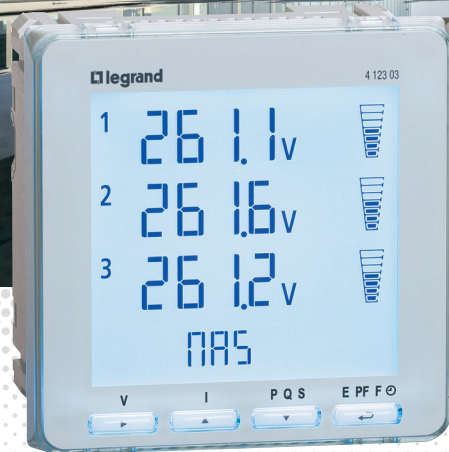


EMDX³

MULTI-FUNCTION MEASURING UNITS



Legrand offers complete solutions to meet energy efficiency needs.

This technical guide provides all the essential information you need to know about **EMDX³ multi-function measuring units** in order to understand how to choose them, their characteristics, installation and configuration rules, etc ...

This document can be downloaded from the online catalog and is a complete technical guide on **EMDX³ multi-function measuring units** in the distribution board.

LEGAL INFORMATION

Presentation pictures do not always include Personal Protective Equipment (PPE), but this is a legal and regulatory obligation that must be scrupulously respected.

In accordance with its continuous improvement policy, Legrand reserves the right to change the specifications and illustrations without notice. All illustrations, descriptions and technical information included in this document are provided as indications and cannot be held against Legrand.

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SAFETY

INSTRUCTIONS

General information

- Use only the products and accessories recommended by the Legrand Group in the catalogue, instructions, technical data sheets and all other documents provided by Legrand (hereinafter referred to as «the Documentation») in compliance with the installation rules.
- Improper installation and/or use may result in the risk of arcing in the enclosure, overheating or fire. The enclosures must be used under normal conditions, they must not be subjected to Voltage / Current / Temperature values other than those specified in the Documentation.
- Legrand declines all responsibility for any modification or repair of the equipment making up the enclosure that is not authorized by the Legrand Group, as well as any failure to comply with the rules and recommendations specified by Legrand in the Documentation. In addition, in the cases mentioned above, the warranty granted by Legrand will not be applicable.
- It is necessary to check that the characteristics of the products are appropriate for their environment and use during maintenance operations, and to refer to the Documentation. If you have any questions or require clarification, please contact Legrand Group.
- The installation, use and maintenance of the enclosures and their components must be carried out by qualified, trained and authorized personnel, in accordance with the regulations in force in each country.




RISK OF ELECTRIC SHOCK, BURNS AND EXPLOSION.

- People working on the installation must have the appropriate electrical authorizations for the work to be carried out.
- Wear the PPE (Personal Protective Equipment) necessary to work on live products.
- Respect the safety rules related to electrical work.
- Improper electrical and mechanical use of equipment can be dangerous and may result in personal injury or damage to property.
- Depending on the maintenance operations to be carried out, partial or total power cuts of the enclosure concerned should be planned before any work.
- When performing operations that involve access to the inside of the enclosure, be aware of the risk of burns before touching any products or metal parts.
- Before turning the power back on, make sure that there are no foreign bodies and that all physical protections have been put back in place (e.g.: screens, covers, shields).

Any failure to strictly apply the procedures and to respect these recommendations, could lead to serious risk of accident, endangering people and property (in particular, without limitation, risk of burns, electric shocks, etc.).



 The rules and recommendations in this document are based on our knowledge of the typical conditions of use of our products in the fields of application usually encountered. However, it is always the customer's responsibility to verify and validate that Legrand products are suitable for its installation and use.

The customer must ensure proper installation, maintenance and operation of the equipment to avoid any risk of injury to personnel or damage to property in the event of product failure, especially for applications that require a very high level of safety (e.g., those in which the failure of a component may endanger human life or health).

The rules for storage, handling, installation and maintenance and the appropriate precautions and warnings must be strictly observed and applied.

EMDX³ MULTI-FUNCTION MEASURING UNITS

Product specifications

EMDX³ multi-function measuring units record the energy consumed by the various circuits, measure the electrical values (current, voltage, power, etc.) or analogue values (temperature) to check the installation is working properly. They monitor energy quality by analyzing harmonics and measuring the reactive energy. They communicate the measured values to supervision or energy management systems, in order to optimise the consumption and energy quality of electrical circuits in commercial and industrial buildings.



CHARACTERISTICS

- **Display:** LCD.
- **Voltage measurement Un:**
 - Modular & ACCESS units:
Phase / Phase: 80 – 500 V
Phase / Neutral: 50 – 290 V
 - PREMIUM unit:
Phase / Phase: 80 – 690 V
Phase / Neutral: 50 – 400 V
- **Frequency:** 50 – 60 Hz.
- **Auxiliary power supply:**
 - 80 – 265 VAC
 - 100 – 300 VDC
- **Conforming to standards:**
 - IEC 61557-12
 - IEC 62053-22/23
- **Accuracy:**
 - Active energy (EN 62053-21): class 0.5
 - Reactive energy (EN 62053-23): class 2
- **Connection:** with CT.
- **Mounting:**
 - on DIN rail for modular unit
 - on door for ACCESS and PREMIUM units
- **Dimensions:**
 - 4 modules for modular unit
 - 92 x 92 mm for cut-out for ACCESS and PREMIUM units

EMDX³ PREMIUM FEATURES CAT.NO 4 120 53



- **Embedded memory**

- **Programmable recording time**

- **Additional embedded measurements:**

- harmonics
- flickers
- voltage dips
- pulse overvoltage
- micro power outages
- frequency fluctuation

- **Data remotely accessible through the communication module**

Cat.No 4 120 55

- **Conforming to standards:**

- IEC 61557-12
- IEC 62053-22 class 0.5
- IEC 62586-1/2 class S
- EN 50160

PRODUCT SELECTION

Multi-function measuring units should be selected according to: the mains supply, fixing system, required displayed values and communication type, which allows it to be run by a supervision system.

CAT.NO		4 120 45	4 120 51	4 120 47
Type		Modular 4 modules	ACCESS 4 modules	ACCESS On door
MEASUREMENT				
Current	Instantaneous: I1 - I2 - I3 - IN	●	●	●
	Max. average: I1 - I2 - I3 - IN	●	●	●
	Average of 3: (I1 - I2 - I3) / 3	●	●	●
Voltage & Frequency	Instantaneous: U1-U2-U3-U12-U23-U31-F	●	●	●
	Min/max: U1-U2-U3-U12-U23-U31-F	●	●	●
	Instantaneous: P - Q - S	●	●	●
Power	Average: P - Q - S	●	●	●
	Max. average: P - Q - S	●	●	●
	Instantaneous power factor	●	●	●
METERING				
Energy	Total/partial active	●	●	●
	Total/partial reactive	●	●	●
Time		●	●	●
HARMONICS ANALYSIS				
Total harmonic distortion	Orders	9 ⁽³⁾ to 25 ⁽²⁾	9 ⁽³⁾ and 25 ⁽²⁾	9 ⁽¹⁾ to 25 ⁽²⁾
	Currents	●	●	●
	Phase-to-neutral voltages	●	●	●
	Phase-to-phase voltages	●	●	●
OTHER				
Dual tariff			●	
Temperature				
Alarm on electrical values				
Communication	MODBUS RS485	●	●	●
	Pulse	●	●	●
MODULES				
RS485 MODBUS communication				
Function	2 outputs: pulse or alarm feedback			
	Memory + MODBUS RS485			
	2I/2O: monitoring/remote control			
	2 x 0/4-20 mA analogue outputs			
	2 PT100 temperature			
	Harmonics analyzer			

⁽¹⁾ with option module ⁽²⁾ available on RS485 COM ⁽³⁾ available on display

⁽⁴⁾ THD only available with module Cat.No 4 120 61 + communication module Cat.Nos 4 120 55 or 4 120 56.

⁽⁵⁾ Only for versions prior to August 2018

CAT.NO		4 120 52	4 120 53
Type		ACCESS	PREMIUM
		On door	On door
MEASUREMENT			
Current	Instantaneous: I1 - I2 - I3 - IN	●	●
	Max. average: I1 - I2 - I3 - IN	●	●
	Average of 3: (I1 - I2 - I3) / 3	●	●
Voltage & Frequency	Instantaneous: U1-U2-U3-U12-U23-U31-F	●	●
	Min/max: U1-U2-U3-U12-U23-U31-F	●	●
Power	Instantaneous: P - Q - S	●	●
	Average: P - Q - S	●	●
	Max. average: P - Q - S	●	●
Instantaneous power factor	●	●	
METERING			
Energy	Total/partial active	●	●
	Total/partial reactive	●	●
Time	●	●	
HARMONICS ANALYSIS			
Total harmonic distortion	Orders	9 ⁽¹⁾ and 25 ⁽²⁾	9 ⁽³⁾⁽⁴⁾ and 50 ⁽²⁾⁽⁴⁾
	Currents	●	●
	Phase-to-neutral voltages	●	●
	Phase-to-phase voltages	●	●
OTHER			
Dual tariff			●
Temperature			● ⁽¹⁾
Alarm on electrical values			● ⁽¹⁾
Communication	MODBUS RS485	●	● ⁽¹⁾
	Pulse	●	● ⁽¹⁾
MODULES			
MODBUS RS485 communication			4 120 55
2 outputs: pulse or alarm feedback			4 120 59
Memory + MODBUS RS485			4 120 56 ⁽⁵⁾
2I/2O: monitoring/remote control			4 120 57
2 x 0/4-20 mA analogue outputs			4 120 60
2 PT100 temperature			4 120 58
Harmonics analyzer			4 120 61 ⁽²⁾⁽⁵⁾

⁽¹⁾ with option module ⁽²⁾ available on RS485 COM ⁽³⁾ available on display

⁽⁴⁾ THD only available with module Cat.No 4 120 61 + communication module Cat.Nos 4 120 55 or 4 120 56.

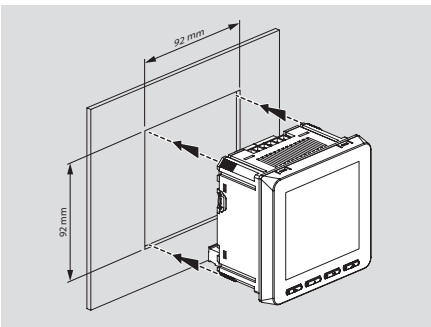
⁽⁵⁾ Only for versions prior to August 2018

MOUNTING MULTI-FUNCTION MEASURING UNITS

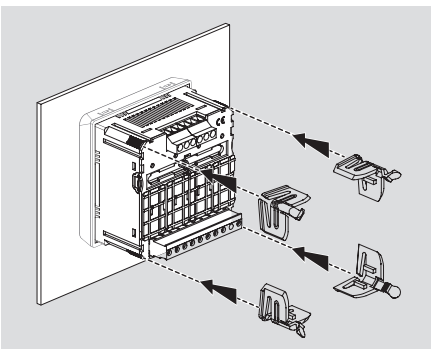
Modular units are mounted on a DIN rail. Door-mounted units require a 92 x 92 mm cut-out in the door or faceplate.



Making the cut-out with a punch.



Once created, insert the measuring unit.



Measuring unit held with clips.

FUNCTION MODULES FOR EMDX³ PREMIUM MULTI-FUNCTION MEASURING UNIT



2 inputs/ 2 outputs
Cat.No 4 120 57



2 x 0/4-20 mA analogue outputs
Cat.No 4 120 60



Temperature 2 x PT100
Cat.No 4 120 58



RS485 communication module
Cat.No 4 120 55



2 pulse or alarm outputs
Cat.No 4 120 59



Function modules can only be adapted to fit on PREMIUM measuring unit Cat.No 4 120 53.

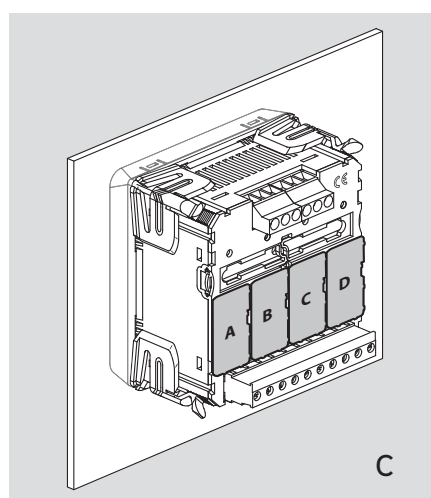
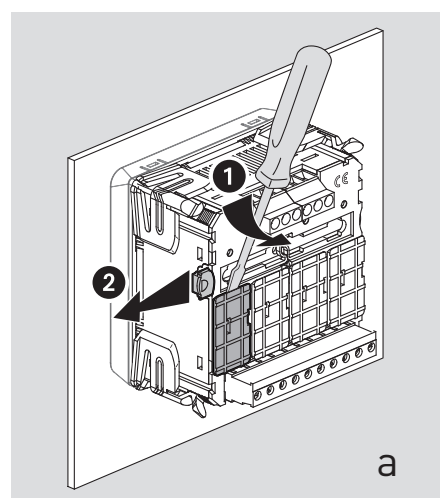
MOUNTING OPTIONAL MODULES

Optional modules are fixed at the back of door-mounted measuring units.

You need to:

- remove the plastic cover (figure a),
- slide the tab to the left (a),
- place the module in the chosen slot (b),
- slide the tab back (c).

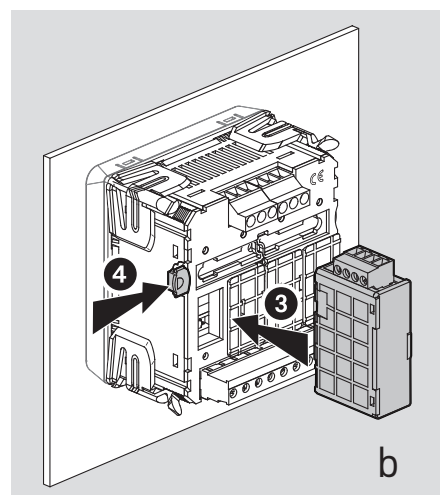
CAT.NO	DESCRIPTION	NUMBER MAX.	POSITION			
			A	B	C	D
4 120 55	RS485 communication module	1	X	-	-	-
4 120 57	Module with 2 inputs/ 2 outputs	2	-	-	X	X
4 120 58	Module with 2 PT100 inputs	1	-	-	-	X
4 120 59	Module with 2 pulse or alarm outputs	2	X	X	X	X
4 120 60	Module with 2 analogue outputs	2	-	-	X	X



Warning, some modules are mounting in specific slots. Their position is indicated in each instruction sheet (c).



Warning, the multi-function measuring unit must be switched off before inserting the modules.



CONNECTION

The multi-function measuring units, as the electricity meters with CT connection, have 2 types of inputs. The «current» inputs and the «voltage» inputs.

Each secondary of the transformers is connected to the corresponding inputs of the measuring unit. This allows the measurement of the current flowing in the CT.

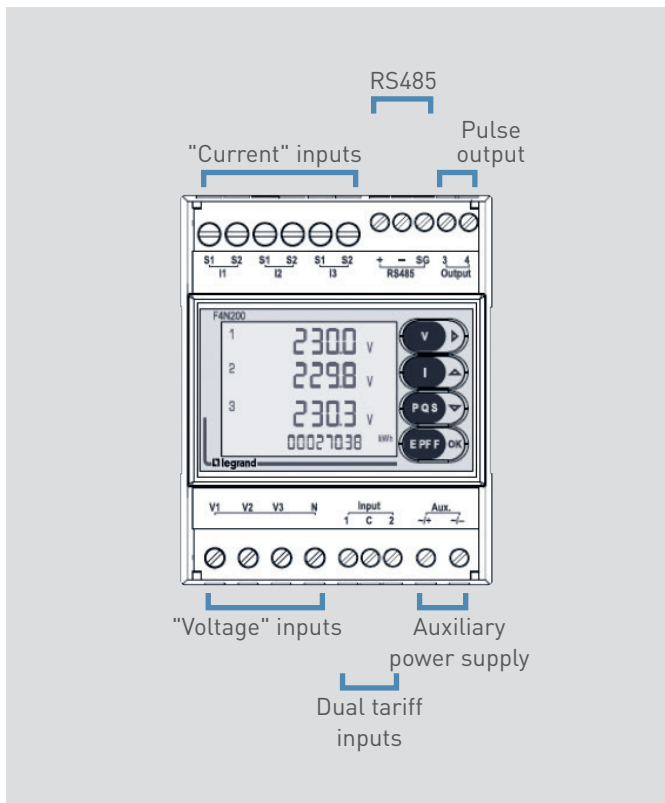
For voltage measurement, each conductor is connected respectively to the voltage inputs.

! Measuring units need an auxiliary power supply in order to work.

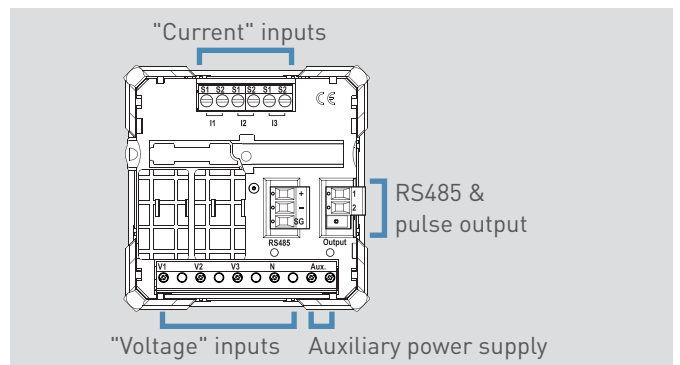
Fuse protection is recommended for:

- auxiliary power supply:
 - 1 A gG for door-mounted unit,
 - 0.5 A gG for modular unit.
- voltage taps:
 - 0.5 A gG.

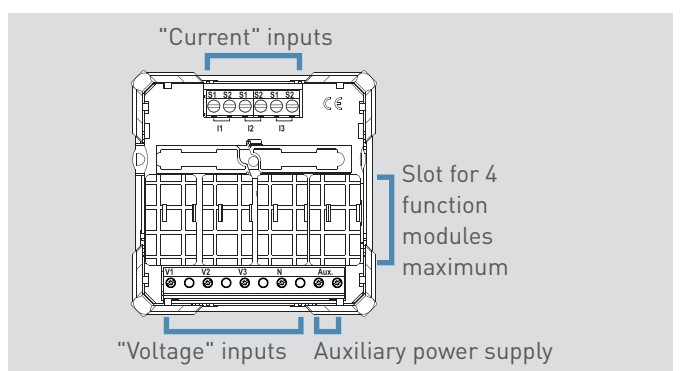
■ Modular multi-function measuring unit



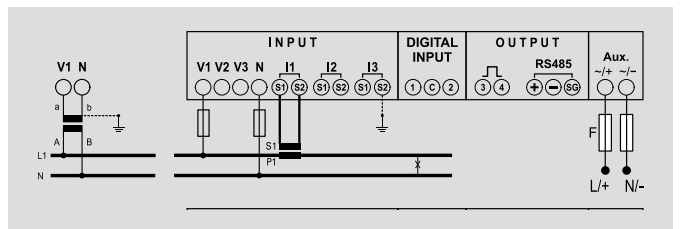
■ ACCESS multi-function measuring unit



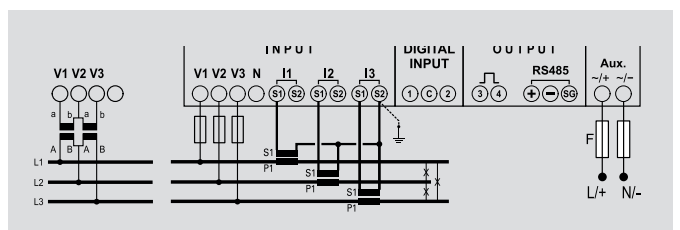
■ PREMIUM multi-function measuring unit



■ Single-phase connection



■ Three-phase connection



SETTING PARAMETERS

After the connection has been made, it is necessary to modify the parameters of the multi-function measuring unit so that it displays consistent data in relation to the currents flowing in the circuits being measured.



Modular multi-function measuring unit

- Programming mode is entered by pressing and holding down the “OK” button on the front.
- Access to the parameters is locked by 2 password levels which can be changed, level 1: “1000”, level 2: “2001”.
- The “↑↓” buttons change the value of the chosen parameter.
- The “→” button moves the cursor.
- Pressing the “OK” button briefly confirms the change.
- Pressing and holding down the “↑” button goes back to the previous page.
- Pressing and holding down the “OK” button exits programming mode.



ACCESS & PREMIUM multi-function measuring unit

- Programming mode is entered by simultaneously pressing both the “↑ + ↓” buttons on the front.
- Access to the parameters is locked by 2 password levels which can be changed, level 1: “1000”, level 2: “2001”.
- The “↑↓” buttons change the value of the chosen parameter.
- The “→” button is used to move the cursor.
- Pressing the “←” button briefly confirms the change.
- Simultaneously pressing both the “↓ + ←” buttons goes back to the previous page.
- In programming mode, pressing and holding down both the “↑ + ↓” buttons exits programming mode without saving.
- After the last parameter is set, pressing the “←” button exits programming mode and saves any data which has been changed.

PARAMETER SETTING (CONTINUED)

PARAMETER IDENTIFICATION

DISPLAY	PARAMETER
PASSE	Password – default value 1000
SYS	Choice of supply type
bASE CUrr	Nominal current at the external CT secondary 1 A if external CT/1 A or 5 A if external CT/5 A
Ct	CT current transformer ratio For example, if CT 100/5 then the value to be set on the control unit is Ct = 100
Ut	VT voltage transformation ratio For example, if VT 600/100 then the value to be set on the control unit is Vt = 6
Fn 50-Hz	50-Hz Nominal frequency (automatic recognition of the frequency)
rUn hOUr	Timer start with choice of voltage U or power P
rUn VAL	Timer setting with option P value of 0.....50% Pn
tiME	Integration time valid for current and average power
Cont	Screen contrast
HArM MAh	Choice of harmonic analysis number
Out	Choice of output type, pulse = iMP and alarm = ALrM
ALrM tYPE	Choice of alarm type, min or max
ALrM MEAS	Choice of alarm value type
ALrM rELE	Choice of relay output type, NO or NC
PULS tYPE	Output type, active or reactive
PULS VAL	Pulse weight
PULS dUr	Pulse duration
C485 Addr	Modbus communication address
C485 bAud	Modbus baud rate
C485 PAr	Modbus parity bit (nonE, EVEn, odd)
C485 tiME	Waiting time before response
bL it	Screen backlighting
SAUE	Save changed data



If the current and/or voltage transformation ratios are changed, the measuring units are reset automatically.

LE PARAMÉTRAGE (SUITE)

MULTI-TARIFF ONLY ON MODULAR MEASURING UNIT

Multi-tariff operation, with up to 4 tariffs, is possible with modular control unit 4 120 51. Simply use **terminals 1/C/2**, EN 61131-2 type 2 inputs max. 27 VDC.

Depending on the modular control unit parameter settings, it is possible to select, for example, the following functions:

- “Partial metering”, user reset option
- “Multi-tariff metering”, option of selecting several tariffs such as Offpeak/Peak.

DUAL TARIFF ON PREMIUM MEASURING UNIT

The dual tariff is available on the PREMIUM unit Cat.No 4 120 53 by adding the 2 inputs / 2 outputs module Cat.No 4 120 57.

Switching between tariff 1 and tariff 2 is only done on input 1 (terminals 15 and 16) and must be of the potential-free dry contact type.

The module must be installed in position C of the PREMIUM unit.

Energy consumption will be available as follows: it:

- * **tariff 1: total energy,**
- * **tariff 2: partial energy.**

DATA TRANSFER

Measurement control units have pulse or RS485 type outputs which can send data to an operating system.

Measurement control units have:

- One output for modular or ACCESS control units.

- Up to 8 outputs (and 4 inputs) for the PREMIUM control unit.

■ Wired outputs available:

- Opto-relay output with SPST-NO voltage-free contact.

Pulse output compatible with S0 EN/IEC 62053-31.

- Maximum voltage 27 V AC/DC.
- Maximum current 50 mA.
- Type of data:

- **Active energy Wh, Reactive energy Varh:**

Pulse weight:

1 pulse/10 – 100 – 1000 Wh (VARh)

1 pulse/10 – 100 – 1000 kWh (kVARh)

1 pulse/10 MWh (MVARh).

Pulse duration:

50 – 100 – 200 – 300 – 400 – 500 ms.

- **Alarm (only for the modular unit):**

Value: phase-to-neutral and phase-to-phase voltages, current, frequency, active and reactive powers

Configuration: Ht, Lt,

Hysteresis, time, relay.

■ Modbus output available:

- RTU mode Modbus protocol
- Baud rate 4800, 9600, 19,200, 38,400 Bauds
- Address from 1 to 255
- Parity: even, odd, none
- Stop bit: 1
- 2-pair wiring RS485 standard (Bel-den 9842)
- Output galvanically isolated from the input and the auxiliary power supply.

MODBUS ADDRESSING

To allow systems integrators to develop an energy management program, addressing tables are available in the E-catalogue on www.legrand.com in the manuals or in separate files depending on the device. All the information concerning available registers can be found in these documents.



If you need examples of how to read or write a register, you should refer to the “Help and definition” section.

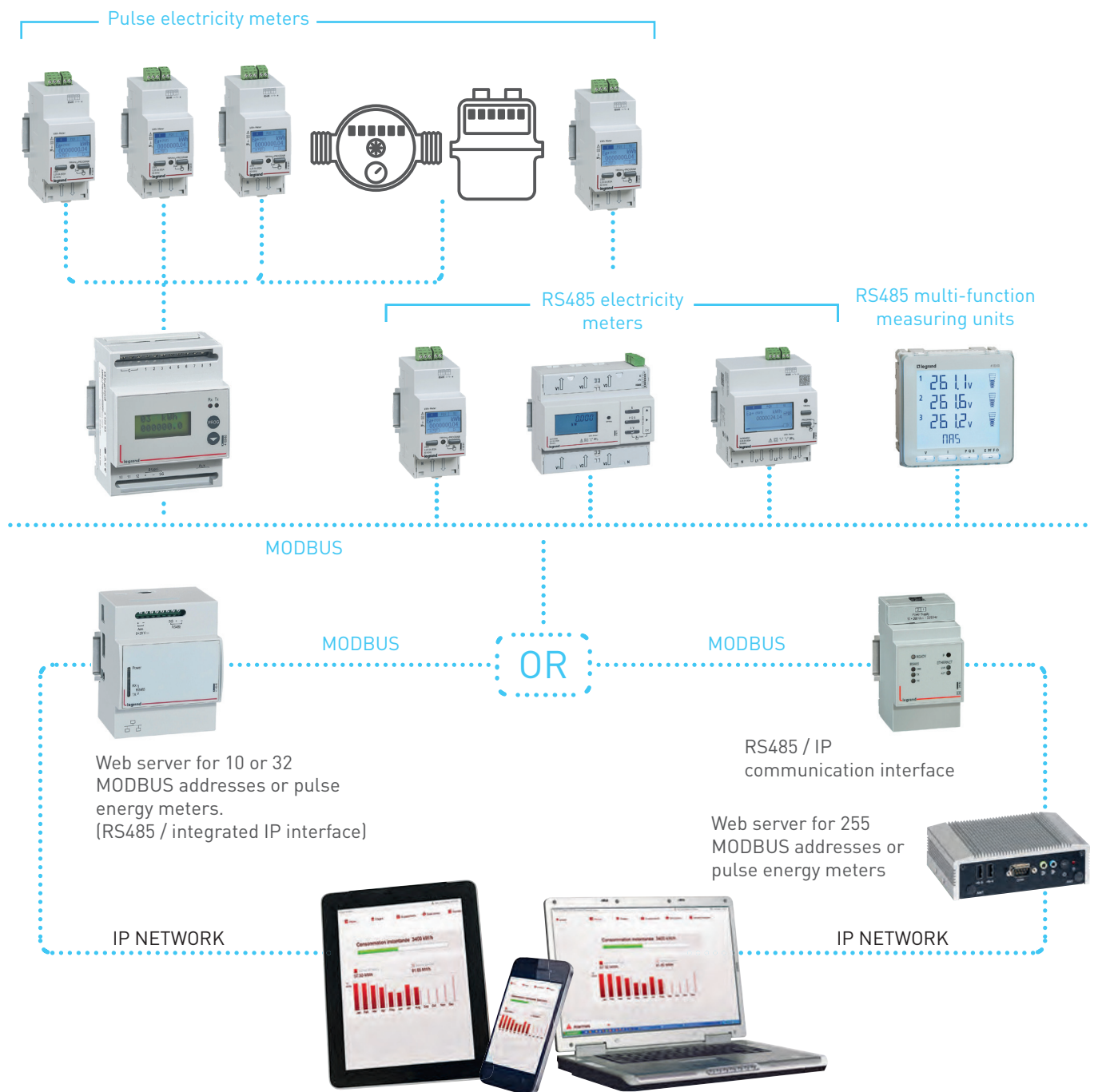
INTERNAL CONNECTION

The connection of each S2 of the CTs to the earth may be different. Some measuring units have isolated inputs for which it is necessary to connect each S2 of the CTs to the earth. While for other units, the secondaries S2 are common.



Refer to the instructions and technical data sheets for each product.

Schematic diagram



Help and definitions

ACCURACY CLASS

All measuring instruments must be characterized by an **accuracy class**. This gives the upper error limit due to the instrument alone, used in reference conditions.

A measuring instrument with an accuracy class of 0.5 is designed not to exceed 0.5% error of its highest indication when used in reference conditions. It is therefore very important to size the product correctly.

Accuracy classes are defined by very precise standards.

For example, measurement control units:

- IEC 62053-22 class 0.5S for active energy
- IEC 62053-23 class 2 for reactive energy.

MEASUREMENT INDEX

Aims for the best match between your needs and the specification of measuring devices at the different levels of your installation. It constitutes a real dialogue frame between supplier and customer for the elaboration of specifications. For each specific need, the index level progresses according to the degree of requirement.

MEASURING CIRCUIT

A measuring circuit takes account of all the components used to take the said measurement.

In this case we can consider, for example, a meter and the current transformer used.

These devices have a clearly defined accuracy class. We should take account of all metering devices, in order to calculate the accuracy class to be taken into account in the final measurement result.

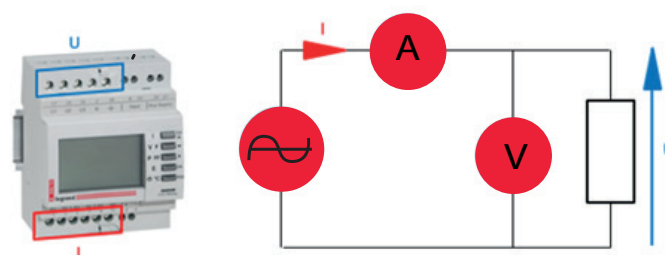
Calculating the accuracy class for 2 devices in combination [measuring instrument + current transformers]:

$$\text{Overall system uncertainty} = 1.15 \times \sqrt{(\text{PMD uncertainty of operation})^2 + \sum_{i=1}^N (\text{sensor uncertainty})^2}$$

Example :






- One class 1 three-phase meter
- Three class 1 current transformers
- Overall class = $1.15 \times \sqrt{1^2 + 3(1)^2} = 2.3 \%$

MEASUREMENT





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