M2M Basic
The measure of efficiency

ABB

M2M Basic
The importance of measurement

ABB Measurement devices range of System pro *M* compact® addresses energy efficiency through a comprehensive and specialist offer of DIN rail and front panel devices designed for every type of civil, commercial and industrial applications.

There is a growing need for energy efficiency nowadays, but this might clash with poor information on how the electrical system operates. If it is not possible to evaluate electrical parameters, to estimate power losses and to get indications on the equipments performances, it is not possible to pursue energy efficiency.

What emerges from this scenario is the importance of measurement devices in order to monitor and keep track of the main network parameters. Through the knowledge of energy consumption and power quality data in the electrical system, it is possible to identify opportunities to operate more efficiently and to optimize the utilization of electricity.

This leads to an improved safety level, not only for the installations, but also for the components and systems connected.

ABB complete range of measuring devices includes multimeters, power meters, network analyzers, each one of them contributing to the improvement of energy efficiency in the system and addressed to specific applications and needs. The introduction of M2M Basic expands the range of measuring devices for main and sub distribution switchboards, by adding an accurate product that has been designed for easy energy and power monitoring.

The software M2M SW allows to easily and quickly update M2M Basic firmware to the latest version. Moreover, thanks to the support of Modbus RTU it is possible to remotely.

M2M Basic
Main features

M2M Basic is a power meter that allows energy and power monitoring, as well as basic THD functionalities on 3-phase and single phase networks. Suitable for panel door mounting, it represents the perfect solution for main distribution in industrial and commercial buildings.

Reliability and accuracy
Compliance to IEC 61557-12, international standard for the main power metering requirements. Highly accurate measurement: 1% accuracy for active energy.

Intuitive visualization
Clear and simple measurement data reading on the large LED display.

Safe installation
Removable terminals facilitate the cabling of the device. Fixing screws allow secure installation, ensuring the device is held strongly on the panel.

Electrical system monitoring
Bidirectional energy measurement for generated and consumed energy. THD measurement for power quality monitoring.

Updatable firmware
Easy and quick firmware update via M2M SW to make sure to have the latest features and the most secure device. Safety password allows protecting the device settings.

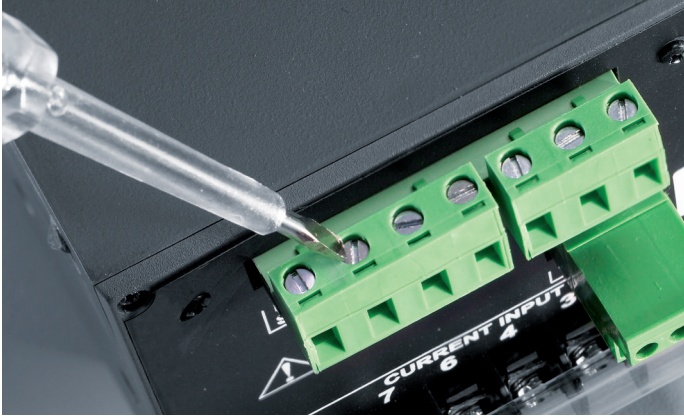**Easy to use**
Front keypad to navigate in setup and menus.

Remote measurement
Serial interface RS485 with the support of communication protocol Modbus RTU facilitating the communication and connection of the device with remote locations. Remote data reading through the M2M SW.

M2M Basic
Measurement, tailored to your needs

Panel Builder

Simple installation and cabling of M2M Basic is guaranteed by the removable terminals, with cables that can be connected by using a single screwdriver.
The device is held strongly to the panel thanks to easy-to-tighten fixing screws, which quickly fit the sides of the product. Preconfigured setup of M2M Basic for the main parameters (transformer ratios, language, type of connection, communication) is based on most common configurations, helping speeding up the first setup if applicable to the system.

End user

M2M Basic is an easy to use measurement device, as it allows to easily navigate among the menus and find the needed information. It provides exactly what is needed for energy and power monitoring purposes. Most accurate measurement is guaranteed by the compliance to IEC 61557-12. Setup of the device is easy and secure, as it is password-protected, which avoids that anyone can change the configuration of M2M Basic. Moreover M2M SW enables the remote setting of the device parameters.

System Integrator

Availability of Modbus RTU protocol for easy communication capabilities allows M2M Basic to cover many of current applications in buildings and industry. The whole solution can be integrated through as less time and effort as possible thanks to the communication protocol map. The device can thus be easily integrated into a supervisory software to remotely obtain measurements. The red LED display enhances clarity in data reading and device configuration.

M2M Basic
Up-to-date information, at any moment

M2M Basic is a digital power meter that allows the effective measurement of more than 40 electrical parameters on 3-phase and single phase networks: voltage, current, frequency, power factor, both active and reactive power and energy. The electrical system is monitored through THD measurement and bidirectional metering of energy on 4 quadrants, which shows both energy production and consumption on a single device.

M2M Basic Modbus supports communications through RS-485 port and Modbus RTU communication protocol, which allows to integrate the power meter with different Modbus RTU devices and systems.

Both M2M Basic and M2M Basic Modbus can be connected to the software M2M SW in order to directly update devices firmware to the latest version.

Moreover M2M SW offers the following functionalities for M2M Basic Modbus, through communication capabilities:
- Data reading: remote access to instantaneous measured parameters
- Data export: basic historical measurements export in .csv files
- Configuration: remote setup of main device parameters, like transformers ratios, type of connection, energy resolution and communication.

M2M Basic
Applications

From commercial buildings to industrial applications, M2M Basic is a power meter for constant, real time power and energy monitoring in main and sub distribution switchboards. Improvement of power quality and preventative maintenance of equipment are made simple through this easy-to-use power meter.

M2M Basic is a device that helps the user identifying opportunities to save energy and reduce costs.
The large and clear display makes it easy and immediate to read measurement data and to monitor electrical loads in the installation.
Through this device, power and energy monitoring operations allow the user highlighting energy consumption trends.
This enhances the awareness towards correct energy consumption and increases energy efficiency in the common user behavior. Installed within commercial buildings, M2M Basic is related to main distribution and energy efficiency functionalities. The power meter allows power monitoring operations, along with the improvement of reactive energies and power factor monitoring.

As measurement data can be easily accessed thanks to the power meter, it is possible for the user to apply specific measures to increase reliability of equipment and to avoid supplying unnecessary loads. Inefficient loads can be identified through basic electrical parameters measurement and basic power quality functionalities.
This power meter represents a basic energy measurement system that can be also integrated in industrial applications. Here, users can keep track of energy consumption of specific and critical processes and loads. This can help, foreseeing future electricity costs and avoiding penalties from the utility, e.g. for exceeding minimum power factor value and maximum reactive energy.

M2M Basic
Applications

Integrating the power meter in larger systems, accessing to measurement data, configuring the device, updating the firmware to the latest version at any moment, even when it is not possible to be in front of the power meter: enhance the potential of M2M Basic Modbus functionalities thanks to M2M SW.

Users are often far away from the switchboards: large commercial buildings and factories do not allow keeping track of the behavior of the electrical system directly on the power meter. Thanks to M2M SW, users can remotely update both M2M Basic and M2M Basic Modbus firmware to the latest version. This helps saving maintenance costs and keeping the device at maximum level of update. The remote firmware update functionality allows users being sure to have the latest features and the most secure device. Moreover, through communication capabilities, M2M Basic Modbus helps remotely monitoring the system on an ongoing basis and configuring the power meter directly through a PC equipped with M2M SW. M2M Basic Modbus can be easily integrated with energy management systems and supervisory systems thanks to the RS-485 Modbus RTU communication protocol.
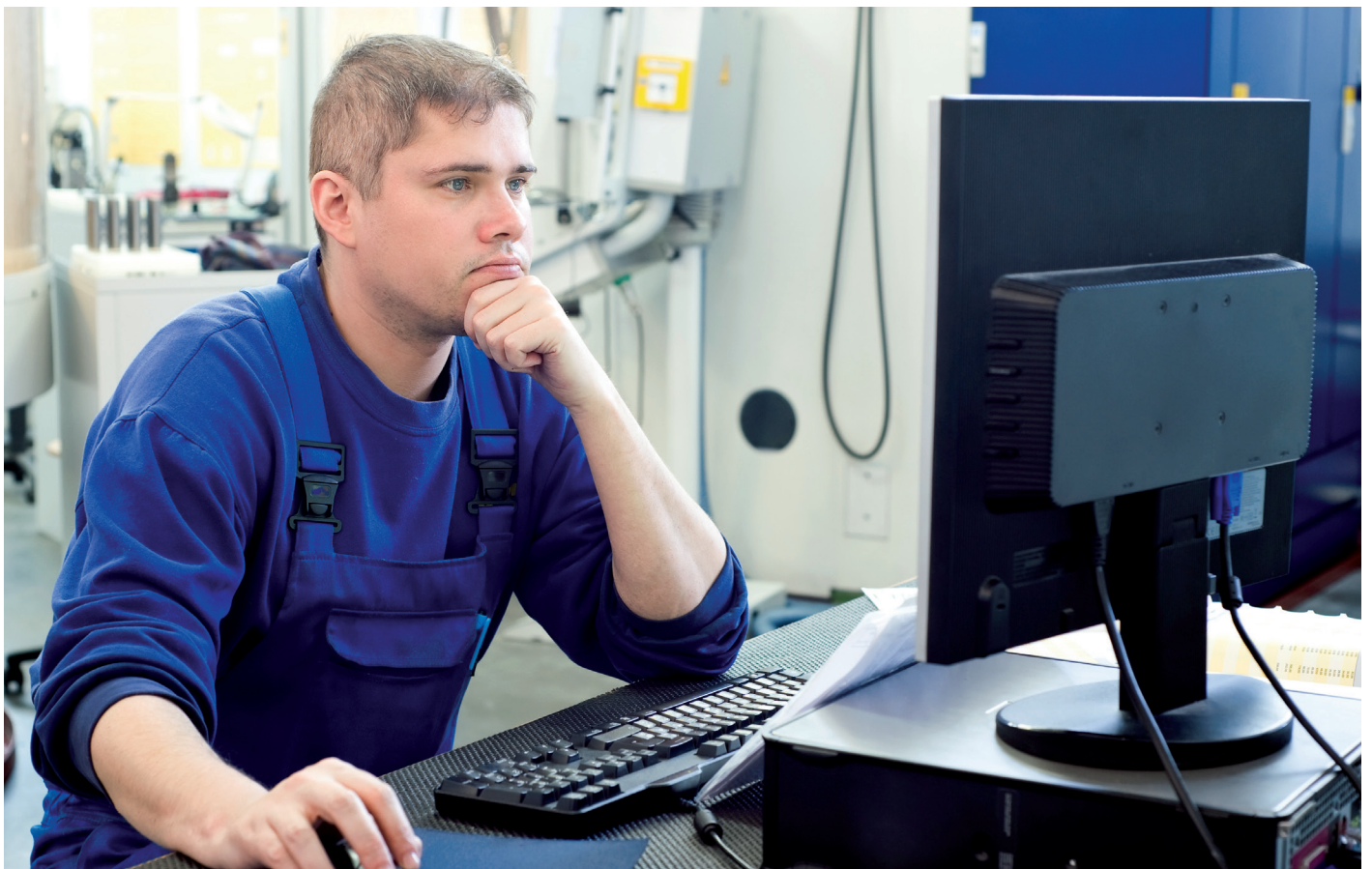
Energy efficiency
Measurement devices selection table

The complete ABB range of measurement devices addresses with different products the different needs, from sub-distribution switchboards, industrial and commercial buildings to main distribution switchboards, power distribution centers and substations.

	Modular and front panel multimeters		
	DMTME	**DMTME-72**	**DMTME-96**
Overall dimensions	6 DIN modules	72x72x90	96x96x103
Display	LED	LED	LED
Power supply	110 V a.c. 230 V a.c.	230 V a.c. 400 V a.c.	110 V a.c. 230 V a.c.
TRMS voltage			
TRMS current			
Frequency			
Power factor			
Cosj			
Active power			
Reactive power	**Electrical parameters measurement**	**Electrical parameters measurement**	**Electrical parameters measurement**
Apparent power			
Active energy			
Reactive energy			
Apparent energy			
Peak value Min/Max/Avg			
Timer and count-down			
Power 4Q			
Energy 4Q			
Current THD			
Voltage THD			
Password set up			
Neutral current			
Tariff			
Maximum demand			
Harmonic analysis up to 31°			
Wave form visualisation			
Memory 1 MB			
Outputs	**Digital**	**Digital**	**Digital**
Inputs			
Serial port	**RS485**	**RS485**	**RS485**
Protocols	**Modbus RTU**	**Modbus RTU**	**Modbus RTU**

All devices of the ABB range are able to measure all main parameters for monitoring electrical systems. Moreover power meters and network analysers also have power quality and energy management functionalities. ABB offer includes several options for different built-in communication protocols that allow the interconnection with other devices.

Front panel network analysers		
M2M BASIC	**M2M**	**ANR96**
96x96x102	96x96x77	96x96x130
LED	LCD backlit	LCD graphic backlit
85-265 V a.c. 90-300 V d.c.	24-240 V a.c./d.c.	20-60 V a.c./d.c.
Electrical parameters measurement	**Electrical parameters measurement**	**Electrical parameters measurement**
Power quality	**Power quality**	**Power quality**
		Energy management
	Digital Electromechanical relays Analogue	**Digital**
	Digital	**Digital**
RS485	**RS485, RJ45**	**RS485, RS232, RJ45**
Modbus RTU	**Modbus RTU, Ethernet TCP/IP, Profibus DP**	**Modbus RTU, Ethernet TCP/IP, Profibus DP**

M2M Basic
Technical details

Auxiliary power supply	Voltage range	85 … 265Vac/90…300Vdc
	Protection fuse	0.5 A
Power consumption		3 VA
Measurement type		Sampling TMRS
Accuracy class	Voltage	±0,5% reading value According IEC 61557-12
	Current	±0,5% reading value According IEC 61557-12
	Frequency	±0,2% reading value According IEC 61557-12
	Power factor	±1% reading value According IEC 61557-12
	Active power	±1% reading value According IEC 61557-12
	Reactive power	±1% reading value According IEC 61557-12
	Active energy	±1% reading value According IEC 61557-12
Measurement range	Voltage	40...300VL-N, 69...515VL-L
		Auto range
	Current	from 20 mA to 6 A TRMS
		Auto range
	Frequency	from 45 to 65 Hz
		Visualisation: with 2 decimal.
	Power factor	Visualisation with 3 decimals
	Cosφ	Visualisation with 3 decimals
Installation	Distribution networks	Low voltage
		Single phase insertion
		3-phase with neutral
		3-phase without neutral
	Ammetric inputs	Always use external CT
		Primary from 1 to 10.000 A a.c. approx., Secondary 5 A and 1 A a.c. approx.
	Voltmetric inputs	Direct insertion up to 300 a.c. approx.
		Indirect insertion with VT:
		Primary from 40 to 800k V a.c. approx., secondary from 40 to 300 V a.c.
	Protection fuse	0.5 A
Data refersh rate		1 time/second
Harmonic distortion		Measurement bandwidth up to 2000 Hz
Energy measurement	3-phase max value counted	10 GWh / Varh / VAh
Terminal characteristics	Ammetric inputs	Section 3.3 mm² - Step 9.5 mm
	Voltmetric inputs	Section 2.5 mm² - Step 7.62 mm
	RS485 Serial port	Section 1.5 mm² - Step 3.81 mm
Overall dimensions		96 mm x 96 mm x 102,3 mm (Depth inside the switchboard: 94,3 mm)
Weight		0.350 kg
Standards	Degree of protection	IEC 60529
	Accuracy class	IEC 61557-12
	Electrical safety	IEC 61010-1
User interface	Display	Navigation through the measured data
	Display type	LED
	Display dimensions	75x60mm

Communication interface - RS485	Protocol	Modbus RTU
	Electric standard	RS485 with optical isolation
	Baud rate	4.8, 9.6, 19.2, 38.4 kbps
	Parity number	Odd, Even, None
	Stob bit	1, 2
	Address	1-247
	Connector	3 pole terminal
Climatic conditions	Storing	from -40 to 85°C
	Operation	from -25 to 70°C
	Relative humidity	75%
Degree of protection	Frontal	IP50
	At terminals	IP20

M2M Basic
Technical details

M2M Basic measures in TRMS mode more than 40 electrical parameters on 3-phase and single phase networks. The device is suitable for panel door mounting and includes basic power quality functionality, like THD measurement and bidirectional metering of energy on 4 quadrants. It has a wide range for auxiliary power supply: from 85 to 265 V AC and from to 90 to 300 V DC.

M2M Basic is equipped with a red LED HMI easy to view and four buttons keyboard for the navigation and configuration of the meter. The firmware of both M2M Basic and M2M Basic Modbus can be remotely updated via the software M2M SW. Communication capabilities allow to remotely configure and monitor M2M Basic Modbus through M2M SW and to connect the device to a supervisory software.

Installation of M2M Basic is completed with:

- CT current transformers and VT voltage transformers to transfer the measurement signals to the device
- E 9F fuses and E 90 fuse holder for protection of auxiliary power supply and voltage inputs
- CP-D power supplies for 24V DC auxiliary power supply
- TS-C, TM-S and TM-C transformers for AC auxiliary power supply

Type	Description	Protocol	Serial Port	ABB Code	Bbn 8012542 EAN
M2M Basic	Power meter	-	-	2CNM203002R2001	178323
M2M Basic Modbus	Power meter with communication	Modbus RTU	RS485	2CNM203001R2001	750222

Overall dimensions

94.3   8
102.33

96

96

dimensions in mm
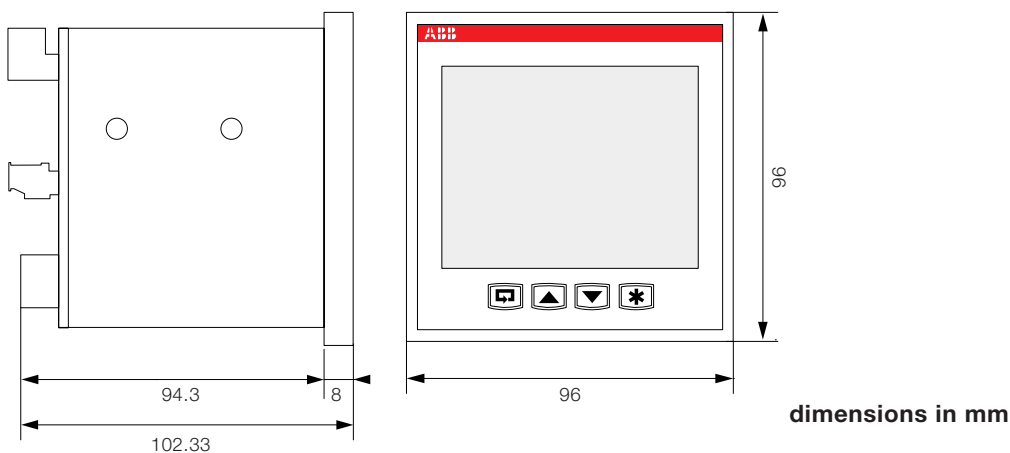
Measurement devices
Order codes

ANR Network analyser

- The ANR analyser allows effective measurement, in TRMS mode, of electrical parameters, THD total harmonic distortion up to the 31st harmonic, both energy and power in 4 quadrants. For the retrieval of load profiles, it is possible to measure and also record network parameters and alarms and associate them to a time-stamp. Modbus RTU, Modbus TCP/IP and Profibus protocols are installed for remote communication on this device.
- Storing of all measured parameters is achieved through the internal memory, expanded to 1 Mbyte in the ANR96P model. All ANR versions have 2 programmable digital outputs. ANR96PRF models have built-in Profibus DP protocol, ANR96LAN models have built-in Modbus TCP/IP protocol and RJ45 port, while the rest of the range has built-in Modbus RTU protocol. The accuracy of measures has been improved to 0,2% in ANR96 02 models.

ANR96

Auxiliary supply	Program. display input	Storage	Bbn 8012542	Order details		Weight 1 piece	Pack unit
V a.c./d.c.			EAN	Type code	Order code	kg	pc.
20÷60	2	128 Kb	943402	ANR96-24	2CSG113000R4051	0.430	1
85÷265	2	128 Kb	943501	ANR96-230	2CSG213000R4051	0.430	1
20÷60	4	1 Mb	943600	ANR96P-24	2CSG123000R4051	0.430	1
85÷265	4	1 Mb	943709	ANR96P-230	2CSG223000R4051	0.430	1
20÷60	2	128 kb	583332	ANR96PRF-24	2CSG258333R4051	0.430	1
85÷265	2	128 kb	571537	ANR96PRF-230	2CSG257153R4051	0.430	1
20÷60	2	128 kb	772538	ANR96LAN-24	2CSG277253R4051	0.430	1
85÷265	2	128 kb	770336	ANR96LAN-230	2CSG277033R4051	0.430	1
20÷60	2	128 kb	573838	ANR96-24 02	2CSG257383R4051	0.430	1
85÷265	2	128 kb	562030	ANR96-230 02	2CSG256203R4051	0.430	1

M2M

The M2M network analyser measures the real value and analyses in real time the main electrical parameters in single-phase or three-phase networks, also verifying the quality of the energy thanks to THD measurements. Through the bidirectional metering of energy and power in the 4 quadrants, it is possible to visualize their production and consumption in a single device. M2M product range includes built-in specific protocols for interaction with control systems, like Modbus RTU, Modbus TCP/IP and Profibus through specific communication ports (RS485 and RJ45). Digital pulse outputs, digital programmable outputs, relay outputs and analogue outputs are installed for connection to control and supervision systems. Digital inputs allow pulse acquisition from other energy counters or users.

M2M

Communication protocol and interface	2 relay outputs	3 digital inputs, 2 analogue outputs	Bbn 8012542	Order details		Weight 1 piece	Pack unit
			EAN	Type code	Order code	kg	pc.
			998839	M2M	2CSG299883R4052	0.300	1
Modbus RTU RS485			998938	M2M MODBUS	2CSG299893R4052	0.350	1
Ethernet RJ45			999034	M2M ETHERNET	2CSG299903R4052	0.400	1
Profibus RS485			999133	M2M PROFIBUS	2CSG299913R4052	0.400	1
Modbus RTU RS485	■		999232	M2M ALARM	2CSG299923R4052	0.400	1
Modbus RTU RS485		■	999331	M2M I/O	2CSG299933R4052	0.400	1
			999430	M2M LV	2CSG299943R4052	0.300	1
Modbus RTU RS485			969921	M2M LV MODBUS	2CSG296992R4052	0.350	1

Measurement devices
Order codes

DMTME

DMTME-96

DMTME-72

DMTME multimeters

- The DMTME instruments are digital multimeters that measure in TRMS mode the main single-phase and three-phase electrical parameters, including the max/min/average detection of the main electrical parameters and the active and reactive energy count. Measured variables are displayed locally on four red 7-segment LED displays.
- DMTME-I-485-96 and DMTME-I-485-72 models are also equipped with two digital relays, programmable as alarm outputs or as pulse outputs for remote metering of energy consumption.
- Communication over Modbus RTU protocol is possible through the RS485 serial port.

RS485 serial port	Program. digital output	Auxiliary supply	Bbn 8012542	Order details		Weight 1 piece	Pack unit
		V a.c.	EAN	Type code	Order code	kg	pc.
-	-	110-230	975700	DMTME	2CSM170040R1021	0.450	1
■	2	110-230	975809	DMTME-I-485	2CSM180050R1021	0.450	1

DMTME-96 panel multimeters

Auxiliary supply 230 V a.c. and 110 V a.c.

RS485 serial port	Program. digital output	Dimensions	Bbn 8012542	Order details		Weight 1 piece	Pack unit
			EAN	Type code	Order code	kg	pc.
-	-	96x96	046752	DMTME-96	2CSG133030R4022	0.450	1
■	2	96x96	046851	DMTME-I-485-96	2CSG163030R4022	0.450	1

DMTME-72 panel multimeters

Auxiliary supply 230 V a.c. and 400 V a.c.

RS485 serial port	Program. digital output	Dimensions	Bbn 8012542	Order details		Weight 1 piece	Pack unit
			EAN	Type code	Order code	kg	pc.
-	-	72x72	046554	DMTME-72	2CSG132030R4022	0.450	1
■	2	72x72	046653	DMTME-I-485-72	2CSG162030R4022	0.450	1

M2M Basic
Questions and answers

What is the difference between cosφ and power factor?

In an electrical system with alternative current, Cosφ estimates the displacement angle between the voltage and current. Cosφ value ranges form π/2 to -π/2, depending on the system. The power factor is the ratio between active and apparent power thus it is used in lines with harmonic components. For non-sinusoidal operations it therefore makes sense to talk about the power factor as opposed to cosφ.

Is it possible to install M2M Basic in a Modbus RTU network where other measurement devices are already installed?

It is possible if each device has built-in Modbus RTU protocol. M2M Basic is compatible with all measurement devices that are equipped with a Modbus RTU serial output, due to its communication protocol. The compatibility is also guaranteed by the possibility to set all communication parameters, like stop bit, parity number and communication speed.

Why is TRMS measurement important?

Inside distribution systems, efficient technologies with low energy absorption (such as computers, electronic regulators, printers) are continuously increasing. They are called non-linear loads, as they generate a non-sinusoidal waveforms. For this reason, in order to measure electrical parameters, the calculation of the average value in a defined period is not enough. Thus, the real value is estimated trough a TRMS measurement, which follows some operational procedures: wave sampling over the whole period, elevation the squares of samples, sum of squares and mean, calculation of the square root.

How does the accuracy affect the real measure of energy system performances and costs?

The accuracy of measuring instruments is a key parameter to determine the actual performance of a network. Every electrical system components are equipped with a specific precision class that directly influences the result of the final measurement.
Therefore, the global measuring error of the metering line is expressed by the following

$$\varepsilon_t = \sqrt[2]{\sum_{i=0}^{N} \varepsilon_i}$$

Where:
ε_t= percentage of the global measuring error
ε_i= accuracy class of metering device
N= total number of the connected devices

The greater the accuracy, the smaller the error on the measurement.
To evaluate how this parameter can affect the system performances it is useful to analyze the following example about the quantification in economic terms of the loss due to the mystification of the energy consumption. Consider an installation of 500 kW rated power that works for 2500 hours/year, for a total of 1250000 kWh/year energy consumed.

In the table below are shown the different supported annual costs in according to the variation of the measurement device accuracy, supposed that the global accuracy of other connected instrument ε_m is 1%:

	Exemple 1	Exemple 2	Exemple 3
ε_m	1%	1%	1%
ε_i	1%	2%	0.5%
ε_t	1.41%	2.24%	1.12%
Annual consumption measured with error	1267,625 kWh/year	1278,000 kWh/year	1264,000 kWh/year
Average cost of energy	0,18 €/kWh	0,18 €/kWh	0,18 €/kWh
Overall expense	228,173 €/year	230,040 €/year	227,520 €/year

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