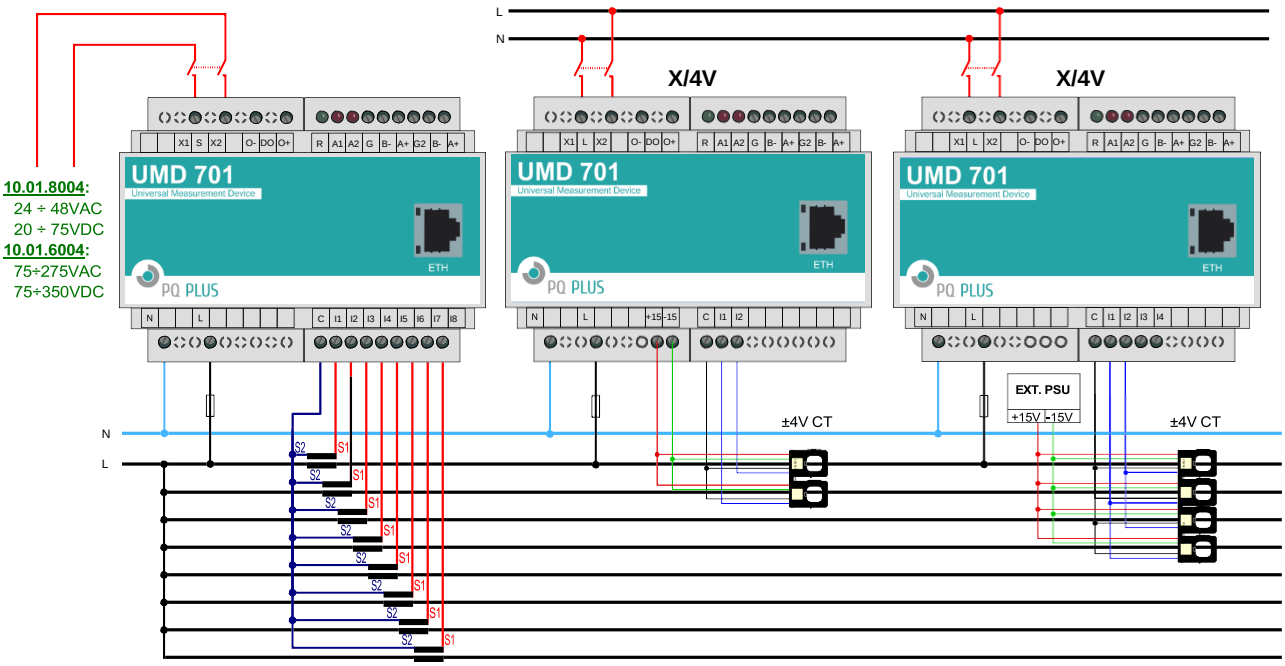

Figure 3: An example of typical installation of UMD 701 instrument in a low voltage network — left to right: with low voltage supply voltage (possible DC, AC including battery backed UPS setups); with supply from measured network. Option E for Ethernet port remote communication, option U for local USB communication port (all instruments provide RS485 serial line).

2.2.3 Measured currents

For proper current measuring the current sensors must be installed with correct orientation and polarity. Figure 3 illustrates such a connection of various current transformers in LV network. Intended direction of power flow is from left (source) to right (load). It is highly recommended to verify correctness of wiring and polarity of currents with phasor diagram in Actual Data window ot the EnVis.Daq application.

The current inputs are directly connected with internal circuits. Inputs I1,I2,..,I8 and C are connected through shunt resistors (or divider in case of X/4V option). A connection cable maximum cross section area is 2.5 mm^2.

Warning !: Current inputs can not be used for dirrect current measurement. Connection of unsupported type of current transformer such as the common type with 5A or 1A secondary to an instrument is strictly forbidden! The instrument can be seriously damaged!

Warning !: Do not connect the current input signals with neither ground nor other potential! Otherwise, measurement accuracy can be affected or the instrument can be damaged!

Always use only correctly rated measurement current transformers (such as ◗X mA or ◗4V) which were originally supplied with the actual instrument.

2.2.4 Communication peripherals

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

USB (optional) 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. Use the supplied USB

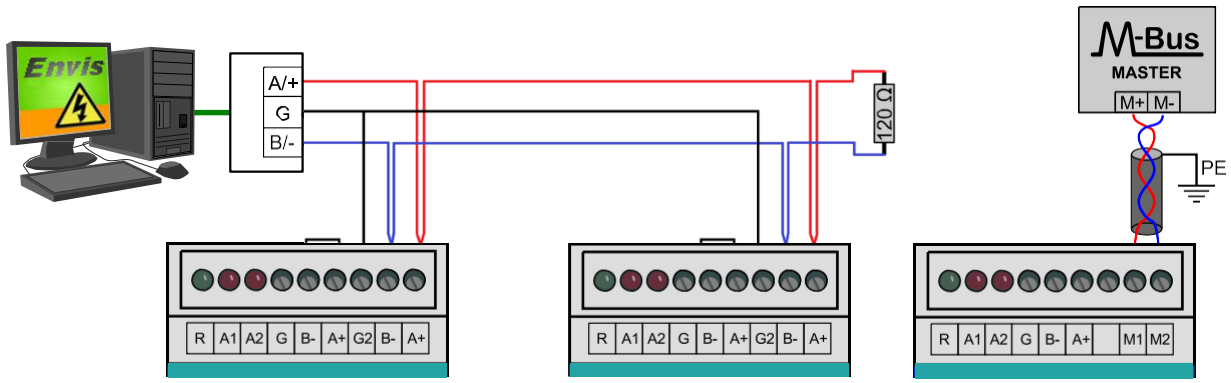

Figure 4: Typical wiring of the RS-485 communication line terminals in UMD 701 or optional M-Bus (right).

cable only (USB-A/mini). UMD 701 is a USB 2.0 slave device. For correct operation it needs a driver installed in your operating system (see the EnVis user guide for more info).

Ethernet interface (optional) 10Base-T Ethernet interface with RJ-45 connector described *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.

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.

Secondary RS-485 (optional) communication line serves for connection of external I/O modules or remote display unit. Secondary RS-485 line uses terminals *A+*, *B-* with shielding at terminal *G2* of *COM2* block (fig. 4). The final points of the communication line have to be fitted with terminating resistor approx. 120n.

M-Bus interface (optional) provides predefined measured values to the remote M-Bus control system. the M-Bus implementation is described in a standalone *Communication Protocol Mbus* manual. Its physical interface uses terminals *M1* and *M2* of *COM2* block on fig. 4 (right). Polarity of the connection is free to choose.

2.2.5 Outputs and inputs

Digital Inputs DI1 and DI2, sensitive to voltage, are using three terminals in *DI* block — *DI* is common terminal, *D1* is first and *D2* is second digital input. Voltage lower than 3 V applied between *DI* and digital input *D1* or *D2* is evaluated as inactive state, voltage greater than 10 V is evaluated as active state. On fig. 5 right there is a sample schema for connection of two external switches in series with voltage source of 24 V_{DC}.

Digital Output connected through terminals *O+* and *O-*. There must be an external voltage source in series (24 V_{DC} is recommended). In case of solid state based DO outputs an external voltage supply polarity must comply with terminal poles (see fig. 5).

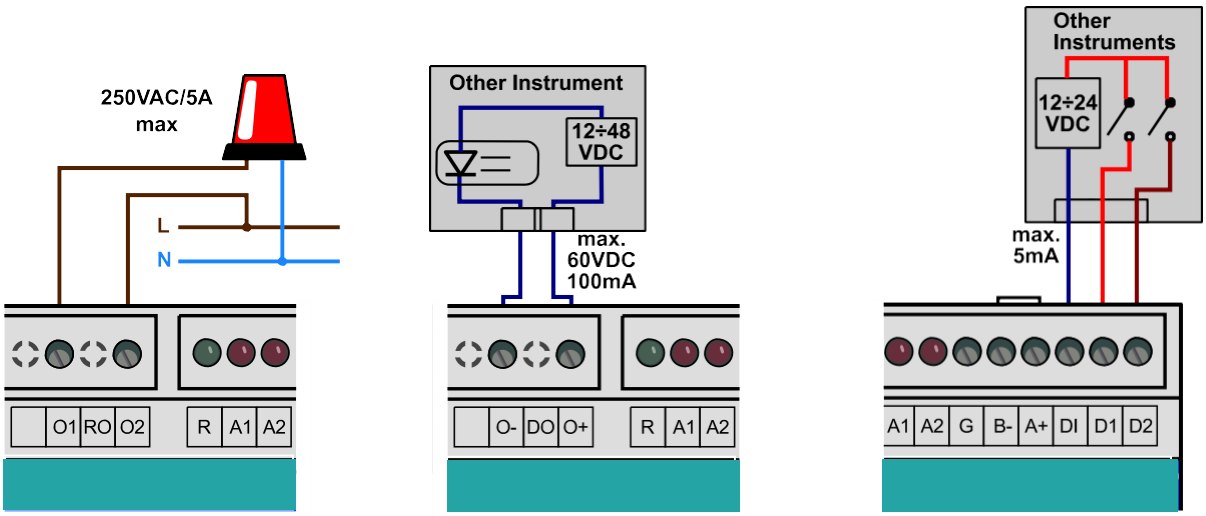

Figure 5: An example of wiring connection for inputs and outputs in UMD 701 .

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 701 has an embedded 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 protool in any other system.

3 Technical Specifications

3.1 Basic Parameters

AUX

Auxiliary Voltage		
	10.01.6004	**10.01.8004**
AC aux. voltage range, f: 40÷450 Hz	85 ÷ 275 VAC	20 ÷ 50 VAC
DC aux. voltage range	80 ÷ 350 VDC	20 ÷ 75 VDC
power supply	14 VA / 6 W	
overvoltage category	III	
pollution degree	2	
connection	isolated, polarity free	

Ostatni

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 (4 kV / 8 kV) EN 61000 – 4 - 3 (10 V/m up to 1 GHz) EN 61000 – 4 - 4 (2 kV) EN 61000 – 4 - 5 (2 kV) EN 61000 – 4 - 6 (3 V) EN 61000 – 4 - 11 (5 periods)
EMC – emissions	EN 55011, class A EN 55022, class A (not for home use)
communication ports	RS-485 (1200 ÷ 921600 Bd), optional USB, Ethernet 10Base-T, M-bus
communication protocols	PQ PLUS, 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

Veliciny - U

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“)**
U_{NOM} (U_{DIN}) – rated voltage	180 ÷ 250 VAC
measuring range line-to-neutral	8 ÷ 360 VAC
measuring range line-to-line	–
intrinsic uncertainty (t_A=23 ± 2ºC)	± 0.05 % of rdg ± 0.02 % of rng
temperature drift	± 0.03 % of rdg ± 0.01 % of rng / 10 ºC
measurement category	300V CAT III
permanent overload	1500 VAC (UL–N)
peak overload, 1 second	2300 VAC (UL–N)
burden power (impedance)	< 0.03 VA (Ri = 3.24 MΩ)
Voltrage Unbalance	
measuring range	–
measuring uncertainty	–
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“**
I_{NOM} (I_B) – rated (basic) current	0.1 A_{AC}
measuring range	0.00025 ÷ 0.12 A_{AC}
intrinsic uncertainty (t_A=23 ±2 °C)	± 0.05 % of rdg ± 0.02 % of rng
temperature drift	± 0.03 % of rdg ± 0.01 % of rng / 10 °C
measurement category	600V CAT III
permanent overload	0.2 A_{AC}
peak overload 1 second, maximum repetition frequency > 5 minutes	1 A_{AC}
burden power (impedance)	< 0.005 VA (Ri < 0.5 Ω)
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 °C

Measured Quantities – Power, Power Factor, Energy	
Active / Reactive Power, Power Factor (PF), cos φ (P_{NOM} = U_{NOM} x I_{NOM})	
reference conditions “A”: ambient temperature (t_A) U, I for active power, PF, cos φ for reactive power	 23 ± 2 °C 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 power	 23 ± 2 °C 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 °C
Energy	
measuring range	6 „quadrants“, corresponds to U & I measuring ranges
active energy uncertainty	class 1 acc. to EN 62053 – 21
reactive energy uncertainty	class 2 acc. to EN 62053 – 23

4 Maintenance, Service, Warranty

Maintenance: the UMD 701 power analyzer does not require any maintenance during its operation. 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.

Service: in the case of failure or a breakdown of the product, you should contact the supplier at their address:

PQ Plus GmbH
Kersbacherstraße 5
91094 Langensendelbach
Tel.: (+49) 9133-60444-25
E-mail: info@pq-plus.de
Web: 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 701	Serial number:	.....
Date of dispatch:	.....	Final quality inspection:	.....
		Manufacturer's seal:	.....
Date of purchase:	.....	Supplier's seal:	.....