TECHNICAL GUIDE

ENERGY MANAGEMENT IN ELECTRICAL PANELS

from MEASUREMENT to SUPERVISION

CREATING AN E-COMMUNICATING STRUCTURE

THE GLOBAL SPECIALIST IN ELECTRICAL AND DIGITAL BUILDING INFRASTRUCTURES

legrand®

Measurement is the basis of all diagnostics.
By simply monitoring consumption,
between 8 and 12% savings can be made.
Computer equipment, temperature control and lighting
rank amongst the energy-intensive items.
These results can be improved by implementing specific initiatives.
Encouraged by new standards and directives, measurement is
increasingly used in both commercial and residential buildings
so that occupants can easily view their consumption (heating,
cooling, hot water production, power sockets, lighting, etc).
In addition to **energy meters**, **measurement control units**
and new protective devices incorporating measurement functions,
Legrand offers an **e.communicating infrastructure** that can
display data such as electricity consumption, reactive power, harmonic
distortion, etc, and also **control** different states, **remotely control**
circuits and program actions such as alarms, schedule **corrective**
actions using diagnostics, etc - in a word: "**supervise**".

To meet these needs,
Legrand offers a whole range of products

LEGRAND ENERGY EFFICIENCY

CONTENTS

STANDARDS AND REGULATIONS

THE BROAD OUTLINES

European Directive 2012/27/EU

The European Energy Efficiency Directive 2012/27/EU dated 25 October 2012 imposes an obligation on large companies to conduct an energy audit.

The **dates**

This directive requires all companies concerned to conduct an energy audit:

→ **before 6 December 2015**

→ **which must be repeated every 4 years**

Who

This directive concerns all companies which have:

→ **a workforce of more than 250 people**

→ **annual sales in excess of 50 million euros**

→ **or a balance sheet of more than 43 million euros**

Exception: companies certified ISO 50001 are exempt from this obligation.

The **requirements**

The scope of this energy audit must represent at least 80% of the company's energy bills, otherwise they may be liable to sanctions of up to 2% of their sales.

If the company is certified ISO 50001, this certification should cover 80% of its energy bill. If not, the company should conduct an additional audit on activities which are not covered.

Measurement

The energy audit should be conducted based on the energy performance of the building(s) concerned. To do this, all significant energy use should be identified in order to define opportunities for improvement. An energy inventory should be conducted based on an assessment of consumption and identification of usage. The aim is to collect and analyse the field data required for the energy review and construction of the energy management system.

ISO 50001 certification

Standard ISO 50001:2011 specifies the requirements on organisations to establish, implement, maintain and improve an Energy Management System (EnMS).

The **dates**

ISO 50001:2011 is an international voluntary standard drawn up by the ISO (International Organization for Standardization).

→ **since 2011**

→ **3-year certification cycle**

Who

This certification can apply to organisations of all shapes and sizes, regardless of their geographical location and cultural or social context.
A company which complies with standard ISO 50001:2011 will therefore be able to demonstrate the existence of a robust EnMS.

The **requirements**

General requirements relating to this certification:

→ a commitment to continuous improvement in terms of energy efficiency

→ appointment of a qualified energy management specialist

→ organisation of a management plan

→ an assessment of the main energy applications

→ the setting up of energy performance indicators and targets

→ the setting up of action plan(s)

→ all staff must undergo training in how best to improve energy efficiency

→ the results should be evaluated and sent out to all staff on a regular basis

Measurement

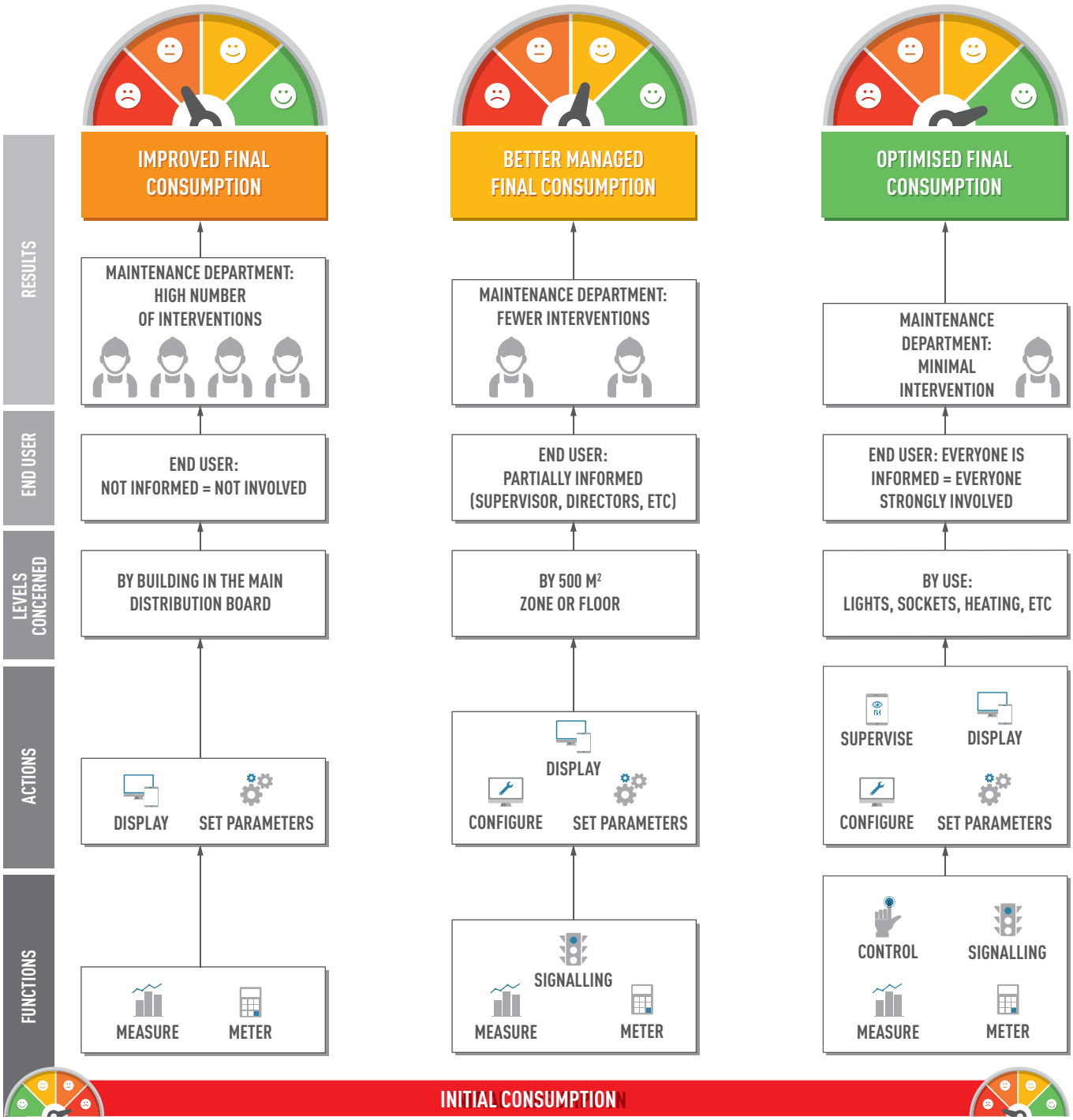
Like directive 2012/27, ISO 50001 does not require specific measurements by type of use or circuit.
However, in order to construct the energy management system for buildings, it is important to know which are the most energy-intensive items in order to identify potential sources of improvement.
Use of a measurement and supervision system ensures continuous improvement in the company's energy performance.

ENERGY MANAGEMENT

OVERVIEW

Maximum number of functions and actions = minimum number of interventions and consumption

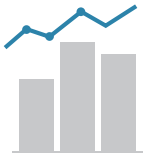
In an electrical infrastructure, having more functions and actions reduces the number of human interventions and makes a major contribution to optimising final consumption.



DEFINITIONS

METERING

Recording the electricity consumed by a circuit.
This is the basic function which is available on all metering devices.



MEASUREMENT

Measuring electrical values (current, voltage, power, harmonic distortion, etc) or analogue values (temperature) to check the installation is working properly.

SIGNALLING

Checking locally (LEDs, display unit, touch screen, etc) **or remotely** (LEDs, display unit, PLC, PC, tablet, smartphone, etc):
→ the on/off status of one or more devices and/or circuits
→ any faults such as circuit breaker tripping, min. or max. threshold overrun, etc

CONTROL

Managing control devices such as relays, contactors, circuit breaker motorised controls, load shedding/restoration, etc following a manual or automatic command, fault, etc.

DISPLAY

Viewing data, locally, on built-in, external, or remote screens, on PCs, smartphones or tablets with a web browser.

PARAMETER SETTING

A parameter is **an element in a computer program** which remains accessible for user modification. Most electronic devices need a minimum amount of parameter setting, such as the date and time, etc, as well as setting of an alarm set point, the level to be reached for a load-shedding operation, etc.
This data can be modified locally directly on the devices or remotely on a computer.

CONFIGURING

Designing instructions which can then be used to establish a set of **automatic operations**.

SUPERVISION

Supervision is a computerised **control and monitoring technique** for processes. In the measurement field, it is used as an umbrella term for all the aforementioned functions (display, monitor, control, set parameters, program). Supervision concerns acquisition of data (measurements, alarms, status feedback, etc) and process control (circuit breaker remote control, etc). A supervision system helps control and optimise energy consumption at any time on the whole of the electrical network. It monitors all the equipment with respect to safety, control, speed of intervention and continuity of service.
Data retrieved concerning the equipment operating status, distributed power measurements and consumption can be exploited in order to set up a technical energy management solution.

SOLUTIONS FOR ANY BUILDING

The Legrand measurement and supervision range can satisfy many varied customer needs:
- regardless of the type of building: residential, commercial or industrial
- regardless of the type of need:
  - "ACCESS", or simple standalone offers, where it is mainly possible to view information: "I am informed"
  - "PREMIUM", or interconnected offers, where it is also possible to make changes to the installation by controlling it: "I am informed and I take the control"

Legrand **ACCESS** solution **"I am informed"**

PRIVATE HOUSING

Structure(s): private homes, apartment blocks, small offices, etc
Function(s): metering, measurement
Option(s): setting parameters locally or remotely
View: locally or remotely

Page: 12

COLLECTIVE HOUSING

Structure(s): private homes, apartment blocks, small offices, etc
Function(s): metering, measurement
Option(s): setting parameters locally or remotely
View: locally or remotely

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COMMERCIAL/SERVICE SECTOR

Structure(s): commercial buildings, small industrial concerns, large offices, etc
Function(s): metering, measuring numerous circuits
Option(s): setting parameters locally
View: locally

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INDUSTRIAL/SERVICE SECTOR

Structure(s): office buildings, large industrial concerns, hospitals, data centres, etc
Function(s): metering, measuring numerous circuits in several buildings
Option(s): setting parameters locally
View: locally or remotely

Page: 24

Legrand **PREMIUM** solution
“I am informed and I take the control”

PRIVATE HOUSING

Structure(s): private homes, apartment blocks, small offices, etc
Function(s): all the functions in a “connected” home
Option(s): setting parameters, configuring locally or remotely
View: locally or remotely

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COLLECTIVE HOUSING

Structure(s): private homes, apartment blocks, small offices, etc
Function(s): measurement, standalone load shedding in each apartment or in communal areas
Option(s): setting parameters locally or remotely
View: locally or remotely

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COMMERCIAL/SERVICE SECTOR

Structure(s): commercial buildings, small industrial concerns, large offices, etc
Function(s): measurement, metering, monitoring, control, supervising all energy management
Option(s): setting parameters locally or remotely
View: locally or remotely

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INDUSTRIAL/SERVICE SECTOR

Structure(s): office buildings, large industrial concerns, hospitals, data centres, etc
Function(s): measurement, metering, monitoring, control, supervising all energy management and that of the whole building (lighting, fire, access control, etc)
Option(s): setting parameters, configuring, controlling locally or remotely
View: locally or remotely

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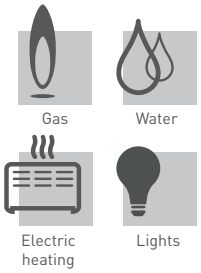
PRIVATE HOUSING

Legrand **ACCESS** solution **"I am informed"**

EMDX³ METERING OR ECOMETER
Direct display on device
Remote display on Web page with ecometer solution
Consumption displayed in euros, in kWh or in m³

Display electricity consumption with Modbus or EMDX³ pulse meters.

OR

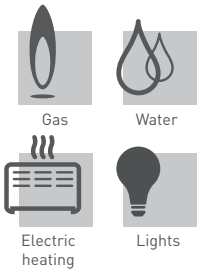


Display consumption with water, gas, electricity pulse EMDX³ meters.

+

Centralise consumption with the EDMX³ concentrator.

OR



Display all the information on a single device, the ecometer.

Customer need

Compliance with current regulations in the country of use or all other regulations for a new house. Measuring the most energy-using items. Displaying the result of these measurements, in order to gain awareness of the various items. Managing consumption.

With the solution EMDX^3

Display consumption locally with EMDX^3 meters.
Centralise all electricity, water and gas consumption with the EDMX^3 concentrator.

With the Ecometer solution

Display consumption automatically on web pages (smartphone, tablet, PC, etc) for ease of analysis and ways to alter consumption.

Individual connection of the different apartments and communal areas to each ecometer makes it possible to:
→ **Display** the instantaneous power of each circuit in watts
→ **Display** consumption in euros and kWh, for the day, the month
A precise analysis can, through the decisions taken and corrective actions, lead to lower consumption.

PRIVATE HOUSING

Legrand **PREMIUM** solution **"I am informed and I take the control"**

MYHOME ENERGY MANAGEMENT
Measurement, metering, load shedding
Display, Looking up

MEASURE, METER

Pulse counter interfaces

Consumption indicators

Central control unit

Controllers with consumption measurement

MYHOME BUS

DISPLAY ON WIRING ACCESSORIES

Display units in the MyHome range

LOOK UP LOCALLY OR REMOTELY

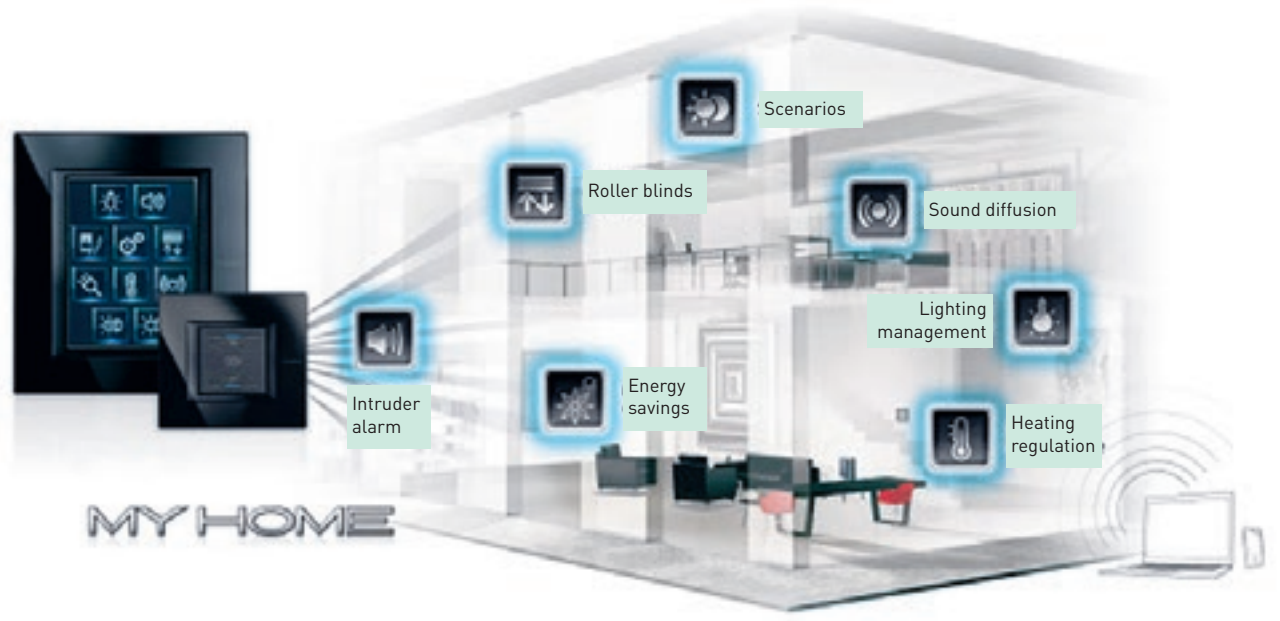
Web concentrator

Supervision software

Find technical information on www.legrand.com.sg/products/home-system/my-home.

Customer need

Integrating measurement and display of energy and fluid consumption in the MyHome home automation solution and, if necessary, complying with current regulations.
Optimising the subscribed demand of an energy supply contract by implementing a load-shedding solution based on priority mechanisms.



Display

consumption on the door entry system screen.

Control

by defining automated or manually-controlled load-shedding mechanisms.

Supervise consumption

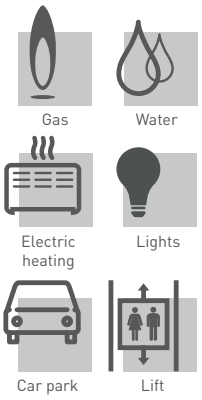
in the flats in an apartment block while guaranteeing the thermal comfort and safety of people and property.

COLLECTIVE HOUSING

Legrand **ACCESS** solution **"I am informed"**

EMDX³ METERING OR ECOMETER
Direct display on device
Remote display on Web page with ecometer solution
Consumption displayed in euros, in kWh or in m³

COMMUNAL AREAS

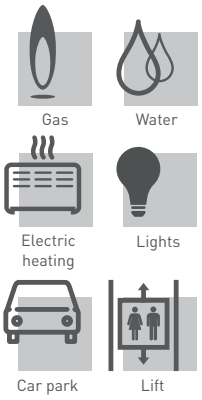


Display consumption of the communal areas with water, gas, electricity pulse EMDX³ meters.

+

Centralise consumption of the communal areas with the EDMX³ concentrator.

OR



Display on a single device, the ecometer, all the information from the communal areas.

PRIVATE AREAS

Display individual electricity consumption, one EMDX³ meter per apartment.

OR

Display individual electricity, water and gas consumption, one ecometer per apartment.

Customer need

Compliance with regulations in France or any other regulations for new apartment blocks.
Article 23 of RT2012 (French energy efficiency regulations) requires each home (apartment block or private house) to measure the consumption from heating, air conditioning, domestic hot water, power sockets and other types of consumption.
The intention is to provide each occupant with a minimum level of information by displaying the result of these measurements, so they gain awareness of the various energy-using items and manage their consumption better.

With the solution EMDX^3

Display consumption locally with EMDX^3 meters.
Centralise electricity, water and gas consumption with the EDMX^3 concentrator.

With the Ecometer solution

Display consumption automatically on web pages (smartphone, tablet, PC, etc) for ease of analysis and ways to alter consumption.

Individual connection of the different apartments and communal areas to each ecometer makes it possible to:
→ **Display** the instantaneous power of each circuit in watts
→ **Display** consumption in euros and kWh, for the day, the month
A precise analysis can, through the decisions taken and corrective actions, lead to lower consumption.

COLLECTIVE HOUSING

Legrand **PREMIUM** solution **"I am informed and I take the control"**

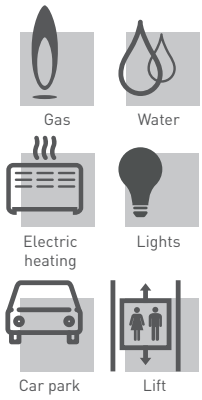
METERING EMDX³

Direct display on device

Remote display on Web page with ecometer solution

Consumption displayed in euros, in kWh or in m³

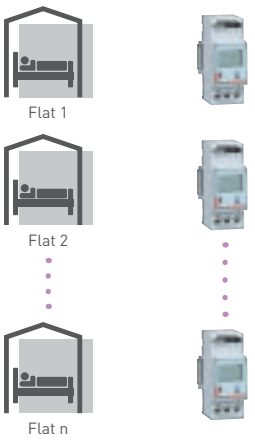
COMMUNAL AREAS



Display consumption of the communal areas with water, gas, electricity EMDX³ pulse meters.

Centralise consumption of the communal areas with the EDMX³ concentrator.

PRIVATE AREAS



Display the individual electricity consumption, one EMDX³ meter per apartment.

VIEW DATA REMOTELY

RS 485/IP converter

EMDX³ measurement software for **local viewing**
or
Energy web server for **remote viewing**

Viewing data

CONTROL

EMDX³ measurement control units have 1 to 8 feedback contacts depending on the model.
It is therefore possible to have:

- signalling feedback
- load shedding control
- data transmission to an email or GSM phone

Customer need

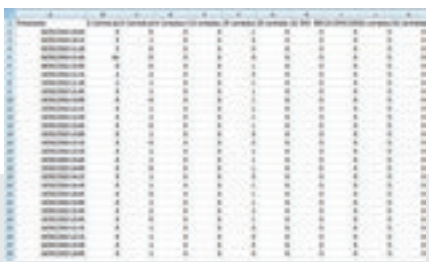
Compliance with current regulations in the country of use or all other regulations for a new apartment block.
Measuring the most energy-using items.
Displaying the result of these measurements, in order to gain awareness of the various items.
Managing consumption.

View private and communal areas:

Read the instantaneous power of each circuit in watts and consumption in euros and kWh, for the day, month, year, etc.
Connection, on the same Energy web server, for all flats and communal areas, allows accurate analysis and decisions to be taken which lead to an immediate reduction in consumption.

View private areas:

→ automatic display of consumption on web pages (smartphone, tablet, PC, etc)
→ ease of analysis and ways to alter consumption



Display log:

Possibility of extracting CSV file in order to study consumption by means of a spreadsheet.

COMMERCIAL/SERVICE SECTOR

Legrand **ACCESS** solution **"I am informed"**

METERING AND MEASUREMENT EMDX³

Direct display on device

Local display

Consumption displayed in euros, in kWh or in m³

METER, MEASURE AND DISPLAY LOCALLY

Gas

Electric heating

Lights

Water

Air conditioning

Centralised local viewing is possible with a concentrator connected to the water, gas meters and EMDX³ electricity pulse meters (up to 12 connected devices).

Viewing on the front of each meter and EMDX³ electricity pulse measurement control unit.

Customer need

Compliance with current regulations in the country of use or any other regulations for new apartment blocks.
Measuring the most energy-using items.
Displaying the result of these measurements.
Sending automatic load-shedding commands.
Managing consumption.

View:

consumption monitoring.

Display locally:

very accurate information easily:
electrical values such as harmonics, power, cos φ, etc.

Measure:

the range of current transformers, opening and closed from 50 to 4000 A.

Measure, meter:

the concentrator displays up to 12 water, gas or electricity pulse meters.

COMMERCIAL/SERVICE SECTOR

Legrand **PREMIUM** solution **"I am informed and I take the control"**

METERING AND MEASUREMENT EMDX³

Direct display on device
Remote display on Web page with
Energy web server solution
Consumption displayed in euros, in kWh or in m³

MEASURE AND DISPLAY LOCALLY

Gas
Electric heating
Lights
Water
Air conditioning

WHERE

Meter:
water, gas, electricity
EMDX³ pulse meters

Display on a screen all the data from pulse devices with the EMDX³ concentrator.

+

EMDX³ pulse meters and measurement control units for **local viewing** or RS485 for **remote viewing.**

CONTROL

Modular
1 control output

Premium
8 control outputs

Load shedding of some circuits automatically in the event of exceeding a preprogrammed threshold possible with EMDX³ measurement control units.

VIEW DATA REMOTELY

RS 485/IP converter

+

=

The EMDX³ measurement software for **local viewing or** Energy web server for **remote viewing**

Viewing data

Customer need

Compliance with current regulations in the country of use for buildings for non-residential use.
Measuring or calculating energy consumption by zone, by floor or by outgoing line of more than 80 A and by use: heating, lighting, power sockets, ventilation control.
Displaying the result of these measurements, in order to gain awareness of the various items.
Managing consumption.

View consumption monitoring locally.

Control load shedding to switch off some circuits automatically in the event of over-consumption.

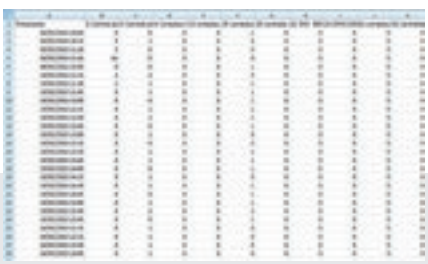
Display

the option of automatic display of consumption on web pages (smartphone, tablet, PC, etc) for ease of analysis and implementation of actions to alter consumption.

Multiple possibilities:
- read the instantaneous power of each circuit in watts
- view consumption in euros and kWh, for the day, month, year, etc.

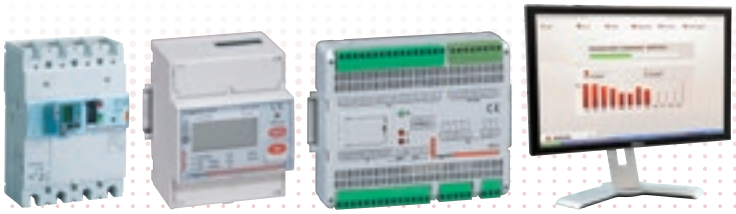
Display logs:

Extraction of CSV file in order to study consumption by means of a spreadsheet.



INDUSTRIAL/SERVICE SECTOR

Legrand **ACCESS** solution **"I am informed"**



METERING AND MEASUREMENT
EMDX³, STATUS FEEDBACK, CONTROL
Direct display on device
Remote display on Web page with the Energy web server
Consumption displayed in euros, in kWh or in m³

MEASURE AND DISPLAY LOCALLY

Gas

Electric heating

Lights

Water

Air conditioning

Display on a screen all the data from water, gas, electricity pulse devices with the EMDX³ concentrator.

EMDX³ pulse meters and measurement control units for **local viewing** or RS485 for **remote viewing.**

Devices such as the **DMX³**, **DPX³** add-on module ranges allow **local or remote viewing** of data in the same way.

VIEW DATA REMOTELY

RS485/IP converter

+

EMDX³ measurement software for **local viewing or** Energy web server for **remote viewing.**

=

Viewing data

Customer need

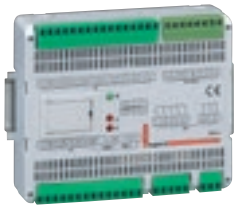
Compliance with current regulations in the country of use for buildings for non-residential use.
Measuring or calculating energy consumption by zone, by floor or by outgoing line of more than 80 A and by use: heating, cooling, hot water production, lighting, power sockets, ventilation control.
Displaying the result of these measurements.
Sending automatic load-shedding commands.
Managing consumption.

SIGNAL CONTROL

Contactor

Status add-on module

Motorised control unit



Send this data remotely via the 24-input/6-output interface. It **transcribes electrical data < --- > RS485.**

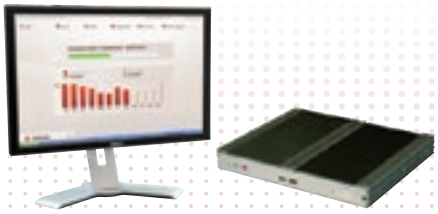
Display remotely consumption on web pages (smartphone, tablet, PC, etc).

Signal remotely on a single page, the status of all devices which make up one or more zones in an installation.

Remotely control devices, manually or automatically.

INDUSTRIAL/SERVICE SECTOR

Legrand **PREMIUM** solution **"I am informed and I take the control"**



SUPERVISE THE WHOLE BUILDING

Building Manager Viewer:
- View
- Manage
- Be alerted

Building Manager Controller:
- Interact
- Integrate

IP INFRASTRUCTURE

LIGHTING, SHUTTERS, SOCKETS

KNX IP

IP/KNX gateway
Cat. No. 0 035 43

BUS/KNX

Controller

Sensor — Control unit

Sensor — Control unit

Controller

Sensor — Control unit

Sensor — Control unit

Touch screen

EMERGENCY LIGHTING

BACNET

Management interface for addressable units
Cat. No. 0 626 00

Addressable self-testing emergency lighting unit

Self-contained emergency background lighting unit

Self-contained reinforced emergency lighting unit

Flush-mounting Kickspot emergency lighting unit

MEASUREMENT

MODBUS IP

Converter RS485/IP
Cat. No. 0 046 89

RS485 BUS

Circuit breaker

Measurement control unit

Electricity meter

FIRE ALARM

MODBUS IP

Converter RS485/IP
Cat. No. 0 046 89

Type 1 fire alarm - URA (Legrand group brand)

Smoke detector

Smoke detector

Smoke detector

ACCESS CONTROL, CCTV

HEATING, VENTILATION, AIR CONDITIONING (HVAC)

MEASURE, METER
EMDX³ measurement systems, DMX³, DPX³ protection systems, signal interface units

MANAGE, CONTROL
Lighting and shutter management, green sockets and temperature regulation systems

MONITOR, MAINTAIN
Emergency lighting and fire alarm systems

Pre-programmed "Ready-to-supervise" solution for ease of implementation with Legrand systems, without the need for specialist skills in systems integration.
Find technical information on www.legrand.com in the Building Manager section.

Customer need

Compliance with current regulations in the country of use for buildings for non-residential use.
Measuring or calculating energy consumption by zone, by floor or by outgoing line of more than 80 A and by use: heating, cooling, hot water production, lighting, power sockets, ventilation control.
Displaying the result of these measurements.
Sending automatic load-shedding commands.
Managing consumption.

View the operating status and manage comfort and safety equipment:

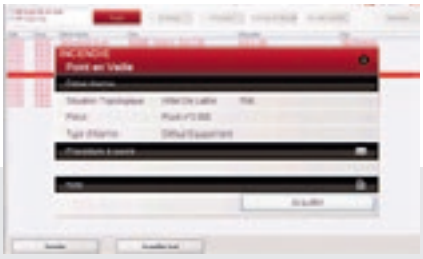
- lighting, green sockets and temperature regulation
- emergency lighting
- fire safety system

Manage energy:

energy consumption, characteristics of the distributed electrical signal

Manage alarms:

alerts, data logging, procedures to be followed, intervention comments

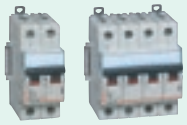
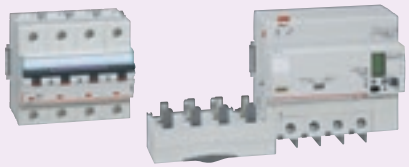


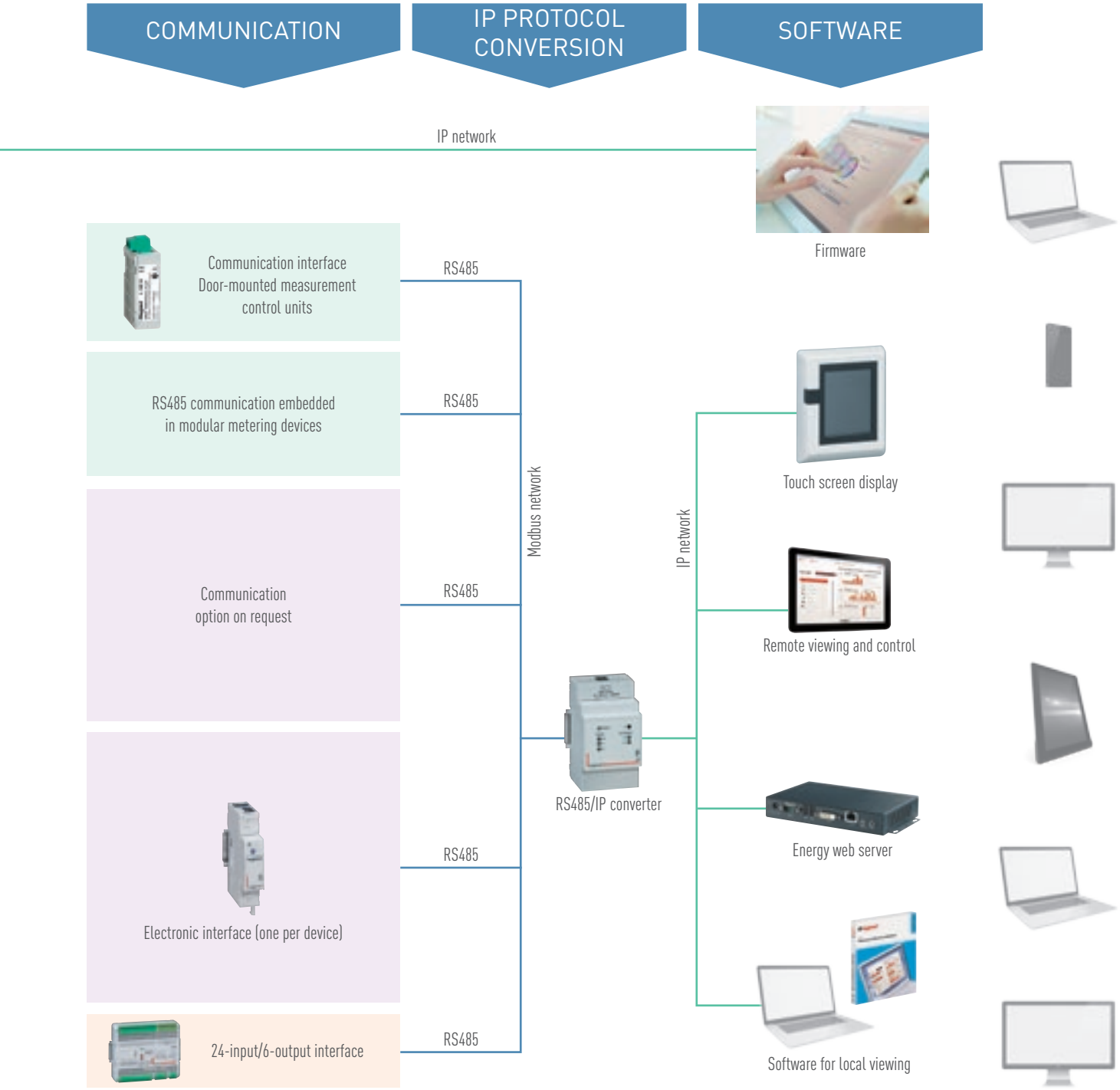
Program time slots:

groups of actuators, control scenarios

Fully customisable in project mode by a systems integrator for integration of third-party systems and/or customising graphic displays.

PRODUCT OVERVIEW

	PROTECTION	MEASUREMENT	CONTROL SIGNALLING
MEASUREMENT IN COMBINATION	 DX³ Ph+N	 Ecometer	
	 DPX³	 Measurement control units	 Status add-on modules and motorised control unit
	 DX³	 Meters	 Status add-on modules and motorised control unit
INTEGRATED MEASUREMENT	 DMX³	 Electronic protection unit	 Status add-on modules and motorised control unit
		Electronic DPX³ with integrated measurement	 Status add-on modules and motorised control unit
		Add-on module with integrated measurement	 Status add-on modules and motorised control unit
REMOTE CONTROL AND SIGNALLING			 Contactor


COMMUNICATION
IP PROTOCOL CONVERSION
SOFTWARE
IP network
Firmware
Communication interface Door-mounted measurement control units
RS485
RS485 communication embedded in modular metering devices
RS485
Communication option on request
RS485
Electronic interface (one per device)
RS485
24-input/6-output interface
RS485
Modbus network
RS485/IP converter
IP network
Touch screen display
Remote viewing and control
Energy web server
Software for local viewing

ELECTRICITY
METERS EMDX^3

PRODUCT SPECIFICATIONS

Meters record the electricity consumed by a single-phase or three-phase circuit downstream of the electricity supply company's metering.
They display the electricity consumption of the measured circuit and other values (depending on the catalogue number) such as current, voltage, power, etc, and transmit this information to supervision or energy management systems.
There are 2 electricity meter families:
• Direct connection
• CT connection

CHARACTERISTICS

- Display: LCD
- Reference voltage Un:
  - Single-phase: 230 – 240 VAC
  - Three-phase: 230 (400) VAC – 240 (415) VAC
- Frequency: 50 – 60 Hz
- Conforming to standards:
  - IEC 62052-11
  - IEC 62053-21/23
  - IEC 61010-1
- Accuracy:
  - Active energy (EN 62053-21): class 1
  - Reactive energy (EN 62053-23): class 2
- Connection: Direct or with CT
- Device: non-MID or MID
- Output: pulse and/or RS485
- Mounting: on DIN rail
- Dimensions: 1 to 4 modules according to the device

PRODUCT SELECTION

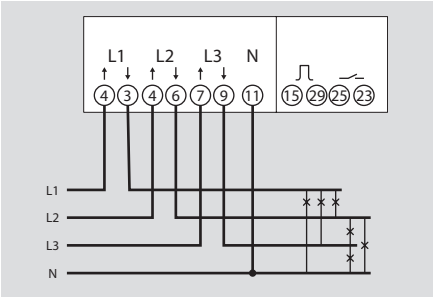
A meter should be selected according to the network (single-phase or three-phase) and its maximum current, required displayed values and communication type allowing it to be run by a supervision system.
MID certification, in some meters, ensures the accuracy of metering with a view to charging out the electricity used.

CAT. NO.		4 120 68	4 120 69	0 046 70	0 046 81	0 046 72	0 046 77	0 046 78	0 046 79	0 046 73	0 046 80	0 046 82	0 046 83	0 046 74	0 046 84	0 046 85	0 046 86
Type of mains supply		Single-phase								Three-phase							
Number of modules		1	1	1	2	2	2	2	2	4	4	4	4	4	4	4	4
Connection	**direct (max. current)**	45 A	45 A	32 A	36 A	63 A	63 A	63 A	63 A	63 A	63 A	63 A	63 A				
	via a current transformer													5 A	5 A	5 A	5 A
Metering and measuring	**Total active energy**			●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Total reactive energy									●	●	●	●	●	●	●	●
	Partial active energy (reset)				●	●	●	●	●		●	●	●	●	●		
	Partial reactive energy (reset)										●	●	●	●	●		
	Active power	●				●	●	●	●	●	●	●	●	●	●	●	●
	Reactive power	●								●	●	●	●	●	●	●	●
	Apparent power	●								●	●	●	●	●	●	●	●
	Current + voltage	●				●	●	●	●	●	●	●	●	●	●	●	●
	Frequency					●	●			●	●	●	●	●	●	●	●
	Power factor	●				●	●			●	●	●	●	●	●	●	●
	Operating time (reset)					●	●										
	Average active power									●	●	●	●	●	●	●	●
	Max. average active power									●	●	●	●	●	●	●	●
	Dual tariff									●							
Communication	**Pulse output**		●	●	●	●		●		●		●		●	●	●	●
	RS485 interface	●					●		●		●		●		●		●
MID compliant			●					●	●			●	●			●	●

CONNECTION

■ **Direct connection meters:**

The meter is connected in series on the line to be metered. It is protected by the circuit breaker placed directly upstream. This must be calibrated to cope with the maximum current permitted by the meter.

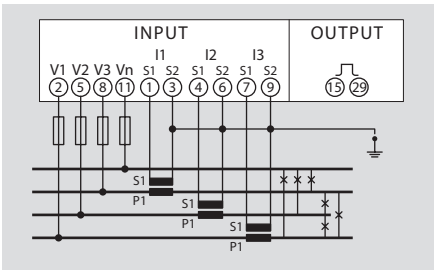


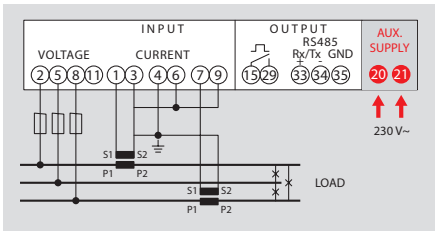
To protect the meters, refer to the information in the product manuals and technical data sheets.

■ **CT connection meters:**

Meters have 2 types of input: "current" and "voltage" inputs. Each current transformer secondary is connected to the corresponding meter inputs (terminals 1-3/4-6/7-9). This allows the current flowing through the CT to be measured.

To create the voltage tap, each conductor is connected to inputs 2/5/8 and 11 respectively. These connections are used to supply the meter with power.

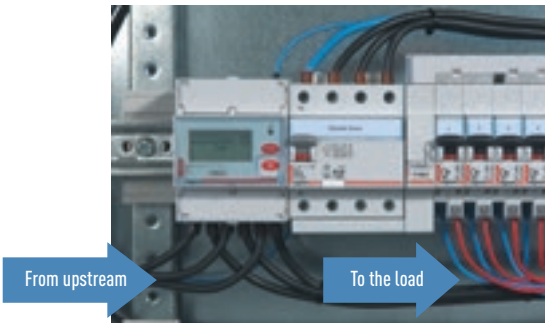




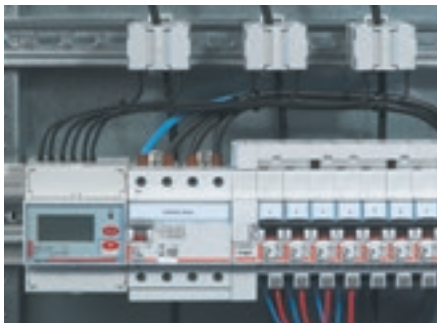
Some meters, such as MIDs, need an auxiliary power supply in order to work.

Some three-phase meters can be used to measure a single-phase mains supply, as can different wiring methods, but this is not true for all of them. Please refer to the manuals and technical data sheets.

DIRECT CONNECTION

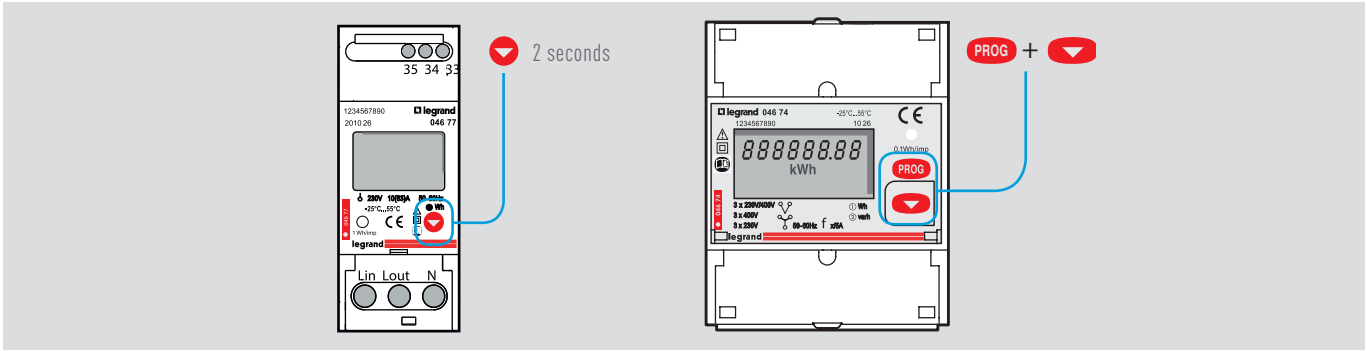


CONNECTION WITH A CT



PARAMETER SETTING

After connection, the electricity meter parameters may need to be changed so that it displays data consistent with the currents flowing through the measured circuits.



A button on the front of the meter is used to enter programming mode, confirm and go to the next step.
Access to the parameters is locked by a password which can be changed if necessary (factory code = 1000).

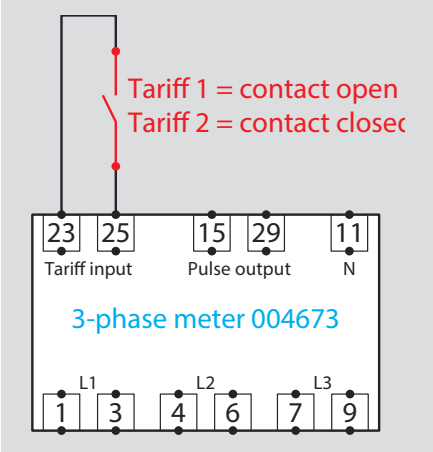
PARAMETER IDENTIFICATION

DISPLAY	PARAMETER
Cd, CodE	Password – default value 1000
Pu, PLSU	Pulse weight
Pd, PLSd	Pulse duration
PLSt Act	Pulse output = active energy
PLSt rEA	Pulse output = reactive energy
Ad, Addr	Modbus address
Br, bAUd	Modbus baud rate
PY, PAr	Modbus parity bit (nonE, EVEn, odd)
Mode ASY	Partial electricity metering always active
Mode SYn	Partial electricity metering activated when the contact closes (23/25)
Mode trF	Dual-tariff electricity metering switched by the contact action (23/25)
Time	Average power integration time
MD	Active average power
PMD	Maximum active average power
Mode A ou b	Meters with CT only, depends on the wiring - see product manual
Ct	CT current transformer ratio For example, if CT 100/5 then the value to be set on the meter is Ct = 20
VT	VT voltage transformer ratio For example, if VT 600/100 then the value to be set on the meter is VT = 6
SetP E, CaLd E	Fault message, refer to the product instructions
t. run	Timer start
PC, PASS	Password modification
SAU inG	Configuration backup
CrC	Software version

If the current and/or voltage transformation ratios are changed, the electricity meters are reset automatically.

DUAL TARIFF

Dual tariff is only possible with meter Cat. No. 0 046 73. Simply connect a volt-free contact to terminals 23 and 25 of meter 0 046 73.



DATA TRANSFER

Electricity meters have pulse or RS 485 type outputs which can send data to an operating system.

■ **Meters with pulse output:**

- Output: on optocoupler relay S0 according to EN 62053-31 volt-free.
- Voltage **U** imp: 115 VAC/DC max - except Cat. No. 0 046 70: 27 V max.
- Current **I** imp: 50 mA - except Cat. No. 0 046 70: 27 mA.
- Connection: on terminals 15 and 29 – except Cat. Nos. 0 046 70 and 0 046 81 terminals 4 and 6.
- Data type:
  Active energy Wh for Cat. Nos. 0 046 70/81/72/77/78/79/85/86
  Active energy Wh and reactive energy Varh for Cat. Nos. 0 046 73/80/82/74/84
- Pulse weight:
  Programmable with possible values: 1–10–100–1000 Wh/pulse
  Non-programmable, fixed value for 0 046 70 (2000 pulse/kWh), 0 046 81 (10 Wh/pulse)
- Pulse duration:
  Programmable with possible values: 50–100–150–200–300–400–500 ms
  Non-programmable, fixed value for 0 046 70 (40 ms), 0 046 81 (100 ms)

■ **Meters with Modbus output:**

- RTU mode Modbus protocol
- Baud rate 2400, 4800, 9600, 19,200 Bauds
- Address from 1 to 247
- Parity: even, odd, none
- Stop bit: 1
- Query response time < 200 ms
- 2-pair wiring RS485 standard (Belden 9842)

The wiring diagram for an RS485 BUS is illustrated in the "Communication protocols" section.

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.

MEASUREMENT
CONTROL UNITS EMDX^3

PRODUCT SPECIFICATIONS

EMDX^3 control units record the energy consumed by the various circuits, mesure the electrical values (current, voltage, power, etc) or analogue values (temperature) to check the installation is working properly; they monitor energy quality by analysing harmonics and measuring the reactive energy; they communicate the values measured to supervision or energy management systems, in order to optimise the consumption and energy quality of electrical circuits in commercial and industrial environments.

CHARACTERISTICS

- Display: LCD.
- Reference voltage Un:
  - Modular and ACCESS control units:
    Phase/Phase: 80 – 500 V
    Phase/Neutral: 50 – 290 V
  - PREMIUM control 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 control unit
  - on door for ACCESS and PREMIUM control units
- Dimensions:
  - 4 modules for modular control unit
  - 92 x 92 mm cut-out for ACCESS and PREMIUM control units

PRODUCT SELECTION

Measurement control units should be selected according to the mains supply, mounting in the enclosure, required displayed values and communication type which allows it to be run by a supervision system.

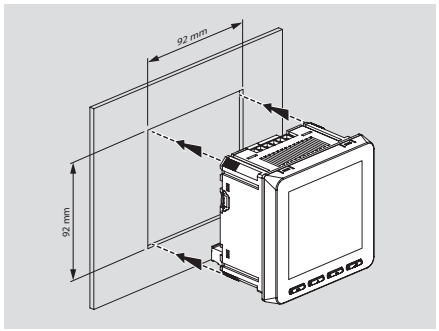
CAT. NO.		 4 120 51	 4 120 52	 4 120 53
Type		Modular 4 modules	ACCESS On door	PREMIUM On door
MEASUREMENT				
Currents	**Instantaneous: I1 – I2 – I3 – IN**	●	●	●
	Max. average: I1 – I2 – I3 – IN	●	●	●
	Average of 3: (I1 – I2 – I3)/3	●	●	●
Voltages and Frequencies	**Instantaneous: U1-U2-U3-U12-U23-U31-F**	●	●	●
	Min/max: U1-U2-U3-U12-U23-U31-F	●	●	●
Powers	**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		●	●	●
HARMONIC ANALYSIS				
Total harmonic distortion	**Numbers**	9[3] and 25[2]	9[3] 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	**RS485 MODBUS**	●	●	● [1]
	Pulse	●	●	● [1]
MODULES				
RS485 MODBUS communication				4 120 55
Function	**2 outputs: pulse or alarm feedback**			4 120 59
	Memory + RS485 MODBUS			4 120 56
	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
	Harmonic analyser			4 120 61[2]

[1] with option module [2] available on RS485 COM [3] available on the display
[4] THD only available with module 4 120 61 + communication module 4 120 55 or 4 12056.

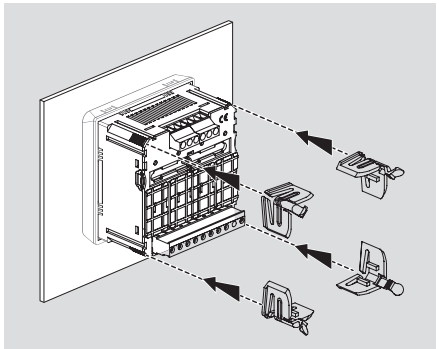
MOUNTING CONTROL UNITS

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

Making the cut-out with a punch.



After creating the cut-out, insert the control unit.



Control unit held in place with clips.

FUNCTION MODULES

2 inputs/2 outputs
Cat. No. 4 120 57

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

Temperature sensor
2 x PT100
Cat. No. 4 120 58

Harmonic analyser
Cat. No. 4 120 61

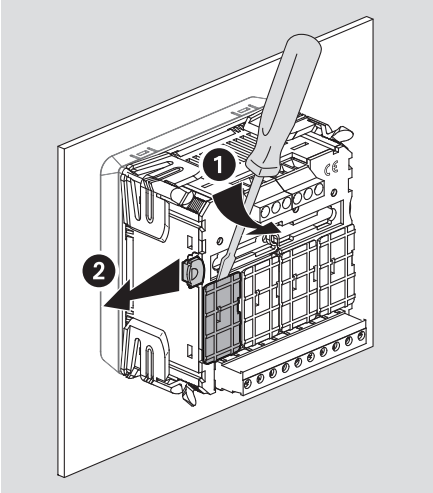
2 pulse or alarm outputs
Cat. No. 4 120 59

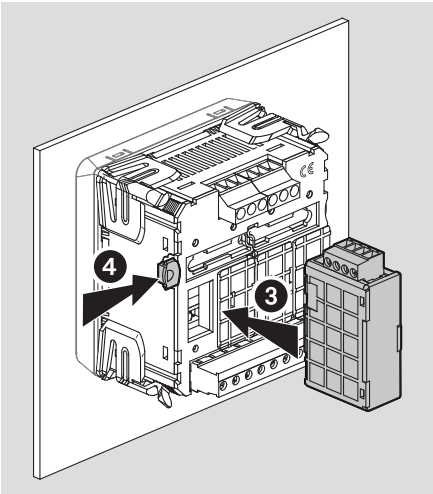
Function modules can only be adapted to fit on PREMIUM control units.

MOUNTING OPTION MODULES

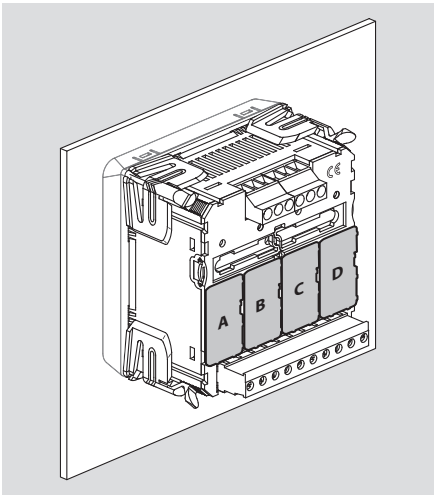
Option modules are fixed to the back of door-mounted control units.
You need to:

- remove the plastic cover
- slide the tab to the left
- place the module in the chosen slot
- slide the tab back





CAT. NO.	DESCRIPTION	NUMBER MAX.	POSITION			
			A	B	C	D
4 120 55	RS485 communication module	1	X	-	-	-
4 120 56	RS485 communication module + memory	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	2 pulse or alarm outputs	2	X	X	X	X
4 120 60	Module with 2 analogue outputs	2	-	-	X	X
4 120 61	Harmonic analyser module	1	-	X	-	-



Caution, some modules are mounted in specific slots. Their position is indicated in each manual.

Caution, the control unit must be switched off before working on the modules.

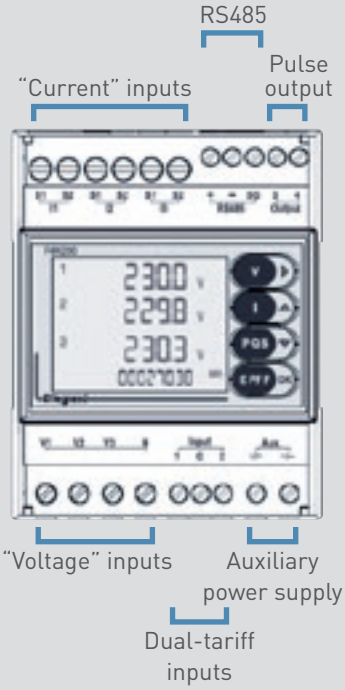
CONNECTION

Like meters connected by a CT, measurement control units have 2 types of input: "current" inputs and "voltage" inputs.
Each transformer secondary is connected to the inputs corresponding to the control unit. This allows the current flowing through the CT to be measured.
To create the voltage tap, each conductor is connected to the voltage inputs.

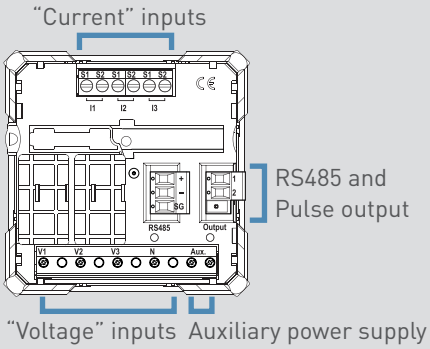
Control units need an auxiliary power supply in order to work.
Fuse protection is recommended for:

- the auxiliary power supply:
  - 1 A gG for door-mounted control units
  - 0.5 A gG for the modular control unit
- the voltage taps:
  - 0.5 A gG

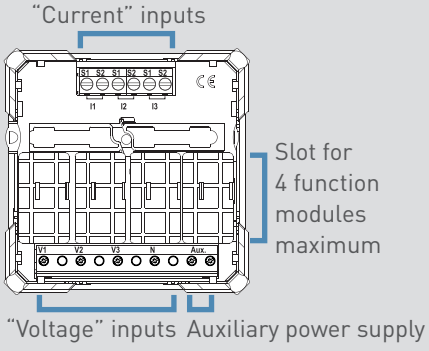
■ Modular control unit



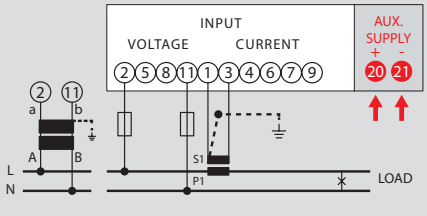
■ ACCESS control unit



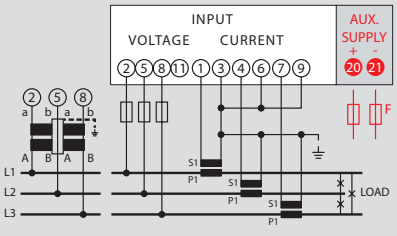
■ PREMIUM control unit



■ Single-phase connection



■ Three-phase connection



PARAMETER SETTING

After connection, the measurement control unit parameters need to be changed so that it displays data consistent with the currents flowing through the measured circuits.

Modular control 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 and PREMIUM control 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 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	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 measurement control units are reset automatically.

MULTI-TARIFF ONLY ON MODULAR CONTROL UNIT

Multi-tariff operation, with up to 4 tariffs, is possible with modular control unit 4 120 51. Simply use **terminals 23/24/25**, 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 Off-peak/Peak

DATA TRANSFER

Measurement control units have pulse or RS 485 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 volt-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 control 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 (Belden 9842)
- Output galvanically isolated from the input and the auxiliary power supply

The wiring diagram for an RS485 BUS is illustrated in the "Communication protocols" section.

MODBUS ADDRESSING

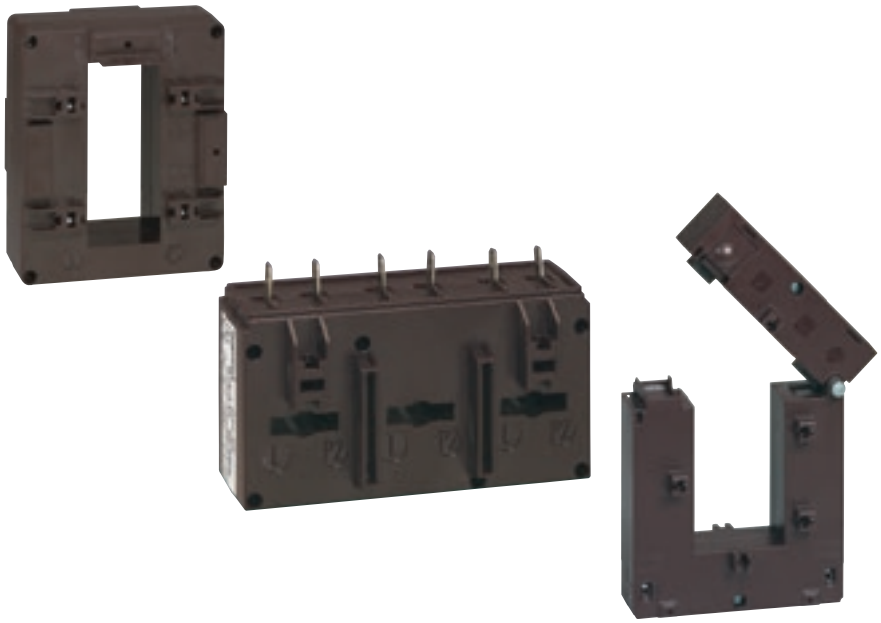
To allow systems integrators to develop an energy management program, addressing tables are available in the E-catalogue on www.legrand.com in the manuals or in separate files depending on the device. All the information concerning available registers can be found in these documents.

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

CURRENT TRANSFORMERS (CTS)

PRODUCT SPECIFICATIONS

Current transformers (CTs) are used to convert high current values circulating in cables or busbars to current values permitted by measuring devices, usually 5 A.



CHARACTERISTICS

- Primary current from 50 to 4000 A
- Secondary current: 5 A
- Frequency: 50/60 Hz
- Degree of protection: IP20
- Accuracy class: 0.5 or 1% depending on the model

All elements used to take a measurement must be included when calculating the overall accuracy class, as they are part of the measurement circuit (details in the "Help and definition" section).

PRODUCT SELECTION

The current transformer rating is selected according to the conductor dimensions, but also according to the maximum prospective current in the circuit to be measured.
An open-type current transformer assembly is available to simplify installation and maintenance, which can be a delicate operation in some cases.
In order to minimise measurement errors, the closest possible rating to this value should be selected.

CURRENT TRANSFORMER	CAT. NO.	TRANSF RATIO	FOR CABLES MAX. Ø (MM)	FOR BUSBARS W X H (MM)	ACCURACY	FIXING ON RAIL	FIXING ON PLATE	DIRECT FIXING ON CABLES OR BUSBARS
Closed-type single-phase								
	4 121 01	50/5	21	16 x 12.5	1 %	•	•	
	4 121 02	75/5						
	4 121 03	100/5						
	4 121 04	125/5						
	4 121 05	160/5						
	4 121 06	200/5						
	4 121 07	250/5						
	4 121 12	400/5	27	32.5 x 10.5 25.5 x 15.5	0.5 %			•
	4 121 14	600/5						
	4 121 16	250/5	26	40.5 x 12.5 32.5 x 15.5				•
	4 121 17	400/5						
	4 121 19	700/5						
	4 121 23	250/5	32	40.5 x 10.5 32.5 x 20.5				•
	4 121 24	300/5						
	4 121 25	400/5						
	4 121 26	600/5						
	4 121 31	700/5	40	50.5 x 12.5 40.5 x 20.5				•
	4 121 32	800/5						
	4 121 33	1000/5						
	4 121 36	600/5		65 x 32				•
	4 121 38	800/5						
	4 121 39	1000/5						
	4 121 42	1250/5		84 x 34				•
	4 121 46	1600/5		127 x 38				•
	4 121 47	2000/5						
	4 121 49	3200/5						

PRODUCT SELECTION (CONTINUED)

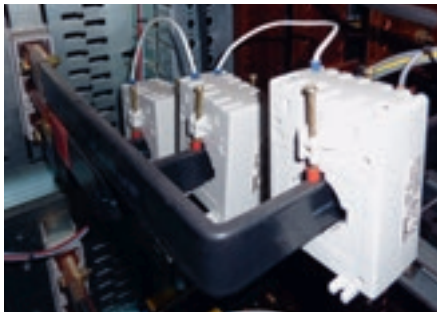
CURRENT TRANSFORMER	CAT. NO.	TRANSF RATIO	FOR CABLES MAX. Ø (MM)	FOR BUSBARS W X H (MM)	ACCURACY	FIXING ON RAIL	FIXING ON PLATE	DIRECT FIXING ON CABLES OR BUSBARS
Closed-type single-phase (continued)								
	4 121 50	1600/5		127 x 54				●
	4 121 51	2000/5						
	4 121 52	2500/5						
	4 121 53	3200/5						
	4 121 54	4000/5						
Open-type single-phase								
	4 121 62	400/5		50 x 80	0.5 %			●
	4 121 63	800/5						
	4 121 64	1000/5		80 x 120				●
	4 121 65	1500/5						
	4 121 66	2000/5		80 x 160				●
	4 121 67	2500/5						
	4 121 68	3000/5						
	4 121 69	4000/5						
Three-phase								
	4 121 57	250/5		20.5 x 5.5	0.5 %			●
	4 121 58	400/5		30.5 x 5.5				●

CTs cannot be used with DC supply.

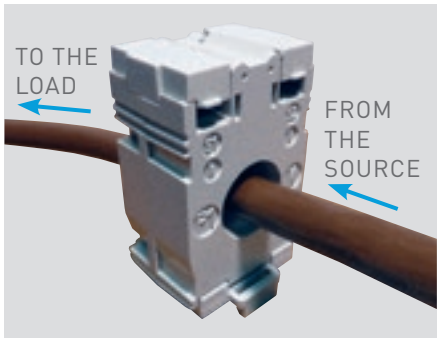
MOUNTING

Current transformers are available with several types of fixing. CTs taking cables can be clipped onto DIN rails. Others, which take busbars, should be fixed in place by tightening the dedicated screw. They can also be fixed on a plate using the fixing points on the bottom.

Current transformers for cables mounted on DIN rail



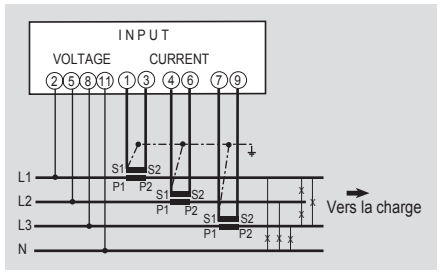
Current transformers mounted directly on flexible busbars



The value sent to the meter or measurement control unit depends on the direction of mounting on the busbar or cable. To avoid errors, it is essential to make sure that the CT is working properly.
The current flow must enter at P1 (coming from the source) and exit at P2 (going towards the load).

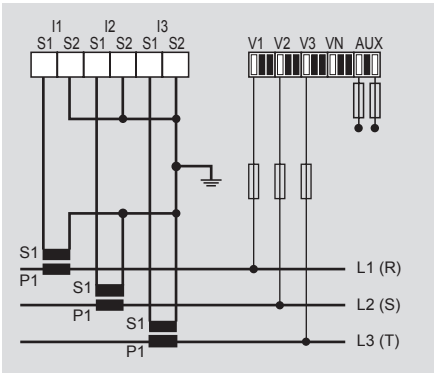
CONNECTION

The secondary terminals (S1 and S2) should be connected to the corresponding inputs on the measuring device (meter, measurement control unit).



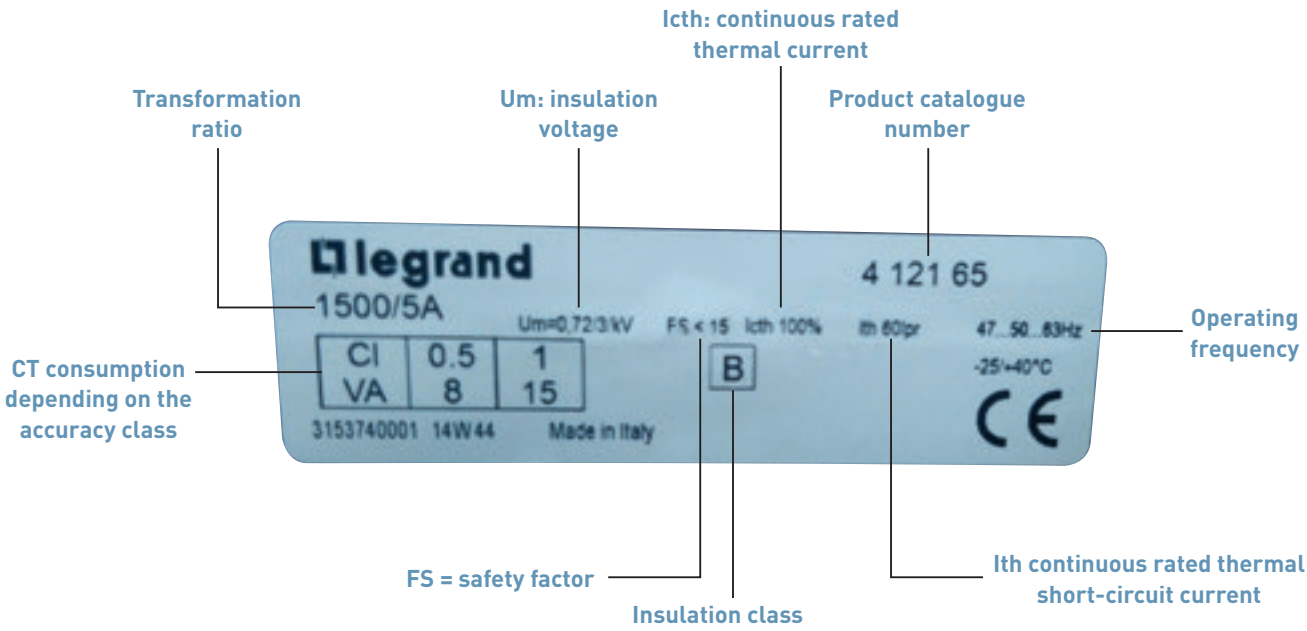
EARTHING THE CURRENT TRANSFORMER SECONDARY

To ensure the safety of the installation when the secondary is opened, we recommend that this is connected to earth in TT or TN systems.
To reduce the number of cables, the S2 outputs on the CT secondary can be grouped together.



If an on-load CT has its secondary open, a high voltage may appear. It is therefore vital to short-circuit the CT secondary when the rating is changed, for example, or to intervene by cutting the power supply to the load.

READING AN IDENTIFICATION LABEL



Um: Maximum reference insulation voltage, in this example 0.72 kV rms value, 3 kV being the rated insulation voltage level.

FS: Safety factor.
Ratio between the maximum primary rated current and the primary rated current.

B: Insulation class.
This should be noted if it is not Class A.
Class A corresponds to a reference temperature of 40°C.
Class B corresponds to an increase in permitted temperature to 80°C.

Icth: Continuous rated thermal current.
Value of the current which can circulate indefinitely in the primary winding without the temperature rise exceeding the specified limits, with the secondary winding connected to the rated load. In this example: Icth < 100% Ipr, therefore 100% of the primary rated current.

Ith: Rated thermal short-circuit current.
Maximum value of the primary current which a transformer can withstand without being damaged for a short specified period, with the secondary winding short-circuited. In this example: Ith < 60 Ipr, therefore 60 times the primary rated current.

DETERMINATION OF THE MAX. CABLE LENGTH

It is important to keep the current transformers and measuring devices as far apart as possible. The table below indicates both the cable length and cross-section for compliance with the stated accuracy class.

Details of how to calculate the maximum cable length: "Help and definition" section.

RATING (A)	CAT. NO.	MAX. CT POWER		MAX. CABLE LENGTH BETWEEN CT/MEASURING DEVICE (M)		
		CLASS 0.5 (VA)	CLASS 1 (VA)	CABLE 1.5 MM²	CABLE 2.5 MM²	CABLE 6 MM²
50	4 121 01		1.25	1.1	1.8	4.4
75	4 121 02		1.5	1.5	2.4	5.9
100	4 121 03	2		2.2	3.7	8.9
125	4 121 04	2.5		2.9	4.9	11.8
160	4 121 05	3		3.7	6.1	14.8
200	4 121 06	4		5.1	8.5	20.7
250	4 121 07	5		6.6	11.0	26.6
400	4 121 12	10		13.9	23.2	56.2
600	4 121 14	12		16.8	28.1	68.1
250	4 121 16	3		3.7	6.1	14.8
400	4 121 17	6		8.0	13.4	32.6
700	4 121 19	8		11.0	18.3	44.4
250	4 121 23	3		3.7	6.1	14.8
300	4 121 24	5		6.6	11.0	26.6
400	4 121 25	8		11.0	18.3	44.4
600	4 121 26	12		16.8	28.1	68.1
700	4 121 31	8		11.0	18.3	44.4
800	4 121 32	8		11.0	18.3	44.4
1000	4 121 33	10		13.9	23.2	56.2
600	4 121 36	8		11.0	18.3	44.4
800	4 121 38	12		16.8	28.1	68.1
1000	4 121 39	15		21.2	35.4	85.8
1250	4 121 42	12		16.8	28.1	68.1
1600	4 121 46	10		13.9	23.2	56.2
2000	4 121 47	15		21.2	35.4	85.8
3200	4 121 49	25		35.8	59.8	145.0
1600	4 121 50	20		28.5	47.6	115.4
2000	4 121 51	25		35.8	59.8	145.0
2500	4 121 52	30		43.1	72.0	174.6
3200	4 121 53	30		43.1	72.0	174.6
4000	4 121 54	30		43.1	72.0	174.6
3 x 250	4 121 57		3	3.7	6.1	14.8
3 x 400	4 121 58		4	5.1	8.5	20.7
400	4 121 62	1.5		1.5	2.4	5.9
800	4 121 63	3		3.7	6.1	14.8
1000	4 121 64	5		6.6	11.0	26.6
1500	4 121 65	8		11.0	18.3	44.4
2000	4 121 66	15		21.2	35.4	85.8
2500	4 121 67	15		21.2	35.4	85.8
3000	4 121 68	20		28.5	47.6	115.4
4000	4 121 69	20		28.5	47.6	115.4

THE CONCENTRATOR EMDX³

PRODUCT SPECIFICATIONS

The EMDX³ concentrator Cat. No. 4 120 65 is used to collect pulses sent by the electricity, gas, water, oil meters, etc and transmit this information, via its RS485 output, to a supervision or energy management system.

The concentrator can collect data from up to 12 Legrand or non-Legrand water, gas or electricity pulse meters at the same time.

CHARACTERISTICS

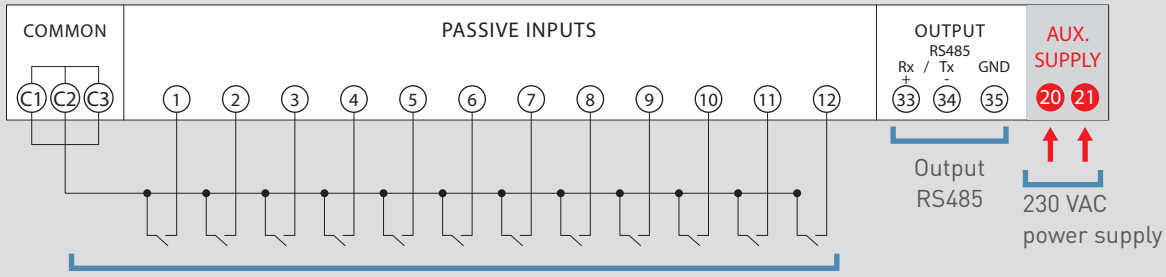
- Display: LCD.
- Power supply voltage: Single-phase 230 VAC.
- Frequency: 50 – 60 Hz.
- Consumption: 5 VA max.
- Connection: 12 digital inputs with volt-free contact
- Output: Modbus RS485
- Mounting: on DIN rail
- Dimensions: 4 modules

PRODUCT SELECTION

The EMDX³ concentrator Cat. No. 4 120 65, is used to:

- Display in a single place the consumption values of several electricity, gas or water pulse meters, ... up to 12 meters.
- Transmit this information on an RS485 BUS so it can be processed by an energy management system such as the Energy web server 0 261 78/0 261 79 or a building supervision system.

CONNECTION



Each meter pulse output is connected to one of the 12 concentrator inputs, and the common of these outputs should be connected to the C1/C2/C3 terminals. Make sure the polarity of the meter pulse outputs connected to the concentrator is correct.

Cable length between each meter and the concentrator: 1000 m max with min. 1 mm² cross-section.

Make sure the polarity of the meter pulse outputs connected to the concentrator is correct.

The concentrator needs an auxiliary power supply in order to work, and we recommend protecting it with 0.5 A gG fuses.

THE CONCENTRATOR EMDX^3

PARAMETER SETTING

After connection, the concentrator parameters need to be changed so that it displays data consistent with the associated meters.

- Programming mode is entered by simultaneously pressing both the "**PROG** and ↓" buttons on the front.
- Access to the parameters is locked by a password which can be changed if necessary (factory code = 1000).
- After simultaneously pressing both the "**PROG** and ↓" buttons with manual mode selected, the parameters scroll down on release.
- The parameters scroll down in succession if automatic mode is selected.
- The "**PROG**" button alone changes the value of the chosen parameter.
- The "↓" button alone moves the cursor.
- The "Rx Tx" LEDs identify RS485 dialogue.

PARAMETER IDENTIFICATION

DISPLAY	PARAMETER
PASSWORD	Password
PRG input	Setting the input type parameters: • Pot Free = 12 pulse inputs with volt-free contact • PotAFree = 12 pulse inputs with volt-free contact (the parameters of the 1st input are loaded on the next automatically) • Pot Live = not used • GME S0 = not used
1 PLS TYP	Pulse type setting (where 1 = input 1)
1 PLS VAL	Pulse weight setting (where 1 = input 1)
1KTA	Connected meter current transformer ratio (where 1 = input 1)
1KTV	Connected meter voltage transformer ratio (where 1 = input 1)
1TIM OFF	OFF time (where 1 = input 1)
Scroll	Automatic or manual parameter scrolling
Address	Modbus communication address
Baudrate	Modbus communication speed
Parity	Modbus parity bit (none, even, odd)
Contrast	Screen contrast setting
SAVING	Backup

DATA TRANSFER

The concentrator has an RS 485 output which can send data to an operating system.

- RTU mode Modbus protocol
- Address from 1 to 255
- Baud rate 9600, 19,200 Bauds
- Parity: even, odd, none
- 2-pair wiring RS485 standard (Belden 9842)

The wiring diagram for an RS485 BUS is illustrated in the "Communication protocols" section.

MODBUS ADDRESSING

To allow systems integrators to develop the 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.

THE ECOMETER

PRODUCT SPECIFICATIONS

The ecometer is used to measure or calculate the consumption of various energy-using items: heating, cooling, hot water production, power sockets, water and gas circuits.

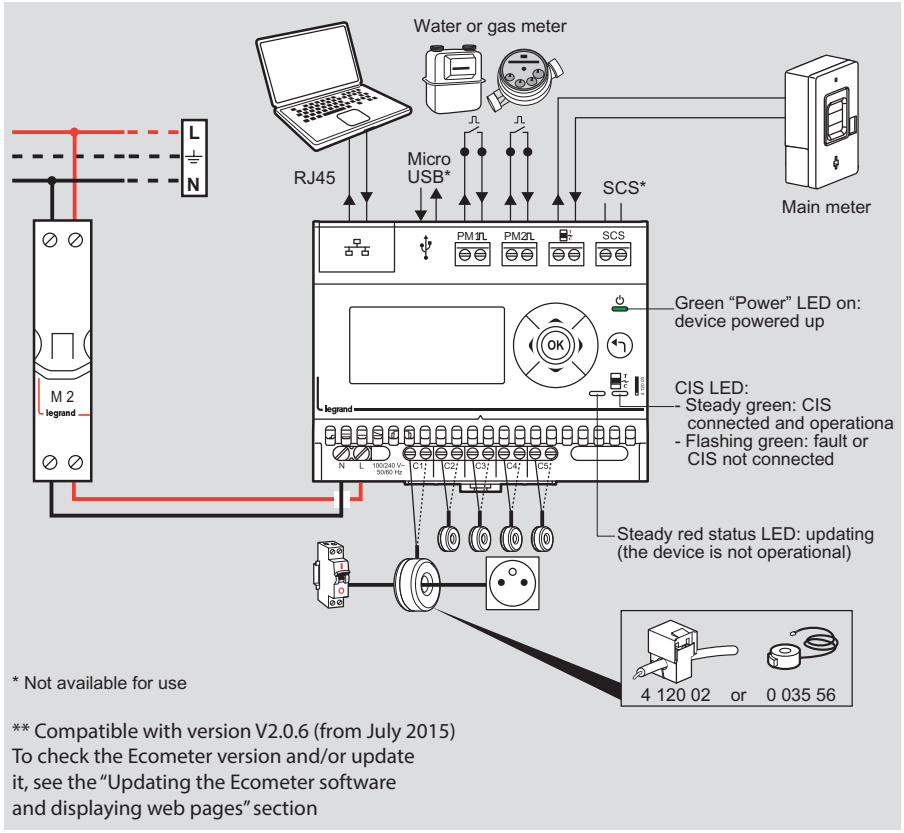
CHARACTERISTICS

- Display: LCD
- Power supply voltage: 100 to 240 VAC
- No-load power consumption: 2 W
- Frequency: 50 – 60 Hz
- Inputs:
  - 5 x 0 - 90 mA current transformer inputs
  - 2 digital inputs with volt-free contact
  - 1 CIS input for electronic meter or Linky
- Outputs:
  - SCS BUS compatible with MYHOME screens, door entry systems BTicino
  - 1 RJ 45 output in Ethernet format
- Mounting: on DIN rail
- Dimensions: 6 modules
- Configuration: local or remote

PRODUCT SELECTION

The ecometer is available for use in private homes and/or apartment blocks. It is ideally designed to comply with regulations such as RT2012.

CONNECTION



* Not available for use

** Compatible with version V2.0.6 (from July 2015)
To check the Ecometer version and/or update it, see the "Updating the Ecometer software and displaying web pages" section

It comprises:

- An IP output in Ethernet format for displaying consumption on web pages via the router. The data can be viewed on a smartphone, tablet, PC etc, at home or remotely.
- 5 inputs for measuring electrical circuits, used to connect up to 2 current transformers per input (Cat. No. 4 120 02 or 0 035 56).
- 2 wired pulse inputs for metering gas and water, etc
- 1 CIS (customer information system) input for CBE (French electricity tariff) or Linky meter, for managing tariff periods.
- A BUS/SCS output for displaying consumption on a Bticino door entry system or MyHome home automation screens.

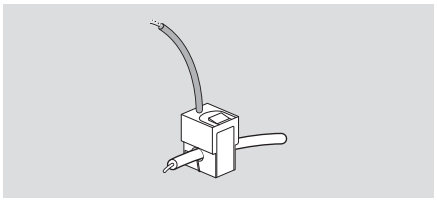
Open CT: Cat. No. 4 120 02
Closed CT: Cat. No. 0 035 56

Ready to install solution: kit Cat. No. 4 120 10 including an ecometer Cat. No. 4 120 00 + 3 CTs Cat. No. 4 120 02.

- **Accuracy of connecting current transformers (CTs):**

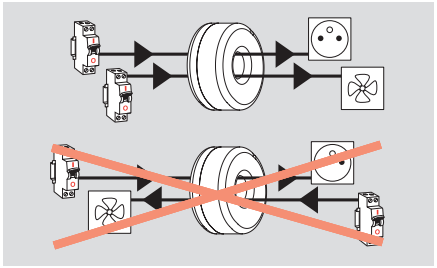
For either CT Cat. No. (4 120 02 or 0 035 56):

Several wires can be passed through each toroid, in accordance with the conditions below:

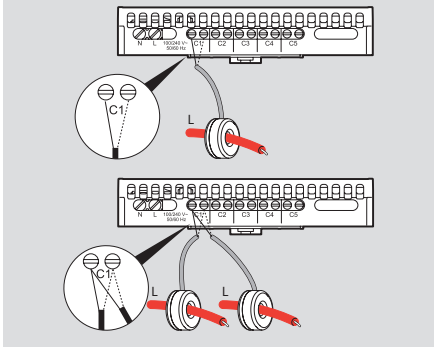


Max. number of wires per toroid: - 10 x 1.5 mm²
- 7 x 2.5 mm²
- 4 x 6 mm²
- 1 x 10/16/25 mm²

The direction of current flow must be identical.



Maximum of 2 toroids used per input.



Take care not to exceed the maximum amount of toroid data: 90 A

PARAMETER SETTING

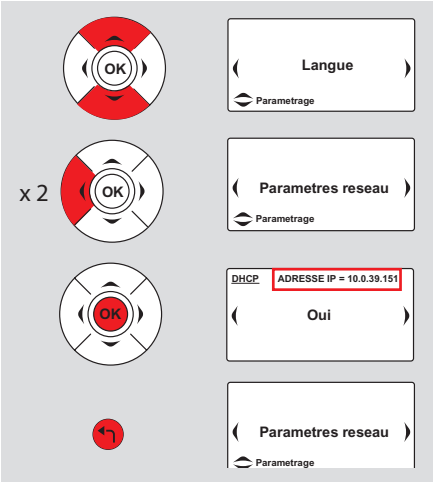
The parameters of ecometer Cat. No. 4 120 00 can be set in 2 different ways:

- **Option 1: setting parameters on the device (on the front):**

Access to the various parameters and data is via the "↑ ↓ → ← ok ←" buttons.
List of parameters:

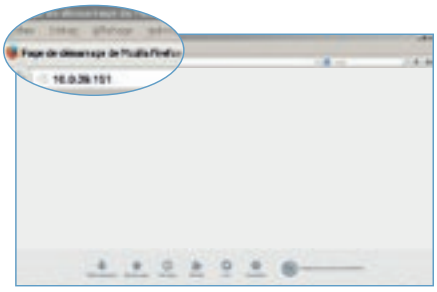
- Language selection
- Date and time settings
- Currency selection
- Choice of toroidal core inputs
- Pulse input setting
- Mains supply parameter

- **Option 2: setting parameters remotely on a computer (connection via IP network):**



The ecometer must therefore be connected to the computer network.
To do this, you need to know the ecometer's automatic IP address given by the DHCP server (in private homes, the router for example).

The ecometer is factory-set with an automatically-assigned IP address. It is possible to fix its address as a static IP.



On a PC connected on the same IP network:

- Open an internet browser.
- Type in the ecometer IP address.
- Confirm by pressing Enter.

Like any device connected on a local area network (intranet), access to the ecometer is secure during a remote connection (internet). To obtain this authorisation, it is preferable to contact the network administrator (router subscription operator) who will do the necessary to open the port and redirect to the ecometer.

OVERVIEW OF MENUS

■ "Home" menu:

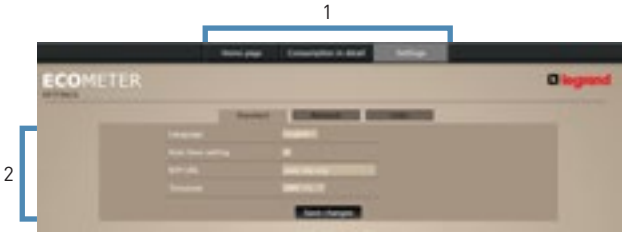
1: Access to menus.
2: Total power consumption (Information provided by the link to the electricity meter).
3: Consumption of water and gas meters.
4: Display of 5 instantaneous powers corresponding to toroidal core inputs.

■ "Detailed consumption" menu:

1: Access to menus.
2: Choice of display by date or period.
3: This page is used to view the detailed consumption of the various connected energy-using items.
4: Choice of display in kWh or in €.
5: Option to extract raw data into files by date and time.

The ecometer must have been connected for at least 24 hours before the first log will appear in the detailed consumption.

■ "Parameter" menu:



1: Access to menus.
2: Setting the language, time, date.

1: Choice of automatic or static IP address.

1: Assignment of circuits and tariffs: Electrical in the "Electricity" tab
Gas and water in the "Other" tab.

See more details in the "Communication protocols, IP addressing" section.

DMX³ COMMUNICATING CIRCUIT BREAKERS

PRODUCT SPECIFICATIONS

DMX³ air circuit breakers are used for the incoming protection and control of low voltage installations up to 6300 A. Assembled in the factory, they must always be ordered with a protection unit Cat. Nos. 0 288 00/01/02/03/04.

They become communicating by combining them with option Cat. No. 0 288 05, which must also be factory-fitted.

Depending on the type of unit chosen, the information appearing on the RS485 BUS differs.

It is still possible to combine measurement with non-communicating DMX³ circuit breakers by means of EMDX³ meters and measurement control units.

DMX³ made communicating with Cat. No. 0 288 05

Protection units
Cat. Nos. 0 288 00/01/02/03/04

CHARACTERISTICS

The characteristics of the various DMX³ circuit breakers are not detailed in this guide which is only concerned with measurement and supervision. Only those in option Cat. No. 0 288 05, specifically designed for communication, are described.
You can find all the necessary information in the various product-related documents such as the general catalogue, e-catalogue, instructions, technical data sheets, Power Guide, and DMX³ workshop specifications.

External power supply Cat. No. 0 288 06:

- This power supply is required when using the communicating DMX³ option Cat. No. 0 288 05.
- This module is itself be supplied with 24 VDC/AC.
- Use a power supply with double galvanic isolation or equivalent, Cat. No. 1 466 23 for example.
- Consumption 5 W, 250 mA.

RS485 communication port:

- Connected on the DMX³ terminal block
- Parameters set on the front of the DMX³

Each external power supply Cat. No. 0 288 06 is capable of powering:
- One MP6 touch screen protection unit
- Up to four MP4 LCD screen protection units
- It is not possible to power an MP4 and an MP6 touch screen protection unit with the same power supply.

It must be protected, like any electrical circuit.

PRODUCT SELECTION

Which DMX³ should be chosen is not specified in this guide, which is only concerned with measurement and supervision.
You can find all the necessary information in the various product-related documents such as the general catalogue, e-catalogue, instructions, technical data sheets, Power Guide, and DMX³ workshop specifications.

The table below indicates the data available on the RS485 BUS for different devices.

	DMX³ WITH PROTECTION UNIT 0 288 00	DMX³ WITH PROTECTION UNIT 0 288 01	DMX³ WITH PROTECTION UNIT 0 288 02	DMX³ WITH PROTECTION UNIT 0 288 03	DMX³ WITH PROTECTION UNIT 0 288 04
Current	X	X	X	X	X
Ph/N and Ph/Ph voltages				X	X
P, Q, A powers (total and per phase)				X	X
Frequency				X	X
Power factor (total and per phase)				X	X
Active and reactive energy				X	X
Total harmonic distortion				X	X
Position (open/closed/fault)	X	X	X	X	X
Date, time and cause of last trip	X	X	X	X	X

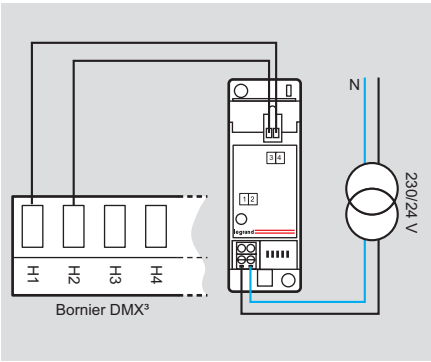
CONNECTION

■ **Power supply 0 288 06:**

Particular care must be taken when connecting the power supply 0 288 06 to the DMX³ terminal block. Reversing the wiring can damage the protection unit.

– Terminal H1 on the DMX³: terminal 4 of the power supply Cat. No. 0 288 06.

– Terminal H2 on the DMX³: terminal 3 of the power supply Cat. No. 0 288 06.



■ **RS485 BUS:**

RS485 BUS connected directly on the DMX³ terminal block on H5, H6, H7:

H5: RS485 BUS SG

H6: RS485 bus (-)

H7: RS485 BUS (+)

The wiring diagram for an RS485 BUS is illustrated in the section with that name.

PARAMETER SETTING

Which DMX³ parameters should be set is not specified in this guide, which is only concerned with measurement and supervision.

You can find all the necessary information in the various product-related documents such as the general catalogue, e-catalogue, instructions, technical data sheets, Power Guide, and DMX³ workshop specifications.

Modbus function parameter settings:

- Modbus RTU and ASCII protocol
- Baud rate 2400, 4800, 9600, 19,200, 38,400 bauds
- Address from 1 to 247
- Parity: even, odd, none
- Stop bit: 1
- Wait times between 2 transmissions: 50 ms
- 2-pair wiring RS485 standard (Belden 9842)

PARAMETER SETTING (CONTINUED)

■ **Modbus parameter-setting mode for MP4 protection units:**

The Modbus parameters can be set on the front of MP4 units using the 4 function keys with a display on the LCD screen:

MENU → Modules → Com. setting → Address
→ Speed
→ Mod. RTU/ASCII
→ Parity

■ **Modbus parameter-setting mode for MP6 measurement units:**

The Modbus parameters can be set on the front of MP6 units using the touch screen:

1 for the address

9.600 bit/s for the speed

ASCI for the mode

EVEN for the parity

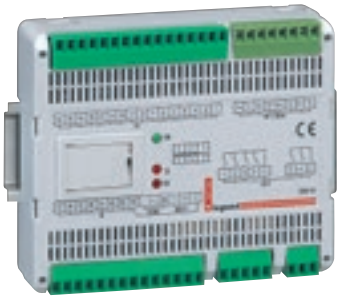
DATA TRANSFER

■ **Communicating DMX³s:**

All the information managed by the circuit breaker's circuit board are shared on the Modbus network via option 0 228 05.

■ **Non-communicating DMX³s:**

The addition of a control and signalling interface Cat. No. 0 261 36 allows some information from non-communicating circuit breakers to be read, such as the circuit breaker status (open, closed, fault), so it can be viewed on the Modbus network.



For further details of this interface, you should refer to the section: "Product specifications: control and signalling interface".

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 by selecting the DMX³ catalogue number.

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

DMX³ COMMUNICATING CIRCUIT BREAKERS

PRODUCT SPECIFICATIONS

Legrand is bringing a new dimension to protection devices, with measurement via e.communication directly integrated in the new DPX³ electronic circuit breakers.
Depending on the type of DPX³ electronic circuit breaker chosen, the information appearing on the RS485 BUS differs.
It is still possible to combine measurement with other DMX³ circuit breakers by means of EMDX³ meters and measurement control units.
DPX³ can be made communicating with communication interface 4 210 75.

DPX³
E.communicating

Communication interface
Cat. No. 4 210 75

CHARACTERISTICS

The characteristics of the various DPX³ are not detailed in this guide, which is only concerned with measurement and supervision.

You can find all the necessary information in the various product-related documents such as the general catalogue, e-catalogue, instructions, technical data sheets, Power Guide, and DPX³ workshop specifications.

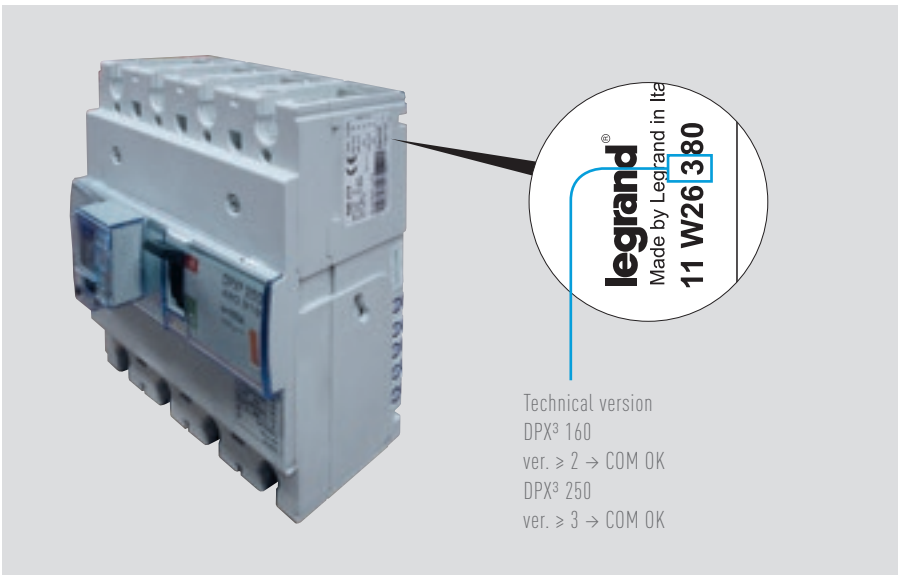
Communication interface Cat. No. 4 210 75 must be protected, like any electrical circuit.

PRODUCT SELECTION

Which DPX³ should be chosen is not specified in this guide, which is only concerned with measurement and supervision.
You can find all the necessary information in the various product-related documents such as the general catalogue, e-catalogue, instructions, technical data sheets, Power Guide, and DPX³ workshop specifications.
The table below indicates the data available on the RS485 BUS for different devices.

	ELECTRONIC DPX³ 250	ELECTRONIC DPX³ 250 WITH RCD	ELECTRONIC DPX³ 250 WITH MEASUREMENT	ELECTRONIC DPX³ 630	ELECTRONIC DPX³ 630 WITH MEASUREMENT	ELECTRONIC DPX³ 1600	ELECTRONIC DPX³ 1600 WITH MEASUREMENT
Currents	X	X	X	X	X	X	X
Voltages			X		X		X
Frequency			X		X		X
Active and reactive power			X		X		X
Power factor			X		X		X
Active and reactive energy			X		X		X
Total harmonic distortion			X		X		X
Position (open/closed/fault)	X	X	X	X	X	X	X
Date, time and cause of last trip	X	X	X	X	X	X	X

■ Identification of the technical version of compatible circuit breakers



The oldest versions of DPX³ 160 and 250 are not compatible with Modbus connection.
All DPX³ 630 and 1600 units are compatible.
Remember that only thermal-magnetic DPX³ with residual current protection and electronic DPX³ can be made communicating by adding an interface 4 210 75.

CONNECTION

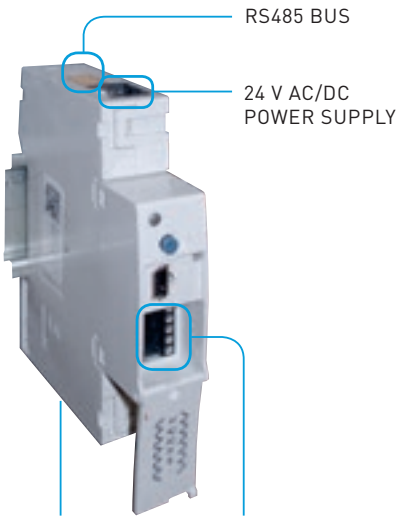
■ **Link between the DPX³ and interface 4 210 75:**

Connection under the communication interface. The connecting cable issupplied with the interface.

Connection on the left-hand side of the DPX³, under the label.

The cable supplied with interface Cat. No. 4 210 75 is 0.70 m long.

Interface 4 210 75 is used to transmit the data on the communicating DPX³ over the RS485 BUS.



The wiring diagram for an RS485 BUS is illustrated in the "Communication protocols" section.

PARAMETER SETTING

■ **DPX³:**

Which DPX³ parameters should be set is not specified in this guide, which is only concerned with measurement and supervision.
You can find all the necessary information in the various product-related documents such as the general catalogue, e-catalogue, instructions, technical data sheets, Power Guide, and DPX³ workshop specifications.

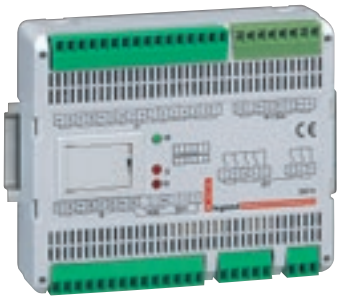
■ **RS485/IP interfaces:**

The parameters of interface 4 210 75 are set using a configurator.
You should refer to the section: "Product specifications, interface 4 210 75".

DATA TRANSFER

■ **Communicating DPX³s:**
All the information managed by the circuit breaker's circuit board is shared on the Modbus network via interface 4 210 75.

■ **Non-communicating DPX³s:**
The addition of a control and signalling interface Cat. No. 0 261 36 allows some information from non-communicating circuit breakers to be read, such as the circuit breaker status (open, closed, fault), so it can be viewed on the Modbus network.



For further details of this interface, you should refer to the section: "Product specifications: control and signalling interface".

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 by selecting the DPX³ catalogue number.

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

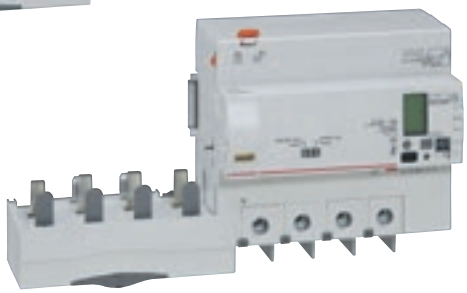
ADD-ON MODULES METERING OR MEASUREMENT FOR DX^3

PRODUCT SPECIFICATIONS

Add-on modules with integrated electricity meter or measurement control unit combined with DX^3(*) modular circuit breakers protect people from direct and indirect contact and protect installations from insulation faults.
They can also be used to measure the main electrical values depending on the choice of catalogue number.
They can be made communicating with communication interface 4 210 75.
(*) 1.5 modules per pole

Communication interface Cat. No. 4 210 75 is also used with communicating DPX^{3}s.

Add-on module with integrated electricity meter



Add-on module with integrated measurement control unit

Communication interface
Cat. No. 4 210 75

CHARACTERISTICS

The characteristics of the various DPX^3 circuit breakers are not detailed in this guide, which is only concerned with measurement and supervision.

You can find all the necessary information in the various product-related documents such as the general catalogue, e-catalogue, instructions, technical data sheets, and Power Guide.

Communication interface Cat. No. 4 210 75 must be protected, like any electrical circuit.

PRODUCT SELECTION

Legrand offers 3 different DX³ add-on modules.

4-pole 400 V~ - Metering

LCD display
For displaying active energy consumption, instantaneous power and current per phase (A)

Hpi type with integrated electricity meter

	Screw	Sensitivity (mA)	Current (A)	No. of modules
1	4 106 57	30 to 3000	63	7.5
1	4 106 58	30 to 3000	125	7.5

4-pole 400 V~ - Measurement

LCD display
For displaying energy consumption, power, frequency, voltage, current and harmonics

Hpi type with integrated measurement control unit

	Screw	Sensitivity (mA)	Current (A)	No. of modules
1	4 106 59	30 to 3000	125	7.5

The add-on module can be used with DX³ circuit breakers with 1.5 modules per pole.

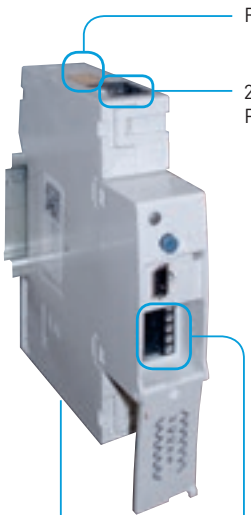
The table below indicates the data available on the RS485 BUS for the different devices.

	ADD-ON MODULE WITH INTEGRATED ELECTRICITY METER 4 106 57/4 106 58	ADD-ON MODULE WITH INTEGRATED MEASUREMENT CONTROL UNIT 4 106 59
Instantaneous value of currents I1, I2, I3, IN	X	X
Instantaneous value of residual current	X	X
Phase-to-neutral voltages V1, V2, V3 and phase-to-phase voltages U12, U23, U31		X
Frequency		X
Active power	X	X
Reactive power		X
Power factor		X
Active energy	X	X
Reactive energy		X
THD V1, V2, V3		X
THD I1, I2,I3, IN		X
Value of last trip on residual current fault:	X	X
Value of last trip due to overheating	X	X
Value of last trip caused by pressing test button	X	X
No trip memory	X	X

CONNECTION

■ **Link between interface 4 210 75 and the installation**

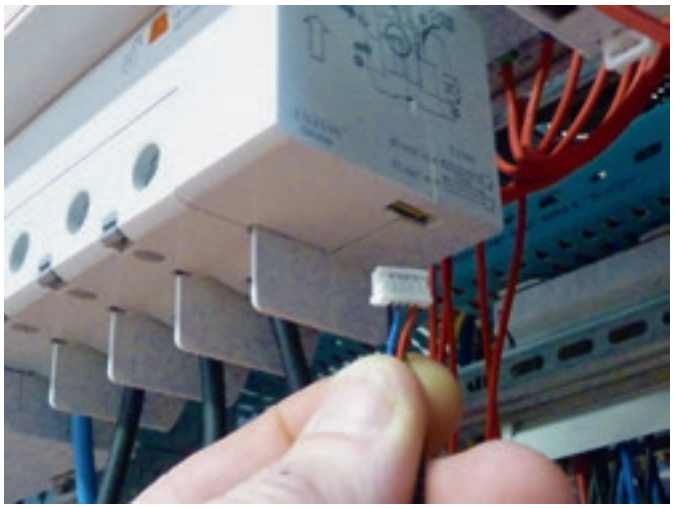
Interface 4 210 75 is used to transmit the data on the communicating add-on module over the RS485 BUS.



The wiring diagram of an RS485 BUS is illustrated in the "Communication protocols" section.

■ **Link between the add-on module and interface 4 210 75:**

Connection under the communication interface.
The connecting cable is supplied with the interface.



The communication interface is connected under the add-on module.

The cable supplied with interface Cat. No. 4 210 75 is 0.70 m long.

PARAMETER SETTING

■ **Add-on modules:**

Which add-on module parameters should be set is not specified in this guide, which is only concerned with measurement and supervision.
You can find all the necessary information in the various product-related documents such as the general catalogue, e-catalogue, instructions, technical data sheets, and Power Guide.

■ **RS485/IP interfaces:**

The parameters of interface 4 210 75 are set using a configurator.
You should refer to the section: "Product specifications, interface 4 210 75".

DATA TRANSFER

All the information managed by the add-on module is shared on the Modbus network via interface 4 210 75.

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 by selecting the add-on module catalogue number.

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

COMMUNICATION
INTERFACE 4 210 75

PRODUCT SPECIFICATIONS

Interface 4 210 75 is used to connect certain Legrand products such as DPX³, add-on modules, on an RS485 MODBUS communication network.

It has a contact which signals when the associated circuit breaker has tripped.

CHARACTERISTICS

- RS485 communication interface for DPX³ and add-on module Cat. No. 4 210 75
- 24 V DC/AC power supply. Use a power supply with double galvanic isolation or equivalent, Cat. No. 1 466 23 for example
- Consumption 90 mA
- RS485 serial communication port
- Modbus parameters set using configurators
- Volt-free contact for circuit breaker tripped status information max. 220 V 0.2 A

PRODUCT SELECTION

Communication interface 4 210 75 should be used with communicating DPX³s and add-on modules.

CONNECTION

■ **Link between interface 4 210 75 and the Legrand device**

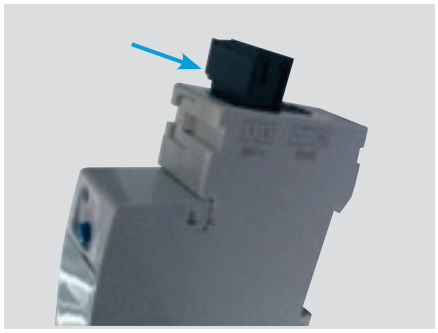
Connection under the communication interface. The connecting cable is supplied with the interface.

The cable supplied with interface Cat. No. 4 210 75 is 0.70 m long.

■ **Interface power supply**

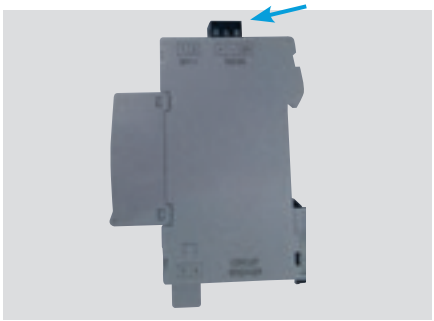
- 24 V DC/AC power supply
- Use a power supply with double galvanic isolation or equivalent
- Connected with a connector

Communication interface Cat. No. 4 210 75 must be protected, like any electrical circuit.



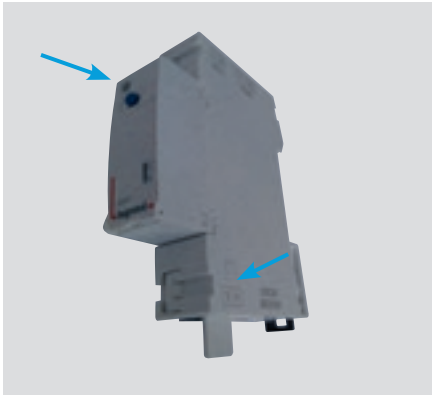
■ **Connection to the RS485 BUS**

- Connect the interface to the RS485 BUS
- The wiring diagram for an RS485 BUS is illustrated in the "Communication protocols" section
- Connected with a connector



■ **Use of the status contact**

- The circuit breaker tripped status information appears on a volt-free contact.
- NC = circuit breaker tripped
- Pushbutton function, relay test, press = NC
- Connected with a connector



COMMUNICATION INTERFACE 4 210 75

PARAMETER SETTING

The parameters of communication interface 4 210 75 are set using configurators.

- A1/A2/A3: Modbus address
- M: Modbus transmission method (RTU/ASCII, parity, stop bit)
- B: Baud rate
- Configurator 6: not used

Parameter setting is described in the technical data sheet.

Configurators are available under the following catalogue numbers:

- Complete set from 0 to 9: Cat. No. 3501K (10 of each configurator)
- Pack of 10 individual configurators: Cat. No. 3501/X (for example Cat. No. 3501/1 = a pack of 10 no. 1 configurators)

DATA TRANSFER AND MODBUS ADDRESSING

Cat. No. 4 210 75 is still a communication interface for transcribing information on Legrand circuit breakers in RS485 Modbus protocol.

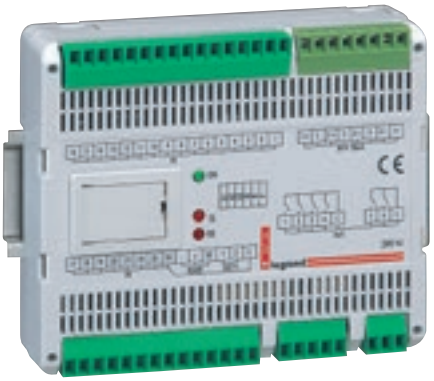
The various register tables are available in the DPX³ and add-on module product specifications.

CONTROL AND SIGNALLING
INTERFACE 0 261 36

PRODUCT SPECIFICATIONS

Control and signalling interface Cat. No. 0 261 36 should be mounted as close as possible to the electrical devices and can be used to:

- Read information such as the status of a circuit breaker, contactor or any other non-communicating electrical device, by simply connecting a status contact, in order to transcribe it in Modbus protocol.
- Control actuators such as circuit breaker motors or any electrical device by simply relaying the command via the RS485 BUS.



It has:
- 24 digital inputs (one common for all 24)
- 4 x 4 – 20 mA analogue inputs
- 6 relay digital outputs – NO contact max. 230 V, 2 A (one common for 4 and one for 2 relays)
- An RS485 link

It is used to:
- Read the status of each digital input, activate an alarm, activate an output in the event of an alarm on the input, and transmit data over RS485
- Read the status of the analogue input, activate an alarm according to an adjustable threshold, and transmit data over RS485
- Control each output individually
- Check the output status
- Modify their configuration individually (timed output, flashing with frequency setting, NC or NO)

CHARACTERISTICS

- Control and signalling interface Cat. No. 0 261 36
- 24 V DC/AC power supply. Use a power supply with double galvanic isolation or equivalent, Cat. No. 1 466 23 for example
- Consumption 3 W
- RS485 serial communication port
- Modbus parameters set using configurators

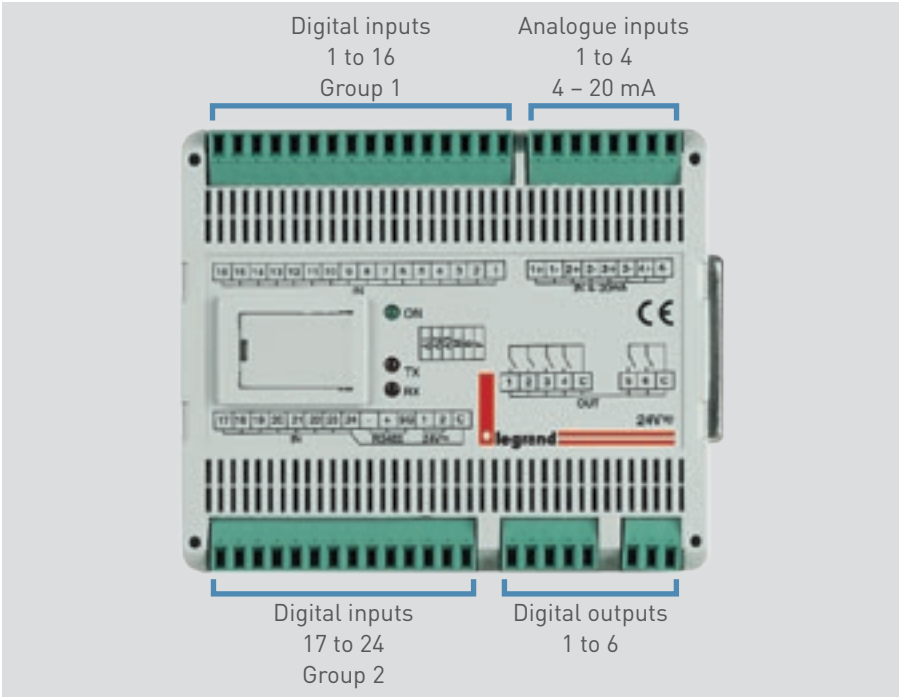
Control and signalling interface Cat. No. 0 261 36 must be protected, like any electrical circuit.

PRODUCT SELECTION

Control and signalling interface Cat. No. 0 261 36 is used with devices which do not have a control and/or signalling function via a communication BUS.

CONNECTION

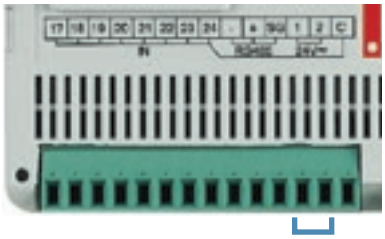
- **Inputs/outputs:**

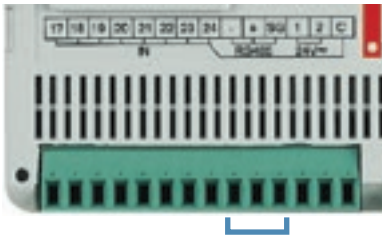


CONNECTION (CONTINUED)

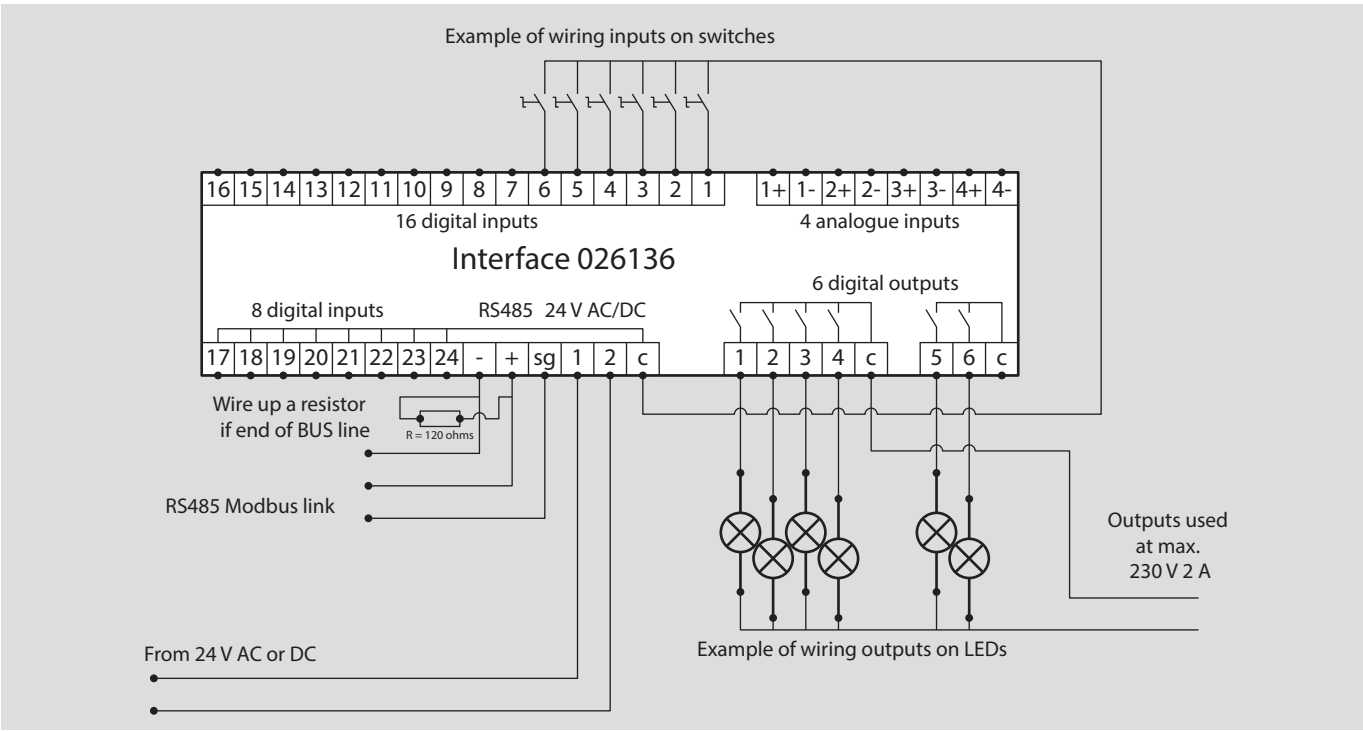
■ **Interface power supply**
- 24 V DC/AC power supply
- Use a power supply with double galvanic isolation or equivalent

■ **Connection to the RS485 BUS**
- Connect the interface to the RS485 BUS
- The wiring diagram for an RS485 BUS is illustrated in the "Communication protocols" section





■ **Wiring example**

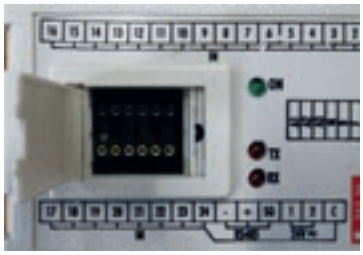


PARAMETER SETTING

The parameters of control and signalling interface 0 261 36 are set using configurators.

- A1/A2/A3: Modbus address from 1 to 247
- M: RTU/ASCII mode
- B: Baud rate, 1200, 2400, 4800, 9600, 19,200, 38,400 bauds
- Configurator 6: not used

Parameter setting is described in the technical data sheet.



Configurators are available under the following catalogue numbers:

- Complete set from 0 to 9: Cat. No. 3501K (10 of each configurator)
- Pack of 10 individual configurators: Cat. No. 3501/X (for example Cat. No. 3501/1 = a pack of 10 no. 1 configurators)

DATA TRANSFER

All the information managed by control and signalling interface 0 261 36 is shared on the Modbus network.

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 by selecting catalogue number 0 261 36.

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

RS485/IP INTERFACE

PRODUCT SPECIFICATIONS

The RS485/IP interface Cat. No. 0 046 89 is used to convert data from the RS485 – MODBUS network to the Ethernet network (TCP/IP protocol), in order to display and exploit the data on a PC, via dedicated software or a web server.

CHARACTERISTICS

- RS485/IP interface Cat. No. 0 046 89
- Power supply: 90 to 260 VAC, 50/60 Hz
- Consumption: 2.94 VA – 12.8 mA at 230 VAC
- Conforming to the following standards and specifications:
  - EN 61000-6-1/EN 61000-6-2
  - EN 61000-6-3/EN 61000-6-4
  - EN 50428 (HBES)
  - IEE 802.3, EIA RS485
- Ethernet interface: RJ45; 10/100 MB
- RS485 interface:
  - 2 wires (+/-) and ground
  - RTU/ASCII mode
  - no. of devices which can be connected, 32 max.
  - length of RS485BUS, 1200 m max.
- 3 modules, mounted on DIN rail

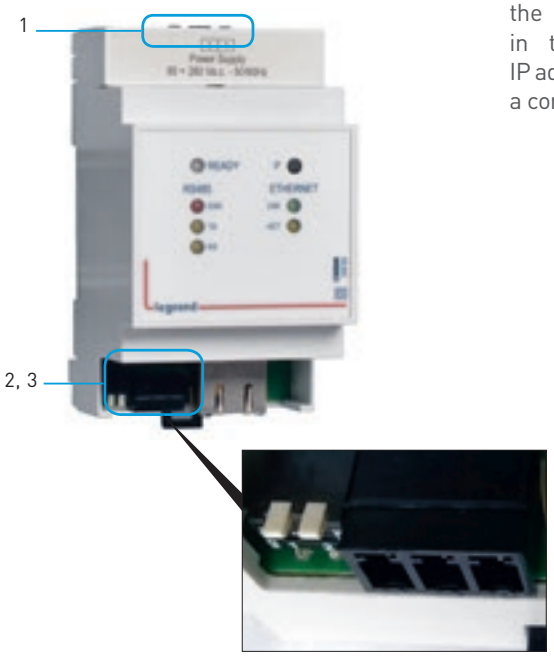
Interface Cat. No. 0 046 89 must be protected, like any electrical circuit.

PRODUCT SELECTION

The RS485/IP interface can be used with any RS485 device which needs a connection to an IP network.

CONNECTION

- **Power supply (1):**
  - Power supply: 90 to 260 VAC
  - Connected with a connector
- **RS485 BUS connection (2):**
  - Interface connection to the RS485 BUS
  - The wiring diagram for an RS485 BUS is illustrated in the "Communication protocols" section
  - Connected with a connector
- **Ethernet connection (3):**
  - Connection to the local IP network
  - Connected with an RJ45 connector

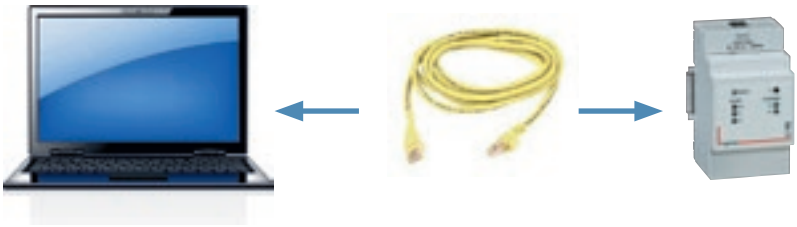


The switch on the underside of the Modbus connection is used to activate the 120 Ω termination resistor.

PARAMETER SETTING

The IP interface parameters must be modified to ensure they are part of the same networks, RS485 at one end and Ethernet at the other end, as all the devices in the same installation.

- **Connection for parameter modification:**



Once the interface is connected and powered:

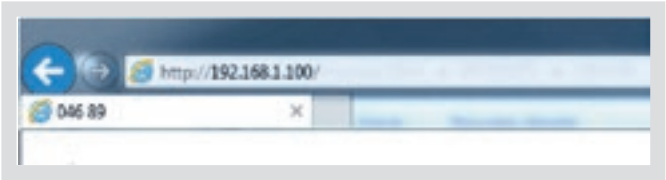
- Connect a PC directly to the converter with a straight RJ45 network cable.
- Modify the PC's network settings by changing to a static IP address, using the procedure described in this guide in the "Communication protocol → IP addressing → Procedure for modifying a computer's IP address" section.
- Since the default static IP address for an interface is 192.168.1.100, simply follow the example given, setting the PC's static IP address to 192.168.1.99. Neither the mask nor the gateway can be the same as in this example.

This involves changing the static IP address for each interface. It is therefore essential to have first contacted the website IT department to obtain a list of static IP addresses you can use.

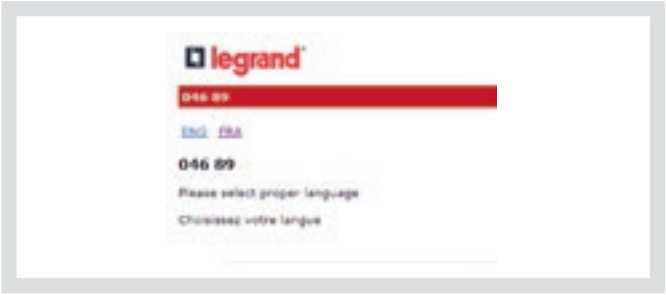
PARAMETER SETTING (CONTINUED)

■ **Connection to the IP interface:**

Open your web browser and enter the interface default IP address (192.168.1.100).



The home page of an IP interface looks like this. Select your language.



You can then access the view of the various interface parameters. You can click on each parameter to modify them.

Enter the username and password.

By default:

- username: customer
- password: 0000

PARAMETER SETTING (CONTINUED)

- **Modifying the IP interface parameters:**
  Enter the new parameters for the device below:

You can now modify the parameters:

- Of the RS485 Modbus network: make sure you have the same parameters on the same RS485 network.
- Of the Ethernet network: follow the instructions given by the website IT department.

Save.

Connect the IP interface to the Ethernet network.

When all the interfaces have been modified, you can switch back to automatic IP address on your PC.

Make sure you can still connect to each interface with its new IP address.

DATA TRANSFER AND MODBUS ADDRESSING

Interface Cat. No. 0 046 89 is a communication interface for transcribing RS485 Modbus protocol information into IP protocol.

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.

RS485 - MODBUS NETWORKS

PRODUCT SPECIFICATIONS

PRINCIPLE

The RS485-Modbus network is a communication network which allows measuring equipment to exchange various information with a computer or a PLC. This network is based on the master/slave principle.

Legrand metering devices operate in 8-bit Modbus RTU protocol.

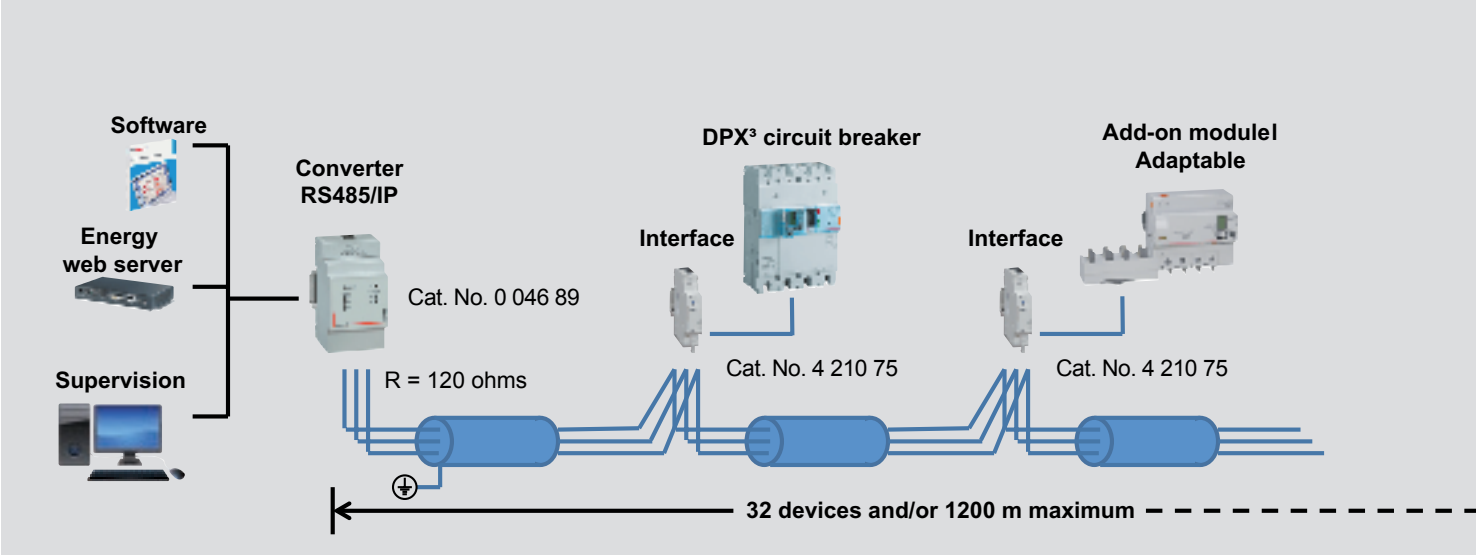
CONNECTION

To create a Modbus network, the various measuring devices with an output, or RS485 interface, must be connected in series (see diagram below).

For connection, Legrand recommends using a cable with 2 shielded twisted pairs (Belden 9842 or equivalent), with minimum cross-section of 0.20 mm² and impedance of 120 Ω.

To ensure equipotentiality of the shielding, only one end must be connected to earth.

A 120 Ω resistor (corresponding to the cable impedance) must be placed on each end of the BUS (first and last device) to prevent reflected signals.



PARAMETER SETTING

Four parameters are essential to ensure correct operation of a Modbus network:

- **MODBUS address:**

Each device must have a different Modbus address. Each meter, measurement control unit or interface must therefore be configured with a different address between 1 and 255.

- **Communication speed:**

The communication speed is the data transmission speed between master and slave in bps (bits per second). This must be identical for all devices connected to the same RS485 BUS.

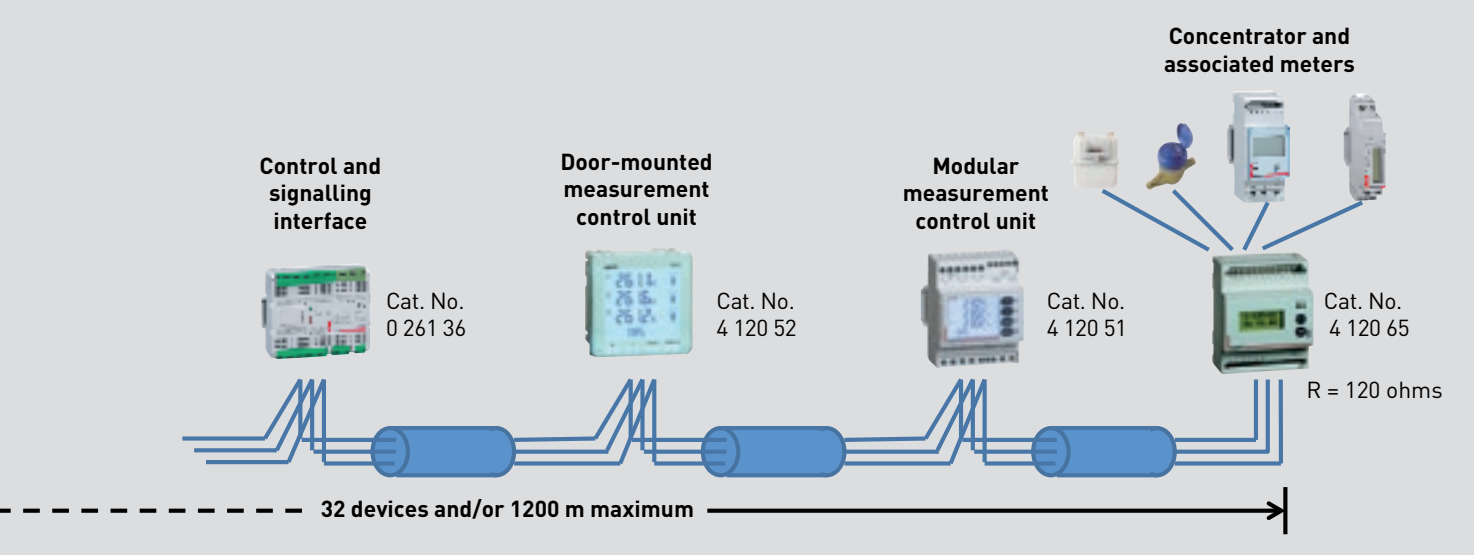
- **Parity bit:**

This improves the reliability of communication.
Legrand recommends setting no parity bit (none) because other more effective checking methods exist within the supervision system.

- **Stop bit:**

After transmission, the line is set to off for 1 or 2 clock periods depending on the chosen stop bit number.
Legrand has chosen to opt for 1 stop bit.

Refer to the "Communication protocols" sections for more information.



TOUCH SCREEN DISPLAY

PRODUCT SPECIFICATIONS

The touch screen display makes it possible to relay different information from a number of devices such as: DX³, DPX³, DMX³ or EMDX³.

CHARACTERISTICS

- Display:
  - On screen Cat. No. 0 261 56 and/or on any other type of screen with a web browser
- Installation:
  - Connection to the communication network, firmware
- Number of measuring devices:
  - Can manage up to 8 metering or power devices
- Power supply:
  - Single-phase 18 to 30 VDC (for example Cat. No. E49)
- Consumption:
  - 2.2 W (80 mA at 27 VDC)
- Connection:
  - With screws for the power supply
- Output:
  - RJ45 for the IP network connection
- Mounting:
  - On door or faceplate
- Dimensions:
  - Casing 128 x 102 x 26 mm overall
  - Cut-out 92 x 92 mm
- Configuration:
  - Local or remote

PRODUCT SELECTION

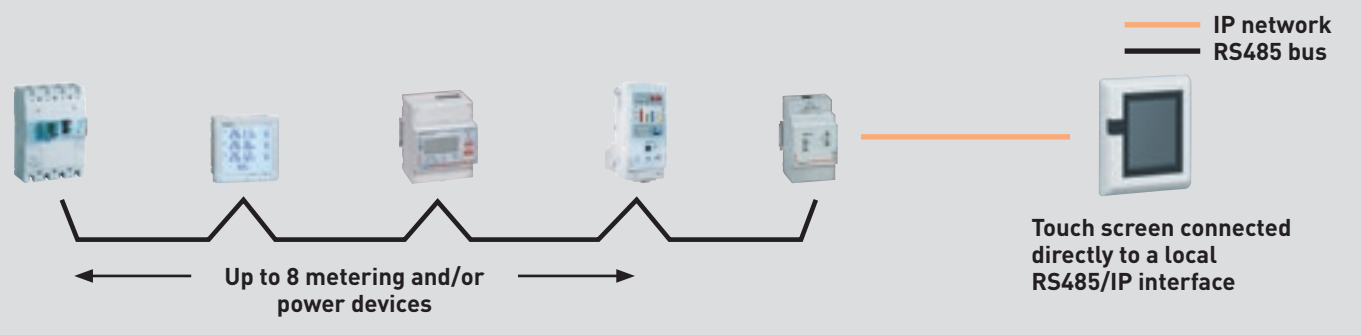
One or more screens Cat. No. 0 261 56 can be connected to an intranet in the same installation in order to relay information from 8 devices maximum per screen.

CONNECTION

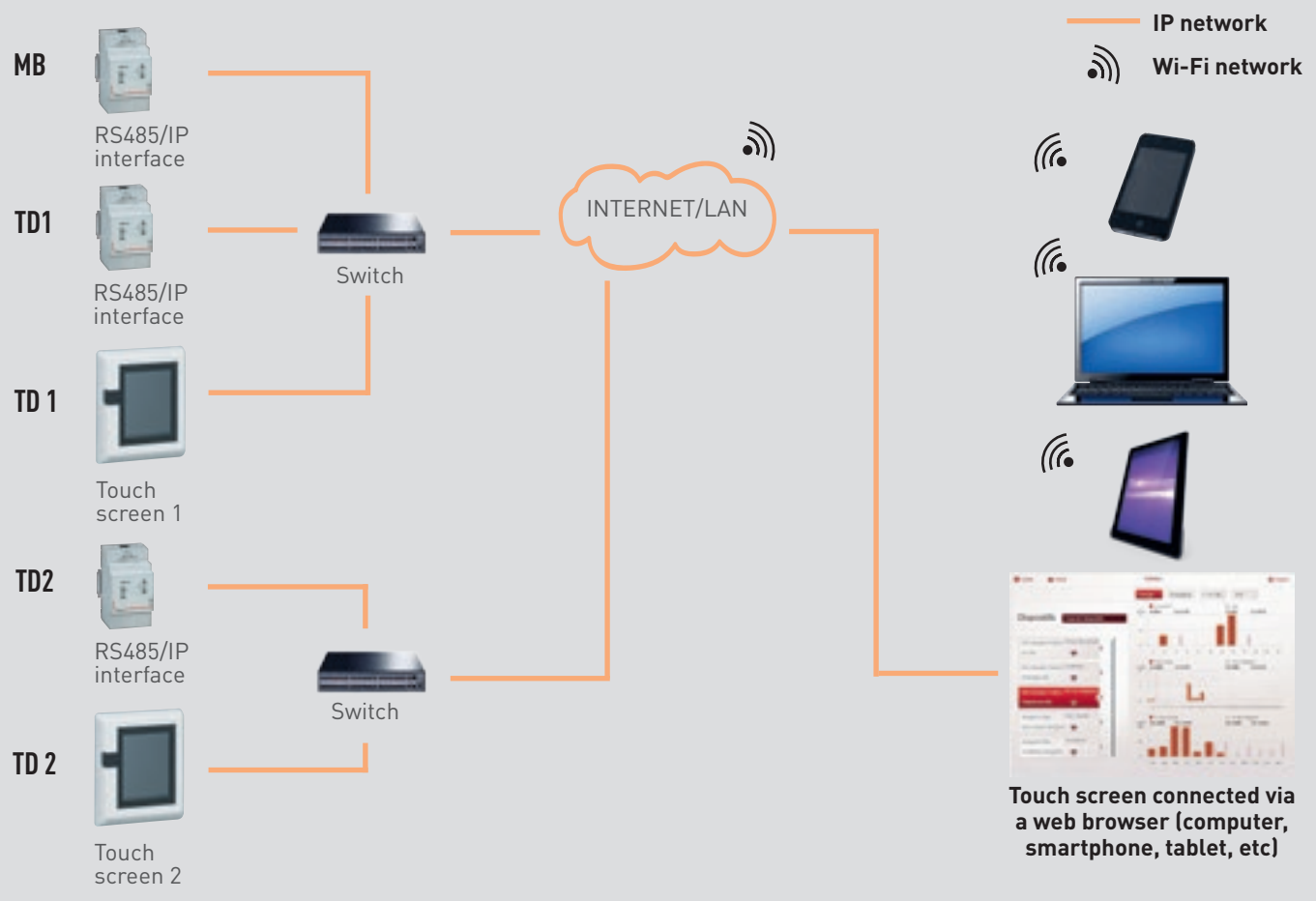
- **Back of the touch screen**

CONNECTION (CONTINUED)

■ **Example 1**



■ **Example 2**

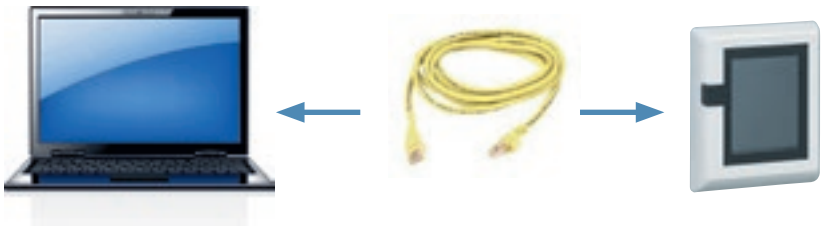


TOUCH SCREEN DISPLAY

PARAMETER SETTING

The screen settings must be modified to ensure they are part of the same network IP as all the IT devices.

- **Access to settings:**



The first time you log in, connect your computer directly to the screen and change its configuration (network settings, date, time, etc). To do this, open your web browser and enter the web server default IP address (192.168.1.100); make sure you have changed your computer's static IP address first (for example 192.168.1.99).

Like any device connected on a local area network (intranet), access to a touch screen is secure during a remote connection (internet). To obtain this authorisation, you should ideally contact the network administrator who will do the necessary to open the ports and redirect them to the web server.

Make sure that the touch screen is powered up before making changes.

Enter the default PIN administrator codes to access the menu.
PIN: 99999

Changing a computer's IP address to automatic or static: help is available in the "Communication protocol → IP addressing" section.

Access to data is protected by an ID code (PIN code).
There are 3 types of predefined user: Administrator, Installer, User.
Different access is offered depending on the ID selected.
It is possible to:
- add users
- change access codes

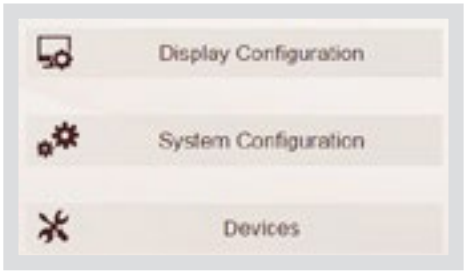
OVERVIEW OF MENUS

■ **"Home" menu:**

• On a computer

The display takes the form of 4 menus which can access various submenus.

Access to screen settings



Access to measuring equipment installation and configuration

Access to view of electrical values fed back by the measuring equipment

• On the touch screen

The display takes the form of 2 menus which can access various submenus.

Access to screen settings

Access to view of electrical values fed back by the measuring devices

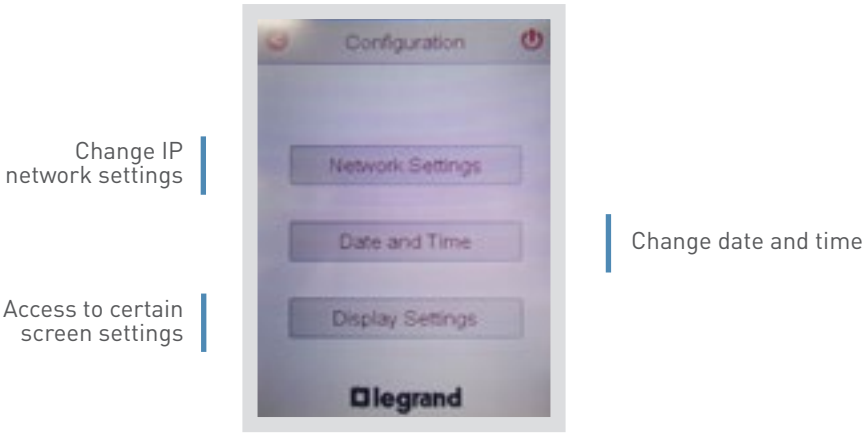
OVERVIEW OF MENUS (CONTINUED)

■ **"Screen settings" menu:**

• On a computer

• On the touch screen

Only some settings can be changed directly on the front of the screen. A password is requested to access them.



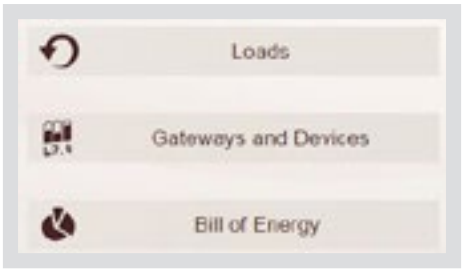
OVERVIEW OF MENUS (CONTINUED)

■ **"System configuration" menu:**

• On a computer

Create measuring circuits

Change currencies and the cost of energy (price per kWh)



Add and change the IP converters and related measuring equipment

• On the touch screen

The system can only be configured on a computer.

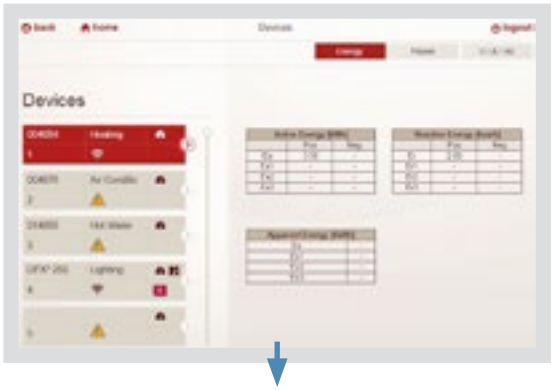
OVERVIEW OF MENUS (CONTINUED)

■ **"Devices" menu:**

View data fed back directly by devices declared on screen.

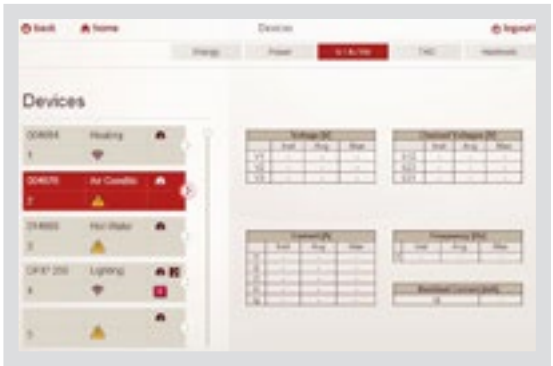
Dispositifs

On the computer
Energy by device



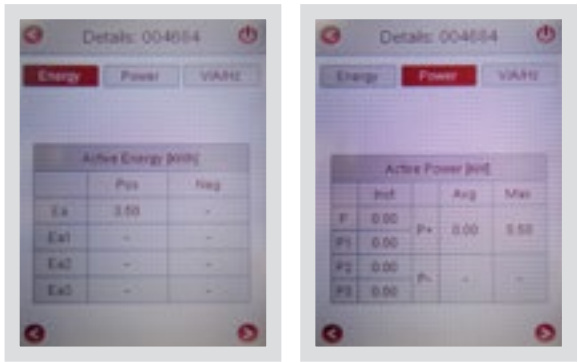
Power by device

Voltage, current, frequency, etc by device



On the screen
Device status

Power and energy by device

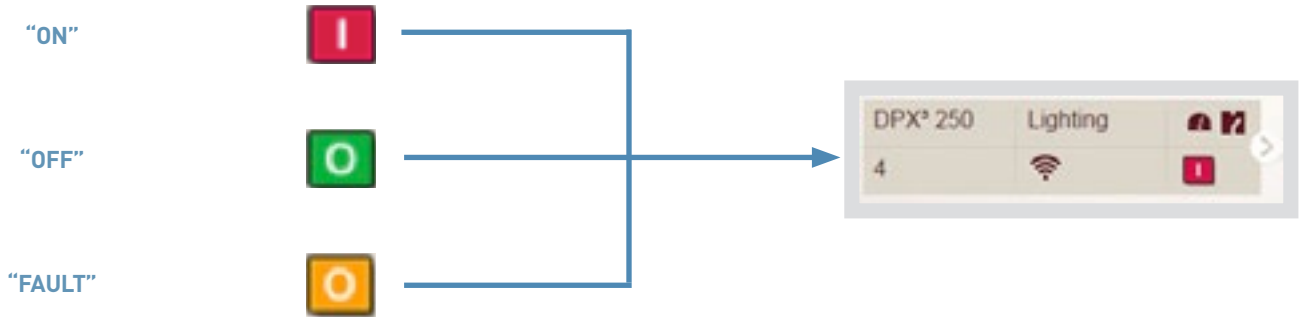


Voltage, current, frequency, etc by device

OVERVIEW OF MENUS (CONTINUED)

■ **Possibility of viewing the circuit breaker status:**

On the computer or on screen, communicating DMX³ and DPX³ circuit breakers indicate their status in real time.



ENERGY WEB SERVER AND MEASUREMENT SOFTWARE EDMX^3

CATALOGUE VERSION

PRODUCT SPECIFICATIONS

The Energy web server or "catalogue version" EMDX^3 measurement software is used to remotely display and save data provided by measuring equipment.

EMDX^3 measurement software can be used to view measurements on a dedicated PC on the local area network. Data is saved to the computer hard disk.

The Energy web server can be used to display data on any type of screen equipped with a web browser (computer, smartphone, tablet, etc). It has a hard disk for saving data.

CHARACTERISTICS

■ **EMDX^3 measurement software:**

■ Display and installation:
- On a dedicated computer

■ Max. number of devices:
- Cat. No. 0 261 88: 32 Modbus addresses or pulse meter
- Cat. No. 0 261 89: 255 Modbus addresses or pulse meter

■ System requirements:
- Intel Core 2 Duo or AMD Athlon X2RAM processor: 2 GB
- 320 MB of available disk space
- USB port for memory stick

■ Operating system:
- Microsoft Windows XP (Professional) with Service Pack 3
- Microsoft Windows Vista with Service Pack 2
- Microsoft Windows 7 with Service Pack 3

■ **Energy web server**

■ Display:
- On any type of screen equipped with a browser

■ Installation:
- Connection to the computer network, firmware

■ Max. number of devices:
- Cat. No. 0 261 78: 32 Modbus addresses or pulse meter
- Cat. No. 0 261 79: 255 Modbus addresses or pulse meter

■ Power supply:
- Single-phase 230 VAC

■ Connection:
- 230 VAC/12 VDC power supply adaptor included

■ Output:
- RJ45 for the IP network connection

■ Mounting:
- With screws on plate

■ Dimensions:
- Casing 170 x 11 x 32 mm excluding fixings

■ Configuration:
- Local or remote

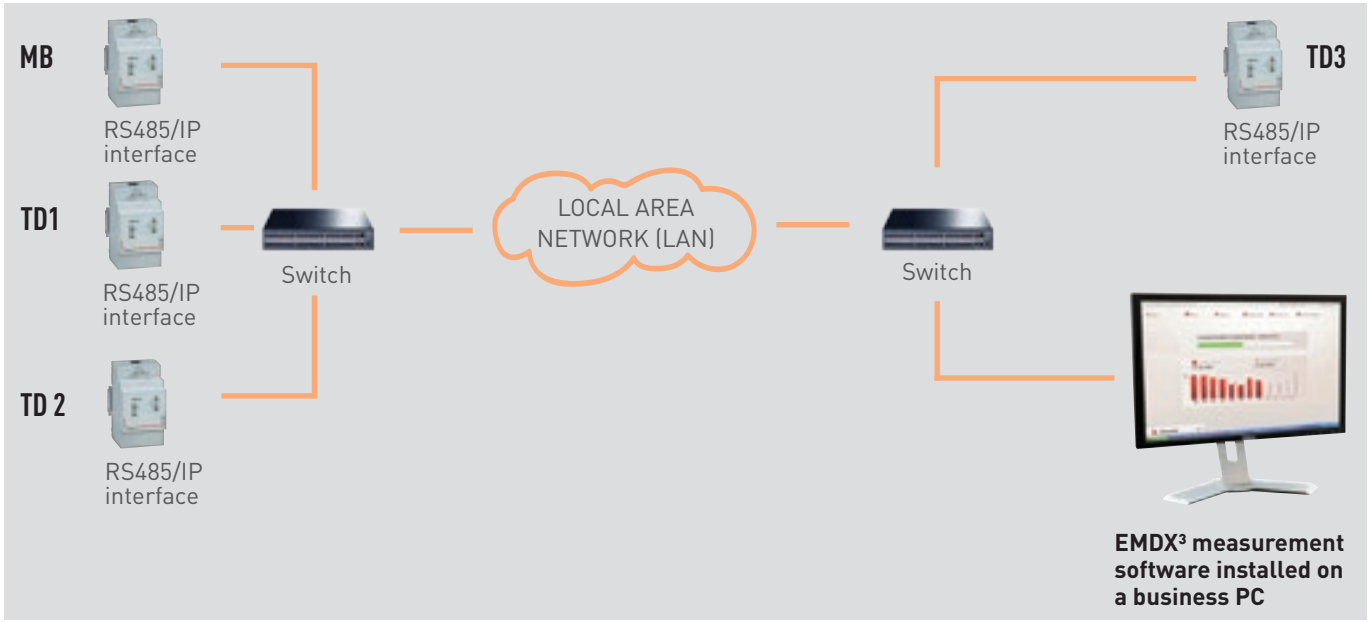
Bespoke version available. Please contact your Legrand sales office.

PRODUCT SELECTION

EMDX³ measurement software Cat. Nos. 0 261 88/89 should be chosen for viewing on a single local station, and Energy web server Cat. Nos. 0 261 78/79 should be chosen for remote viewing via a web browser. The latter can also be chosen for a multi-site installation sharing the same intranet.

CONNECTION

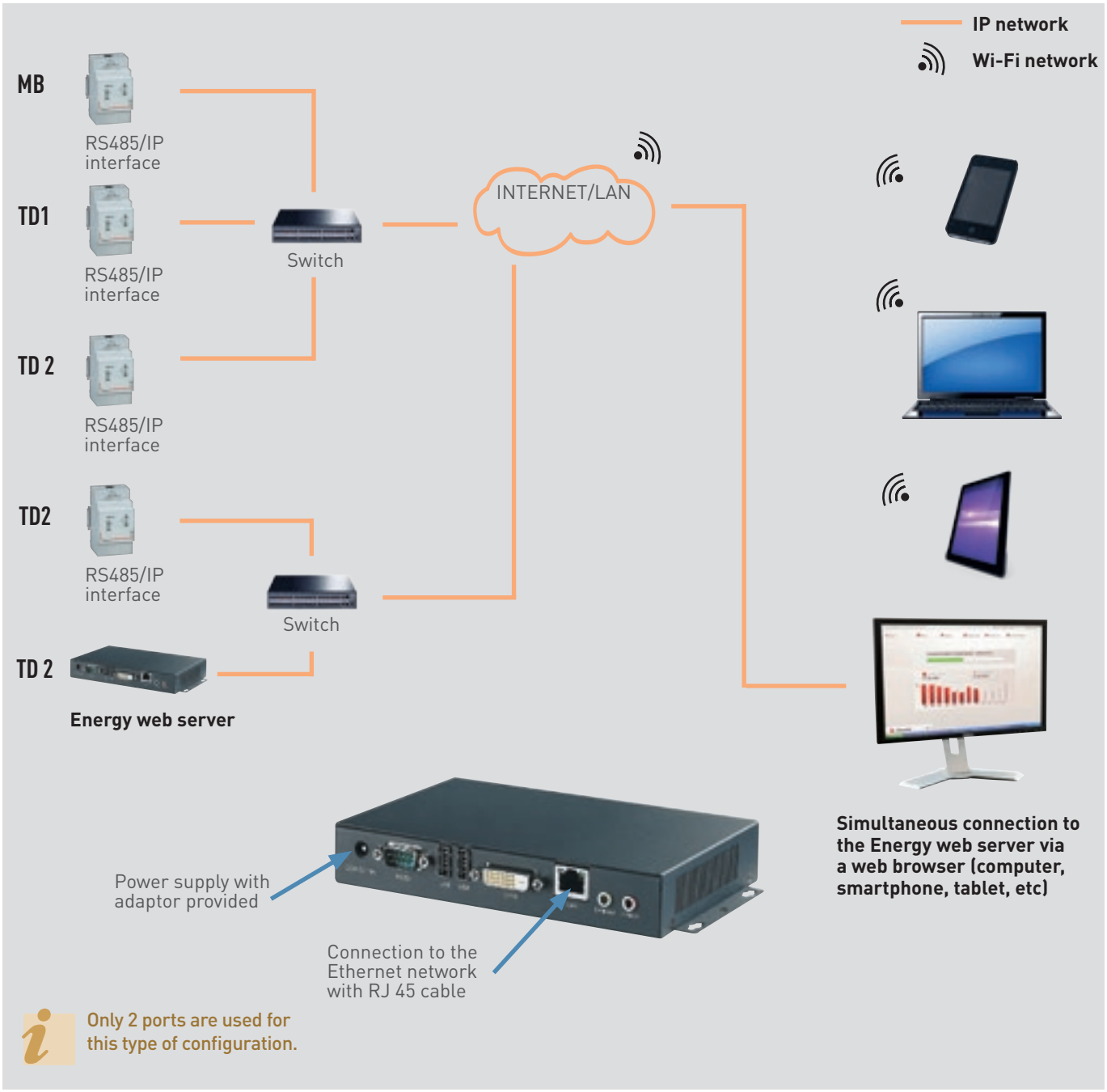
■ **measurement software EDMX³**



The computer on which the software is installed must be on permanently and the software must remain open.

CONNECTION (CONTINUED)

■ **Energy web server**



PARAMETER SETTING

The Energy web server settings must be modified to ensure it is part of the same network IP as all the IT devices.

No parameters need to be set in the case of the EMDX³ measurement software, it just needs to be installed on a chosen station.

■ **Access to settings in the case of the Energy web server:**

The first time you log in, connect your computer directly to the Energy web server and change the server configuration (network settings, date, time, software update, etc). To do this, open your web browser and enter the Energy web server's default IP address (192.168.1.100); make sure you have changed your computer's static IP address first (for example 192.168.1.99).

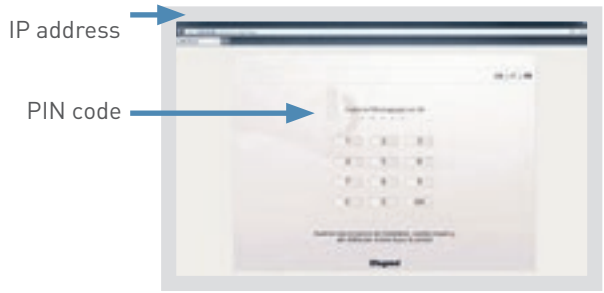
Like any device connected on a local area network (intranet), access to the web server is secure during a remote connection (internet). To obtain this authorisation, you should ideally contact the network administrator who will do the necessary to open the ports and redirect them to the web server.

Changing a computer's IP address to automatic or static: help is available in the "Communication protocol → IP addressing" section.

Enter the default PIN then PUK administrator codes to access the menu.

PIN: 99999

PUK: 00000 9999 00000



Access to data is protected by 2 ID codes (PIN and PUK codes).

There are 4 types of predefined user: Administrator, Green Up, Installer, User.

Different access is offered depending on the ID selected.

It is possible to:

- add users
- change access codes

OVERVIEW OF MENUS

■ **"Home" menu:**

The display takes the form of 4 menus which can access various submenus.

Access to the Energy web server settings

Access to view of electrical values fed back by the measuring equipment

Access to measuring equipment installation and configuration

■ **"Energy Web Server Setup" menu:**

Change user access as well as PIN and PUK codes

Change format of log files, language, name of Energy web server, etc

Install Energy web server updates

Change date and time

Change IP network settings

Back up and restore the database

■ **"Energy Web Server Setup" menu:**

Create panels, circuits and measurement zones

Change currencies and the cost of energy (price per kWh)

Add and change the IP converters and related measuring equipment

Configure management of GREEN UP electric vehicle charging stations

OVERVIEW OF MENUS (CONTINUED)

■ **“Devices“ and “consumption” menu:**

View data fed back directly by devices connected to the network

View of total and partial consumption

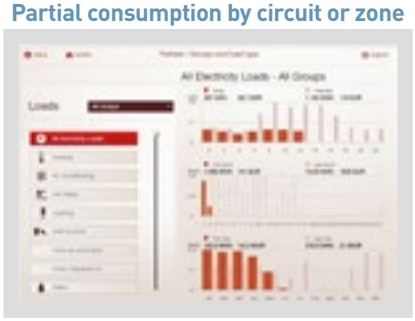
Power by device

Voltage, current, frequency by device

Harmonics by device

Total consumption

Partial consumption by circuit or zone

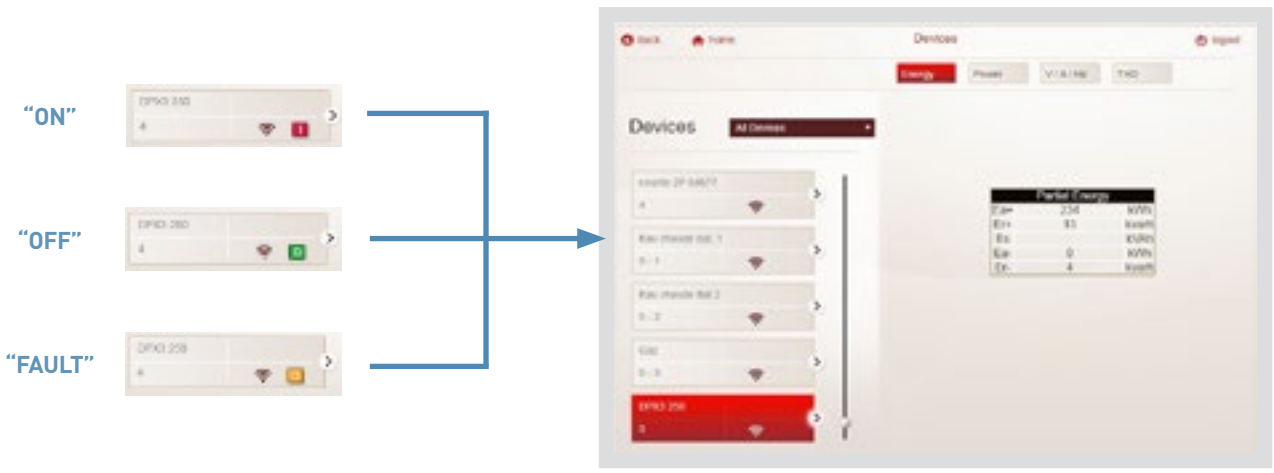


Partial consumption by device

OVERVIEW OF MENUS (CONTINUED)

■ **Possibility of viewing the circuit breaker status:**

On the Energy web server and EMDX³ measurement software pages, communicating DMX³ and DPX³ circuit breakers indicate their status in real time.



RETURNING THE ENERGY WEB SERVER TO FACTORY SETTINGS

If the saved IP address, PIN or PUK codes are lost, reverting to factory settings is possible:

- Power down the web server.
- Connect a screen and keyboard.
- Power up.
- Wait for the screen to settle on a list of options.
- Type in the code:
  - "3" to revert to IP address 192.168.1.100
  - "4" to revert to PIN and PUK factory code
- Confirm your choice with "Y".
- Wait for the screen to settle on the list of options again.
- The operation is complete.
- Power down the Energy web server.

HELP AND DEFINITION

METERING, MEASUREMENT, ETC

■ MID CERTIFICATION:

The MID (Measuring Instruments Directive) is a European directive from 2004. It applies to measuring equipment and systems with a view to charging out the electricity used.

In order to comply with this directive, **Legrand provides a range of MID meters.**

■ ACCURACY CLASS:

All measuring instruments must be characterised 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

■ 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]:

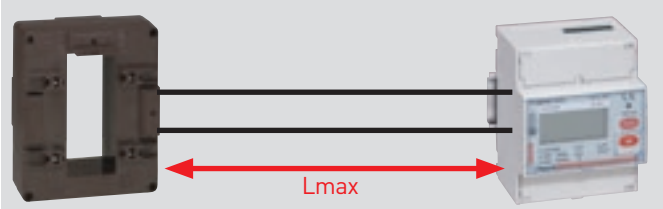
$$\text{Overall system uncertainty} = 1.15 \times \sqrt{(\text{PMD uncertainty of operation})^2 + \sum_{i=1}^{N} (\text{sensor uncertainty})^2}$$

Example:

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

■ CT/MEASURING INSTRUMENT CABLE LENGTH:

Here is the method for calculating the maximum length of the cable connecting the CT and the measuring instrument (meter, control unit, etc) in order to comply with the requested accuracy class.



Lmax = (Sr – Sinst) x k

Lmax	Maximum length of connection wire (m).
Sr	CT nominal load in the selected accuracy class (VA).
Sinst	Device consumption, indicated on the CT nameplate (VA).
K	Constant value as a function of the cable cross-section (see table) at an ambient temperature of 20°C.

Cu cable cross-section (mm²)	K
1	1
1.5	1.46
2.5	2.44
4	3.94
6	5.92

For each 10°C variation in the temperature, the maximum cable length Lmax must be reduced by 4%.

■ CURRENT DEFINITIONS:

The various publications available give different abbreviations for currents.
This is the definition:

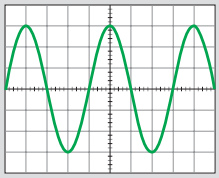
DISPLAY	PARAMETER
Ist starting current	Minimum current value at which the PMD* starts and continues to record (no accuracy)
Ib basic current	Current value according to which the performance of a PMD is set with a direct connection (PMD* Dx)
In nominal current	Current value according to which the performance of a PMD is set when operated by an external current sensor (PMD* Sx)
I min minimum current	Current at which the PMD ensures accuracy

*PMD: Performance measuring and monitoring device.

POWERS, ENERGY, POWER FACTOR CAPACITOR BANKS, ETC

■ ALTERNATING CURRENT:

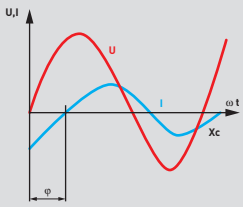
In an electrical installation, alternating current can be represented by a sine wave. Its frequency varies according to country (50 Hz in France, 60 Hz in the United States). Hence, in the case of France, there are 50 oscillations per second.



■ PHASE SHIFT:

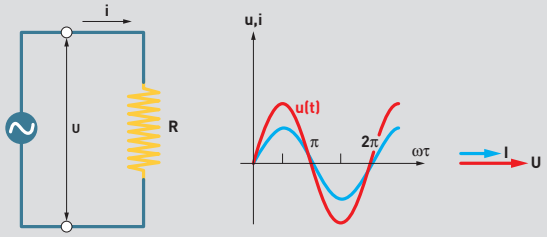
Depending on the type of electrical load (resistive, inductive, capacitive), phase shift occurs to a greater or lesser extent between the current and the voltage.

This phase shift is denoted "φ".



■ THE VARIOUS LOADS:

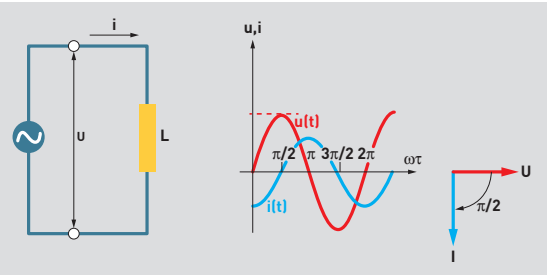
Resistive loads are made up of pure R resistances.
For this type of load, the current generated is always **in phase with the voltage.**



Inductive loads are made up of inductance, also called "inductive reactance".

They can be found in loads such as motor windings, fluorescent tube ballasts, etc.

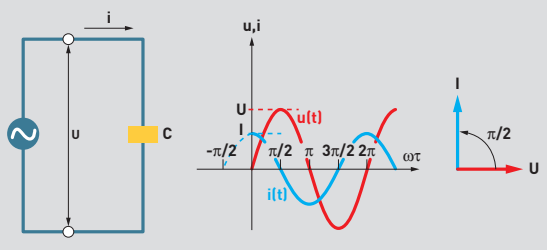
If we consider **a pure inductive load L,** the current generated always lags **behind the voltage phase by 90°.**



Capacitive loads are made up of capacitors, also called "capacitive reactance".

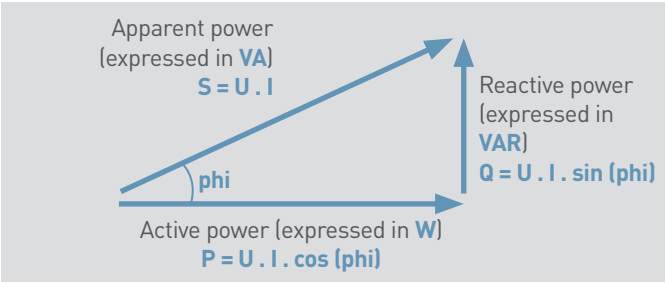
They can be considered as a reservoir of electrical loads.

If we consider **a pure capacitive load C**, the current generated always **leads the voltage phase by 90°.**



■ ACTIVE, REACTIVE AND APPARENT POWERS:

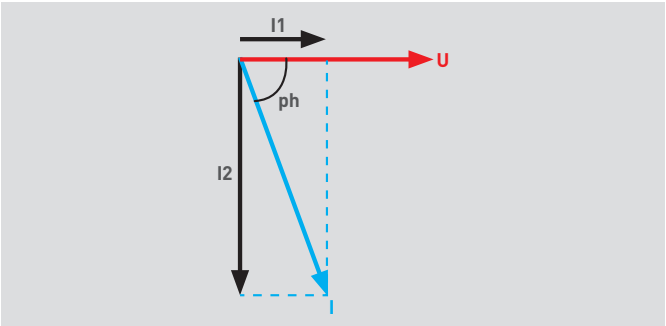
Electrical powers are made up as follows:



phi: voltage/current phase shift angle

Power factor: this corresponds to the **active power/apparent power ratio**, hence if we consider the current and the voltage to be totally sinusoidal without disturbance, it equals **PF = cos (phi).**

Active power: this is what causes, for example, a movement in the case of a motor, or release of heat in the case of a resistive load, and can be termed "useful" power. The unique property of active power is to make work. A load absorbs active power when the current is in phase with the current. Active power is expressed in watts (W).



I1: Purely resistive current component – in phase with the voltage.

I2: Purely inductive current component – 90° phase lag in relation to the voltage.

Reactive power: Strictly speaking this is not a power since no work can be gained from it as can happen with active power. Reactive power Q is defined by analogy to active power P.

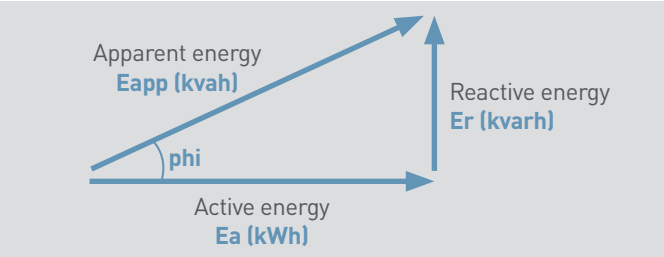
P = U . I . cos (phi)
Q = U . I . sin (phi)

Purely resistive devices are the only ones which do not consume reactive energy. The advantage of reactive energy is that it can compensate for inductive loads.

Active energy: In physical terms, this represents the capacity of a system to produce work, which can result in a movement, light, heat or even electricity.
Energy is expressed in joules (international system of units), and often in kilowatts per hour (kWh).
Energy is therefore the consumption of a system producing work for one hour.
Active energy = Ea = consumption = active power x time

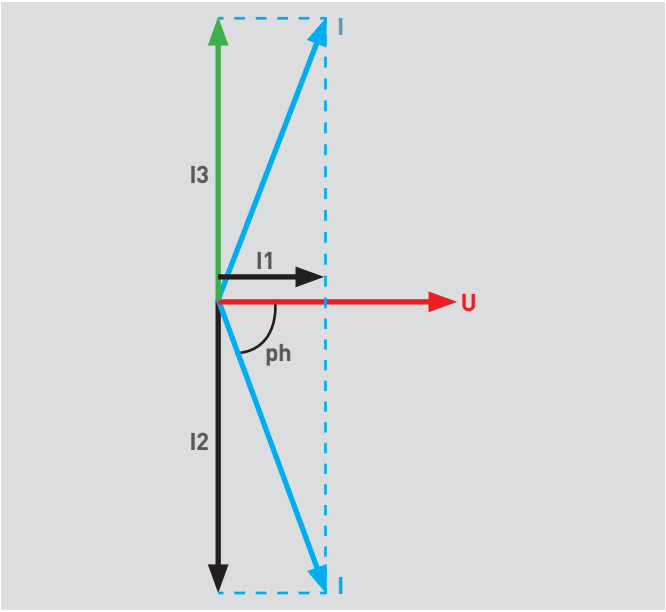
Reactive energy: This is used in particular in the windings of motors and transformers to create the magnetic field without which they would not be able to operate. It corresponds to the reactive power Q (kvar).
Energy is expressed in kilovar per hour (kVArh).
Unlike active energy, reactive energy is said to be "unproductive" for the user.
Reactive energy = Er = reactive power x time

Apparent energy: This is the resultant vector of active and reactive energy.



■ CAPACITOR BANKS:

Capacitors are **the main source of reactive power**, so the idea is therefore to integrate capacitor banks in installations with significant inductive loads.



I1: Purely resistive current component **– in phase with the voltage.**

I2: Purely inductive current component **– 90° phase lag in relation to the voltage.**

I3: Purely capacitive current component **– 90° phase lead in relation to the voltage.**

If the capacitive load is calculated correctly, the capacitive current component cancels the inductive current component. This **can reduce the value of the current**, without changing the installation's energy consumption.

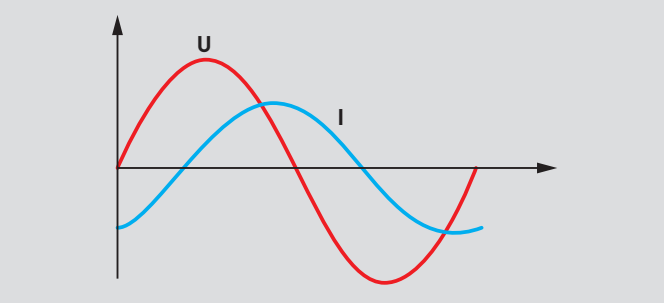
To determine an energy compensation solution, please consult the Alpes Technologies catalogue, available on www.alpestechnologies.com.

■ HARMONICS:

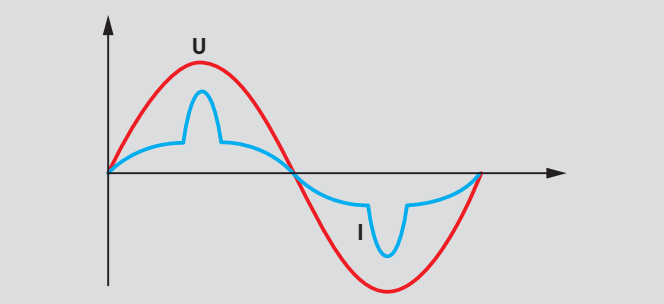
In recent years, the modernisation of industrial processes and the sophistication of electrical machines and equipment have led to major developments in power electronics.

These systems represent "non-linear" loads for electrical supplies.

Linear loads: A load is said to be "linear" if the current it consumes is sinusoidal when it is supplied with sinusoidal voltage.
This type of receiver does not generate harmonics.



Non-linear loads: A load is said to be "non-linear" if the current it consumes is not sinusoidal when it is supplied with sinusoidal voltage.
Non-linear loads distort the current and voltage electrical signals.
This type of receiver generates harmonic currents.



■ HARMONICS (CONTINUED):

Type of non-linear loads:

- Examples of single-phase loads:

Low-voltage or energy-saving bulbs, fluorescent tubes, high-frequency ballast, medical equipment, televisions, computers, printers, photocopiers, UPS, etc

- Examples of three-phase loads:

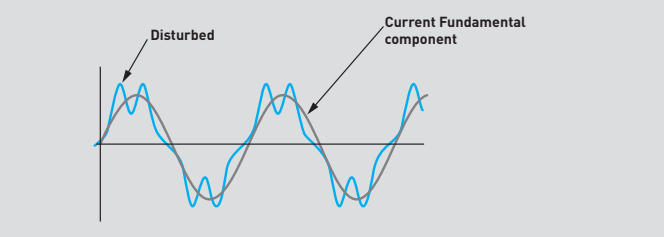
Variable speed drives for motors, rectifier (AC/DC converter), welding machine, arc furnace used in metallurgy, battery charger, PLC, UPS, etc

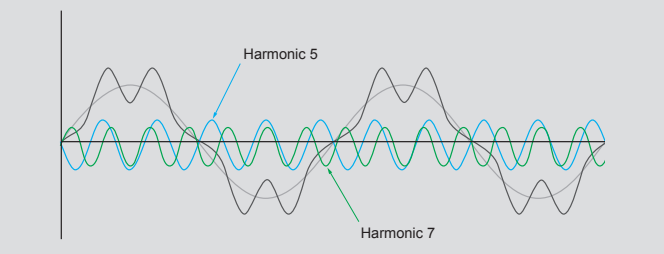
Harmonics: The Fourier decomposition (harmonic analysis) of the current consumption of a non-linear receiver shows:

- The fundamental, a sinusoidal term at the 50 Hz mains supply frequency
- The harmonics, sinusoidal terms whose frequencies are multiples of the fundamental frequency

Harmonic orders:

The Fundamental component corresponds to the frequency **50 Hz,** the **other components** are **multiples of 50 Hz.**





In the context of Fourier analysis of a periodic signal, n electric current consists of a sinusoidal signal at the mains supply frequency and the sum (usually infinite) of frequency sinusoidal signals n times the mains supply frequency.

■ Order 5: additional current of 250 Hz (5 x 50 Hz).

■ Order 7: additional current of 350 Hz (7 x 50 Hz).

- Etc.
- Order n: additional current of xxx Hz (n x 50 Hz)

■ HARMONICS (CONTINUED):

Harmonic effects:

- Immediate effects (losses through the Joule effect):
  - Deterioration of the power factor
  - Reduction in motor power
  - Cable, transformer, motor overloads
  - Increased motor noise
  - Recording error in the meters
  - Oversizing of the network capacity cables
  - Contactor malfunction
  - Disturbance of electronic systems
  - Etc
- Medium and long-term effects:
  - Reduction in motor, transformer life
  - Deterioration of the capacitor banks
  - Accelerated ageing of the insulation and dielectrics
  - Derating of transformers and motors
  - Etc

Solutions to harmonics:

In the case of a **mains supply with a high level of harmonic interference**, the user may be faced with a dual requirement:

- Compensating the reactive energy
- Reducing the harmonic distortion of the voltage to values that are acceptable and compatible with correct operation of most sensitive receivers (PLCs, industrial computers, capacitors, etc)

The solution is to install harmonic filters.

To determine these harmonic filters, please consult www.alpestechnologies.com, a brand in the LEGRAND group.

IT AND NETWORK TERMINOLOGY

■ IP ADDRESS:

An IP (Internet Protocol) address is **an identification number** which is assigned permanently (static IP address) or temporarily (automatic IP address) **to any device connected to a computer network** which uses internet communication protocol.
You can refer to the "Communication protocols, IP addressing" section at the end of this guide.

■ PROTOCOL:

A communication protocol is a specification of a number of rules designed to simplify communication between different components. It can be used to **communicate using the same language.**

■ INTERNET:

The Internet is an international computer network consisting of a set of public or private networks. It is accessible to the public. Communication via these networks is made possible by the standardisation of data transfer protocols.
The Internet is used to:

- **correspond by email**
- **access web pages and sites**
- **exchange files via FTP** (File Transfer Protocol)

■ INTRANET:

An intranet is a computer network which is only accessible to people **in the same organisation.** An **intranet** can be **local** in the case of a small structure (small firm or family network in the case of residential homes) but can also link several sites in the same entity (large firms).
An intranet can be used to publish company-specific **information to the workforce.**

■ EXTRANET:

An extranet is an extension of the information system of an **intranet** which authorises external access (often secured with a password). It can be used for a company and its subsidiaries.

■ FTP:

FTP (File Transfer Protocol) is a communication protocol used to transfer data via the internet between a number of computers. **An FTP server is software** which responds to requests from clients. It can be installed on a terminal (computer, web server, etc), and allows authorised users to read, copy, modify or delete files installed on the said FTP server.

■ WEB BROWSER:

A web browser is **IT software** which can be used to **look up and display web pages**, the most commonly-used being Internet Explorer, Firefox, Google Chrome, etc.

■ HTML PAGE:

HTML (Hyper Text Markup Language) is a computer language **which is used to create web pages.** It is used to **format the page contents.** As the name implies, it is a markup language. An HTML page is therefore a web page created using this language.

■ HTTP PROTOCOL:

HTTP (Hyper Text Transfer Protocol) is used to **transfer data over the internet in HTML format** between a client and an internet server.

■ TCP/IP PROTOCOL:

TCP/IP (Transmission Control Protocol/Internet Protocol) is a set of protocols for exchanging data over the internet. The TCP protocol handles **the transmission of information** from one computer to another over the internet. This data is divided into packets and sent on the network. The IP address **routes data packets**.

■ COMPUTER SERVER:

It is used to **store data**, and can be a simple desktop computer, a set of computer racks in a computer cabinet, or a set of computer racks in a fairly large room.

It **shares data in a network** (home, office or international) such as:

- The operator mailbox interface
- E-commerce
- Simple data storage
- Online games
- Etc

A computer server should be on and providing its services permanently, and must have an uninterruptible power supply.

■ WEB SERVER:

The web server is a **computer server connected to the internet.** It refers to both the physical device and the software. It is used to **publish data on intranets or on the internet.** It is less commonly called the HTTP server. It is often specialised according to the type of data provided.

■ HARDWARE:

Hardware is **all the IT equipment which makes up a computer**. Their role is to send, receive, store, or process data.

■ SOFTWARE:

Software is all the programs needed for the computer system to work correctly.

■ FIRMWARE:

Firmware is a **computer device's internal software**. It consists of a set of instructions and data to ensure it works correctly.

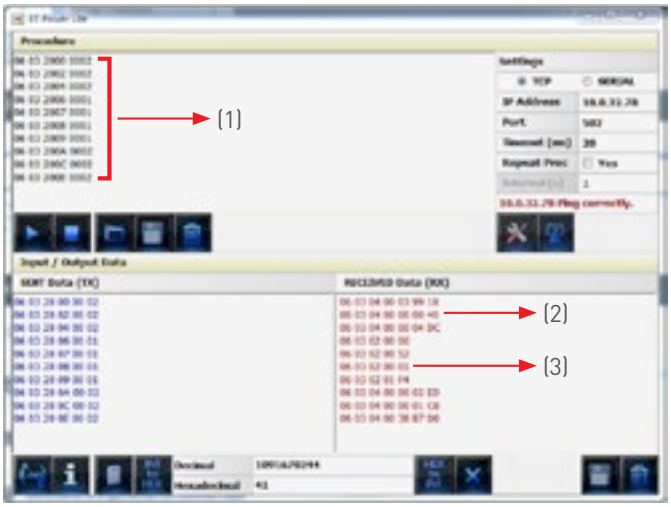
RS485 BUS

■ LINE TERMINATION RESISTOR:

The line termination resistor must be the same value as the line impedance. It can attenuate any disturbance on the cable.
We recommend using the **Belden 9842 cable** with an impedance of 120 Ω, and a 120 Ω resistor should therefore be placed **at each end of the BUS**, between the signal "-" and "+".
It can be incorporated in the device (RS485/IP converter Cat. No. 0 046 89), or may or may not be supplied with the device.

■ MODBUS DIALOGUE FRAME:

• Send/receive a read request frame (for example meter 0 046 77):



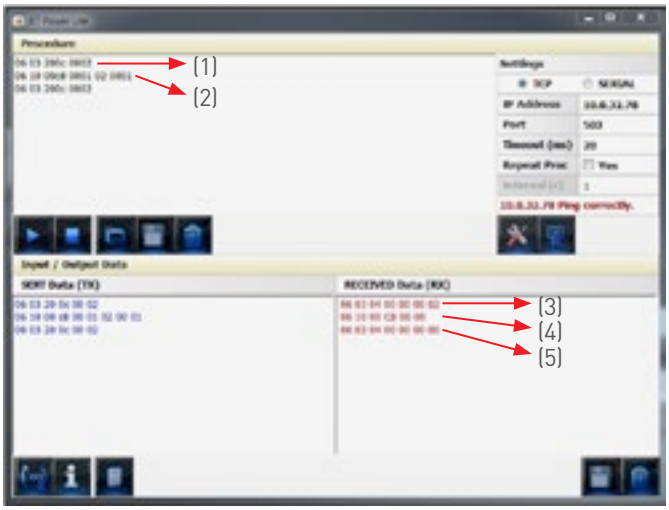
(1) A code read request **03 h** is sent from the **200x h** registers on **1** or **2** words, for the device at address **06 h**.

(2) Receipt of response from the device at address 06 h, a code read request **03 h**, response on **4 bytes** = 00 03 99 18 hexadecimal value and mV of the voltage value.
00 03 99 18 h = 235,800 decimal = 235,800 mV = 235.8 V.

(3) Receipt of response from the device at address **06 h**, a code read request **03 h**, response on **2 bytes** = 00 52 hexadecimal value of the power factor to be halved.
00 52 h = 82 in decimal = 0.82.

■ MODBUS DIALOGUE FRAME (CONTINUED):

• Send/receive a write request frame (for example meter 0 046 77):



(1) A code read request **03 h** is sent from the **200c h** registers (partial active energy) on **2** words, for the device at address **06 h**.

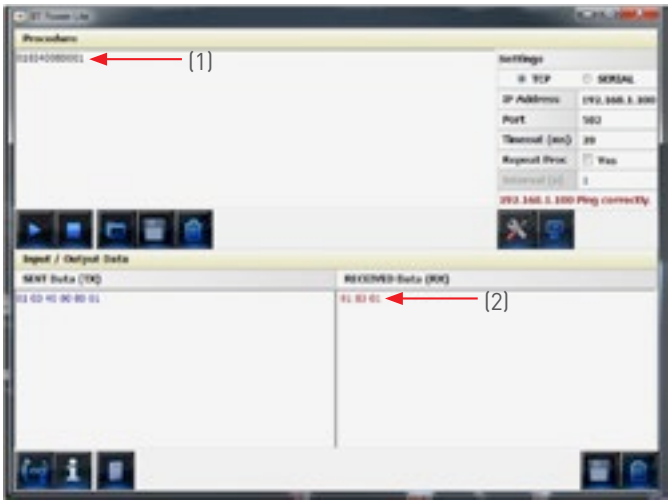
(2) A code write request **10 h** is sent from the **00c8 h** registers (bit-by-bit reset register) on **1** word, by writing the code **0001** corresponding to partial active energy reset, for the device at address **06 h**.

(3) Receipt of response from the device at address **06 h**, a code read request **03 h**, response on **4 bytes** = 00 00 00 02 hexadecimal value.

(4) Receipt of response from the device at address **06 h**, a code write request **10 h**, response on **2 bytes** = 00 00 acknowledging receipt.

(5) Receipt of response from the device at address **06 h**, a code read request **03 h**, response on **4 bytes** = 00 00 00 00 checking reset.

• Receipt of a frame in the event of a fault:



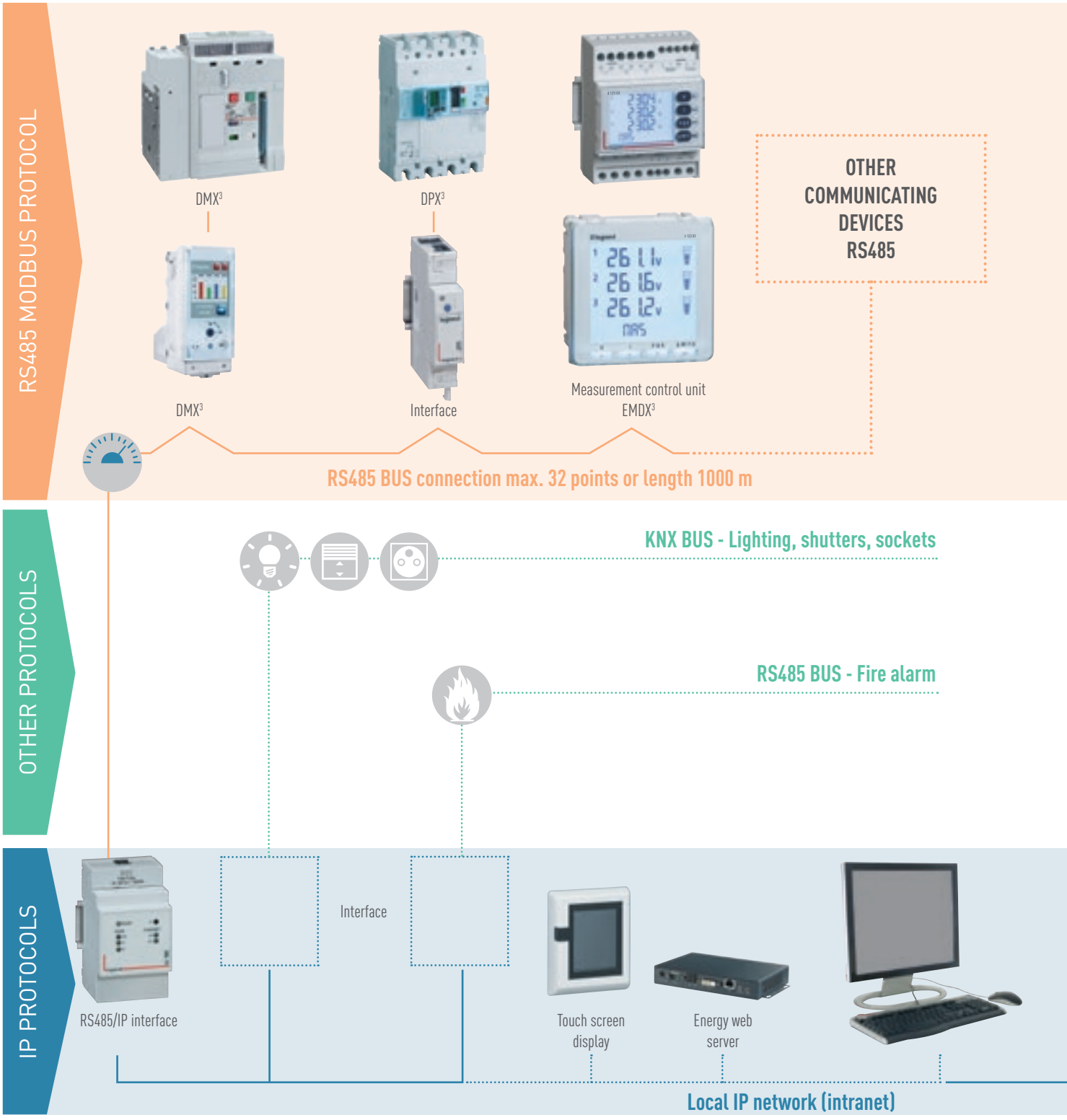
(1) A code read request **03 h** is sent from the **4000 h** register on **1** word, for the device at address **01 h**.

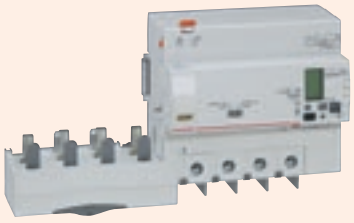
(2) Receipt of response from the device at address **01 h**, a code read request 03 h, response on **2 bytes** = 83 01 identifying a fault.
83 h = **80 h** (fault code) + **03 h** (after read request)
01 h = fault type, corresponding to a function not managed by the device.

List of faults: "Communication protocols" section

COMMUNICATION PROTOCOLS

GENERAL ARCHITECTURE

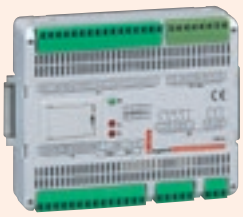




Add-on module

Interface

meter EMDX³



Control and signalling interface

OTHER COMMUNICATING DEVICES RS485

RS485 bus connection max. 32 points or length 1000 m

BACNET BUS - Emergency lighting

Other BUSES - Access control (CCTV)

Heating, ventilation, air conditioning (HVAC)

RS485/IP interface

Interface

Building Management System (BMS)

Remote access to Energy web server data

Local IP network (intranet)

Remote IP network (internet)

REMINDER ABOUT CODING SYSTEMS

DEFINITION

Nowadays, our computers, phones and other devices can manipulate not just numbers, text, but also images, videos and music.
How are these diverse objects from the real or virtual world represented?
What techniques are used to represent all these values digitally?

We will describe the 3 coding systems used in order to understand and use the various protocols: RS485, IP, etc.
As a general rule, coding is used to change from one type of data representation to another and more specifically in our case, to retranscribe the different information into computer language.

DECIMAL CODING SYSTEM

The **decimal system** (or **base 10**) represents numbers as sums to the power of ten, each power being assigned an integer coefficient between **"0 and 9"** inclusive.

Coding a decimal number						
Example of an integer N = **9548** where 0=< a =<9	Row x	Row 4	Row 3	Row 2	Row 1	Row 0
	...	...	Thousands	Hundreds	Tens	Ones
	0×10^{x}	0×10^{4}	$\mathbf{9} \times 10^{3}$	$\mathbf{5} \times 10^{2}$	$\mathbf{4} \times 10^{x1}$	$\mathbf{8} \times 10^{0}$
	$a_5 \times 10^{x}$	$a_4 \times 10^{4}$	$a_3 \times 10^{3}$	$a_2 \times 10^{2}$	$a_1 \times 10^{1}$	$a_0 \times 10^{0}$

We can therefore see that:

BINARY CODING SYSTEM

The components which make up a computer system react internally to **digital** signals.
These 2 stable states are defined by the "**0**" and "**1**" symbols or "**L**" (low) and "**H**" (high).
The **binary system** (or **base 2**) only uses 2 states, the numbers "**0**" and "**1**".

Coding a binary number						
Row value Binary number = 1001 Decimal number = 8 + 1 = 9 where 0=< a =<9	Row x	Row 4	Row 3	Row 2	Row 1	Row 0
	...	16	8	4	2	1
	0×2^{x}	0×2^{4}	$\mathbf{1} \times 2^{3}$	$\mathbf{0} \times 2^{2}$	$\mathbf{0} \times 2^{1}$	$\mathbf{1} \times 2^{0}$
	0	0	**8**	**0**	**0**	**1**
	$a_5 \times 2^{x}$	$a_4 \times 2^{4}$	$a_3 \times 2^{3}$	$a_2 \times 2^{2}$	$a_1 \times 2^{1}$	$a_0 \times 2^{0}$

We can therefore see that:

BINARY CODING SYSTEM (continued)

This unit for coding information in the binary system is called a "**Bit**" (contraction of Binary Digit).
Elementary information (bits) is manipulated in groups, thus forming binary words.
These words are usually a multiple of $8 = 2^3$.

The transfer unit used to exchange data is the **byte = 8 bits**.
For larger exchanges, the following names are used:

1 byte = 8 bits
2 bytes = a word = 16 bits
4 bytes = a long word = 32 bits
8 bytes = a double long word = 64 bits

In a binary **word**, the bit furthest to the left is the most significant bit **MSB** and the one furthest to the right is the least significant bit **LSB**.

Example:

MSB															LSB
0	0	0	0	1	0	1	0	0	1	0	1	0	0	1	1
Most significant byte								Least significant byte							
0 x 2^{15}	**0** x 2^{14}	**0** x 2^{13}	**0** x 2^{12}	**1** x 2^{11}	**0** x 2^{10}	**1** x 2^{9}	**0** x 2^{8}	**0** x 2^{7}	**1** x 2^{6}	**0** x 2^{5}	**1** x 2^{4}	**0** x 2^{3}	**0** x 2^{2}	**1** x 2^{1}	**1** x 2^{0}
32768	16384	8192	4098	2048	1024	512	256	128	64	32	16	8	4	2	1
				2048		512			64		16			2	1
2048 + 512 + 64 + 16 + 2 + 1 = 2643 in decimal															
Word (16 bits)															

HEXADECIMAL CODING SYSTEM

The **hexadecimal system** (or **base 16**) uses 16 symbols, numbers from "**0 to 9**" and letters from "**A to F**". This coding system is a compromise between machine binary coding and the numbering used by people. In fact each hexadecimal digit corresponds to exactly 4 binary digits (or bits), making it more compact to write.
Hexadecimal coding is frequently indicated by an "h" after the datum, for example: 4F67h.

Coding a hexadecimal number						
Row value Hexadecimal number = A30F Decimal number = 40960 + 768 + 15 = 41743 where 0=< a =<F	Row x	Row 4	Row 3	Row 2	Row 1	Row 0
	.....	65536	4096	256	16	1
	0 x 16^{x}	0 x 16^{4}	**A** x 16^{3}	**3** x 16^{2}	**0** x 16^{1}	**F** x 16^{0}
	0	0	**40960**	**768**	**0**	**15**
	a_5 x 16^{x}	a_4 x 16^{4}	a_3 x 16^{3}	a_2 x 16^{2}	a_1 x 16^{1}	a_0 x 16^{0}

We can therefore see that:

HEXADECIMAL CODING SYSTEM (continued)

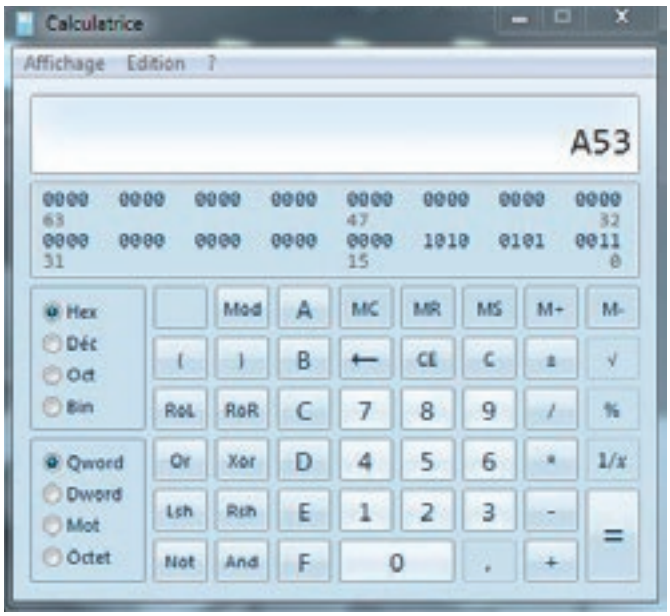
Example:

MSB															LSB
0	0	0	0	1	0	1	0	0	1	0	1	0	0	1	1
Most significant byte								Least significant byte							
0 x 2^3	**0** x 2^2	**0** x 2^1	0 x 2^0	1 x 2^3	**0** x 2^2	**1** x 2^1	**0** x 2^0	**0** x 2^3	**1** x 2^2	**0** x 2^1	**1** x 2^0	**0** x 2^3	**0** x 2^2	**1** x 2^1	**1** x 2^0
0 decimal				10 decimal				5 decimal				3 decimal			
0 hexadecimal				A hexadecimal				5 hexadecimal				3 hexadecimal			
2643 decimal = 0A53 hexadecimal = 0000 1010 0101 0011 binary															
Word (16 bits)															

CONVERSION FROM ONE CODE TO ANOTHER

Decimal	Hexadecimal	Binary
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
10	A	1010
11	B	1011
12	C	1100
13	D	1101
14	E	1110
15	F	1111

The conversion can be calculated mathematically, but it is easier to use an app such as the calculator included on any



UNSIGNED AND SIGNED REGISTERS

For ease of understanding and to make it easier to convert certain data, we need to talk about **signed** or **unsigned** registers.

If we think about natural numbers, the lowest value is "0" value and the highest value is given by the formula 2(exponent n-1), where n = number of bits used.
For example, a byte (8 bits), can contain integer values between 0 and 255, and a word (16 bits) values between 0 and 65,535, etc.

It should be possible to propose integer numbers. Here is the simplified principle used to indicate whether the number indicated is positive or negative:

You should always indicate whether the register is signed or unsigned:
- unsigned = the number does not have a sign, it is a natural number
- signed = the number can be positive or negative, it is an integer number

■ **Interpretation of a signed register by an example:**

For an active power value, the response to a request gives the value of **FF FF FF ED** of a signed register.

This register is **signed** type, so care must be taken when interpreting the read operation.

To determine the negative data value correctly, proceed as follows:

1 - Convert it to binary format:	1111 1111 1111 1111 1111 1111 1110 1101
2 - One's complement: (replace all the 1s with 0s and the 0s with 1s)	0000 0000 0000 0000 0000 0000 0001 0010
3 - Two's complement with the result: (add 1)	0000 0000 0000 0000 0000 0000 0001 0011

This result corresponds to the negative value which is: "**-19**" x scale 0.01 = **- 0.19** kW.

If a negative value is displayed on an EMDX³ device which is not consistent with the installation, you need to open the cabinet and check the CT wiring (do this with the mains power off or at least the CT off-load).
Then check whether the value in the register is definitely positive.

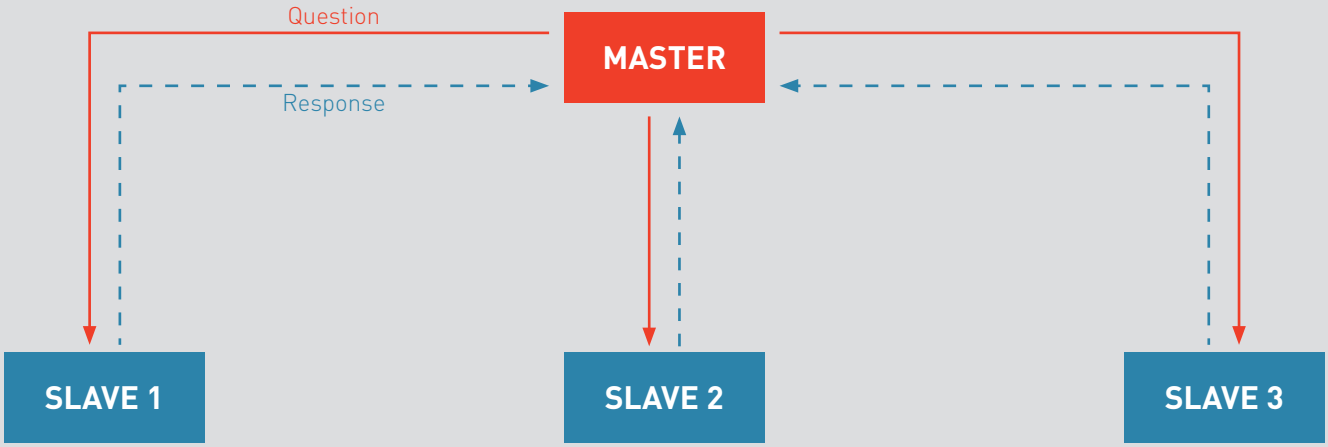
RS485 MODBUS

DEFINITION

A communication protocol is a specification of a number of rules used for communication within computer networks and communications.
It is established to simplify communication between different components and allow communication with a single language.
Communication consists of sending data between various parties. In order to communicate, they need to speak the same language and also handle the minimum rules for transmission and receipt of data.

Modbus is a non-proprietary communication protocol, created by Modicon in 1979, based on a hierarchical structure between a master and a number of slaves.

BASIC PRINCIPLE

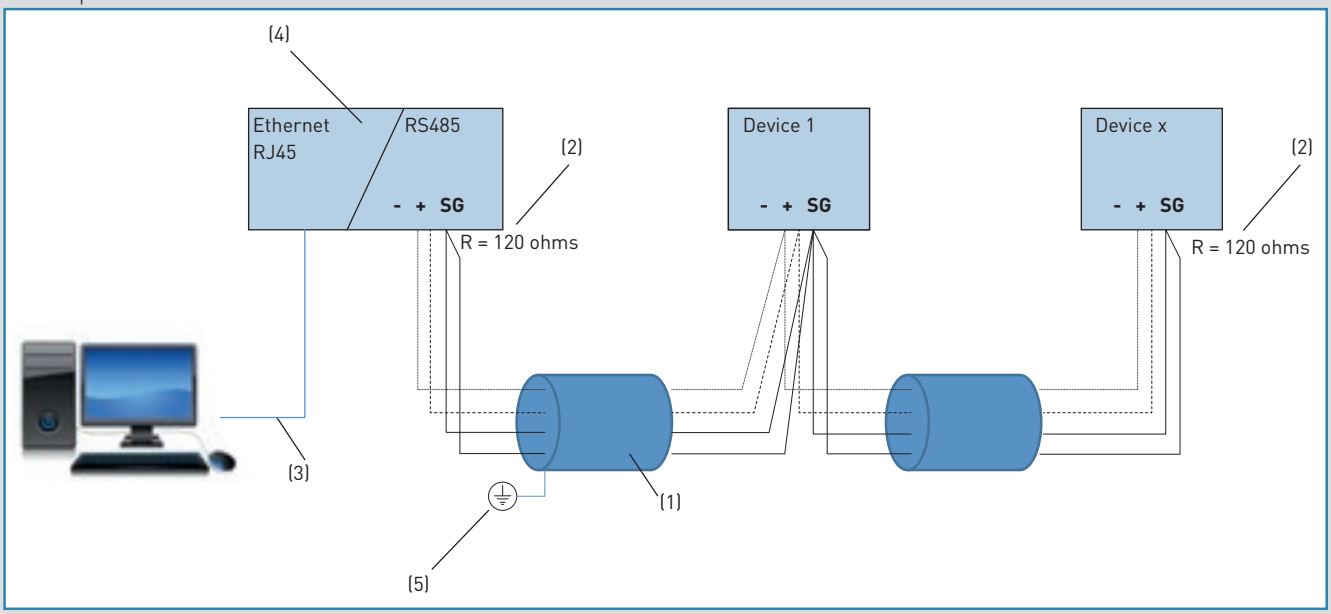


Some important rules to remember:

- Master/slave communication principle.
- The master talks to a slave and waits for its response.
- The master talks to all the slaves, without waiting for a response before broadcasting generally.
- Only one device can transmit on the line at any one time.
- Two slaves cannot talk at the same time.
- No slave can send a message without having had a request from the master.
- Dialogue between slaves is not possible.
- The address of each element is independent of its physical location.
- No two elements can have the same address.
- Master/slave dialogue can be drawn in a diagram as successive point-to-point links.
- Etc.

SCHEMATIC DIAGRAM

A multipoint connection is used to link master and slaves:



(1) RS485 BUS cable
(2) Line termination resistor at each end
(3) Ethernet cable
(4) Ethernet/RS485 interface
(5) Shielding connected to earth at a single point

INSTALLATION CONDITIONS

• 32 devices maximum on the same line, thereafter add commercially-available RS485 signal repeaters, up to 247 devices for each line. **(1)**

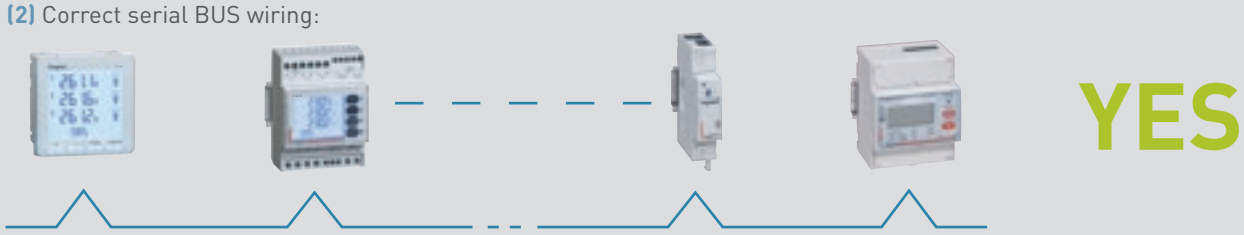
• Maximum length 1000 m with BELDEN 9842 cable (2-pair shielded twisted cable, 24 AWG, impedance 120 Ω) or equivalent. We recommend implementing RS485 serial wiring, using the first pair for the signal (the cable is polarised) and the second pair for connecting the SG (Signal Ground). **(1)**

• Wiring devices in series. **(2)**

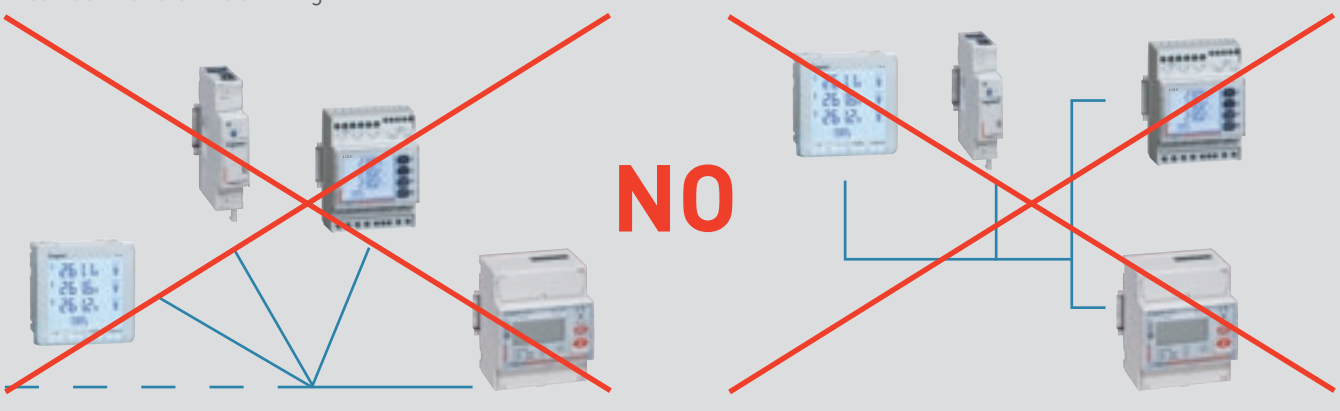
(1) The limits per line are 32 devices or 1000 m.
The signal repeater is used if the installation contains:
- less than 1000 m of line but more than 32 devices
- up to 32 devices but more than 1000 m of line
- more than 1000 m of line and more than 32 devices

The 1000 m of line or 32 devices are calculated:
- between the converter and the last device
- between the converter and the next signal repeater
- between 2 signal repeaters
- between the last signal repeater and the last device

(2) Correct serial BUS wiring:



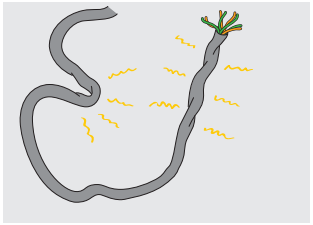
Incorrect T or star BUS wiring:



PRACTICAL ADVICE FOR WIRING THE BUS

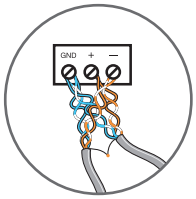
At the design stage:
- Opt for limited distribution on a number of branches, in order to speed up data transfer, simplify maintenance and minimise malfunctions.
- Don't assign the same address to 2 devices on the same RS485 line.

When installing the BUS cables, avoid making tight bends, and don't twist the cables.

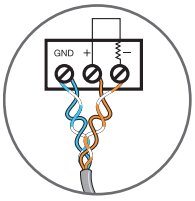


Avoid twisting or untwisting the BUS cable any more than necessary.

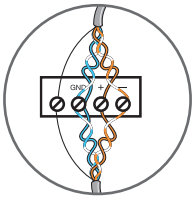
Connect the shielding to ground at a single point.



Make sure the polarity is correct and maintain the shielding continuity.



Insert a 120 Ω resistor at the start and end of the line.



USE

Register number	Register address (Dec)	Register address (Hex)	Dimension (word)	Bit position	Description
51079	51078	C786	2		Max/avg P+
51081	51080	C788	2		Max/avg P-
51083	51082	C78A	2		Max/avg Q+
51085	51084	C78C	2		Max/avg Q-
51087	051086	C78E	2		Max/avg S
51281	51280	C850	30		Measure - Metrology Not Affected by current and voltage transformers
51281	51280	C850	1		Hour meter
51282	51281	C851	1		Phase to Phase Voltage: U12
51283	51282	C852	1		Phase to Phase Voltage: U23
51284	51283	C853	1		Phase to Phase Voltage: U31
51285	51284	C854	1		Simple Voltage: V1
51286	51285	C855	1		Simple Voltage: V2
51287	51286	C856	1		Simple Voltage: V3
51288	51287	C857	1		Frequency: F
51289	51288	C858	1		Current: I1
51290	51289	C859	1		Current: I2

Dimension (word): indicates the data size and number of words used. The unit is the word (= 2 bytes = 16 bits). A register corresponds to one word. In some cases, there is a large amount of data to be processed and it is therefore necessary to use several registers. See "Reminder about coding systems" section.

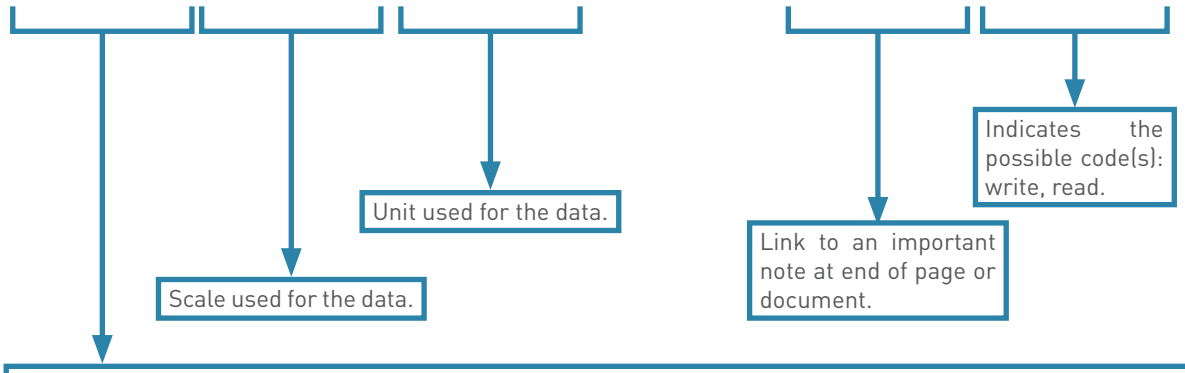
Description: description of data transmitted in the register(s).

A register is a memory location (a box) which is used to store data:
- Register Number: register sequence number
- Register Address (dec): the address, as a decimal value, where the said register is stored
- Register Address (hex): the address, as a hexadecimal value, where the said register is stored

There is a difference in unit between the register sequence number and its address: the sequence number of all registers starts with 1 whereas the address of all initial registers is 0. Whenever working on the registers, use the address, not the sequence number.

The Energy web server manages the data registers automatically

Type	Scale	Unit	Range	Note	Read Function Code (Dec)	Data Storing (2)
Unsigned long	0.01	kW		NOTE1	3	
Unsigned long	0.01	kW		NOTE1	3	
Unsigned long	0.01	kvar		NOTE1	3	
Unsigned long	0.01	kvar		NOTE1	3	
Unsigned long	0.01	kVA		NOTE1	3	
Unsigned word	1	h		NOTE1	3	
Unsigned word	0.01	V		NOTE1	3	
Unsigned word	0.01	V		NOTE1	3	
Unsigned word	0.01	V		NOTE1	3	
Unsigned word	0.01	V		NOTE1	3	
Unsigned word	0.01	V		NOTE1	3	
Unsigned word	0.01	Hz		NOTE1	3	
Unsigned word	1	mA		NOTE1	3	
Unsigned word	1	mA		NOTE1	3	
Unsigned word	1	mA		NOTE1	3	



Type of data transmitted. This datum indicates what the information consists of. For example: integer, number with decimal places, signed or unsigned (with a + or - sign).
- unsigned long: a long word without a sign
- unsigned word: a word without a sign
- signed long: a long word with a sign
- signed word: a word with a sign

In the case of signed data, the automation systems engineer will easily recognise the sign. If not, the easiest thing to do is to use a calculator for coding.

PROTOCOL STRUCTURE

■ **Modbus protocol explained**

Modbus protocol is a set of rules used to define the dialogue frames between a master and slaves.

The master sends a request and waits for a response.

All devices communicating on the same BUS should have the same communication settings.

■ **Addressing**

Each device communicating on the same BUS is identified by a user-defined address.

Its address is independent of its location on the BUS.

The addresses can range from 1 to 247 and do not necessarily need to be assigned sequentially.

Two devices communicating on the same BUS cannot have the same address.

■ **Possible message frames**

2 types of transmission are possible:

• RTU mode, in which data is transmitted on 8 bits

• ASCII mode, in which data is on 7 bits, the frames are therefore visible in hexadecimal and need two characters to represent one byte. This mode is very rarely used.

■ **The communication settings must be common to all parties**

• Device address: from 1 to 247

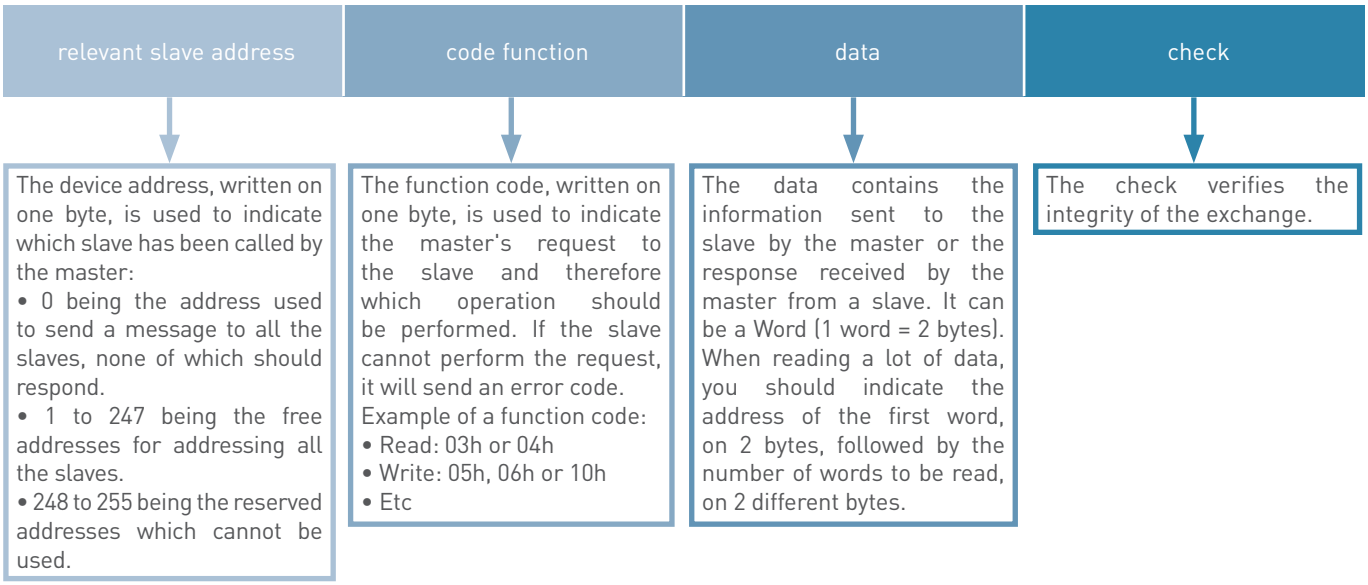
• Frame transmission speed:
1.2 - 2.4 - 4.8 - 9.6 - 19.2 - 38.4 kbps

• Transmission mode: RTU or ASCII

• Stop bit: 1, 2

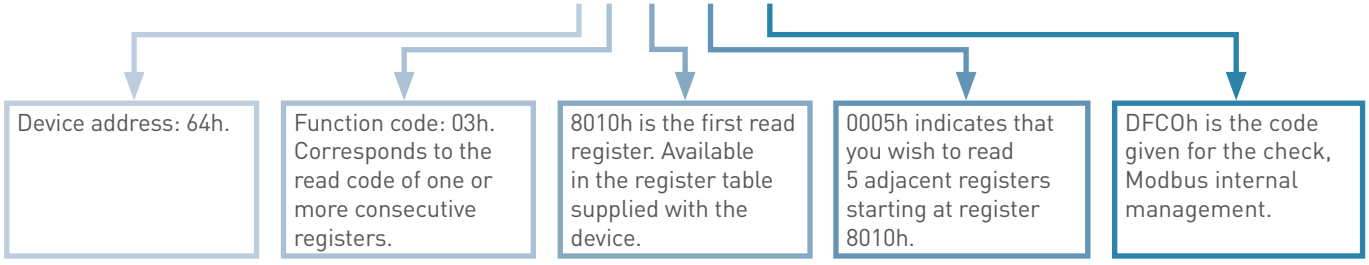
• Parity: even, odd, none

FRAME STRUCTURE IN MODBUS PROTOCOL

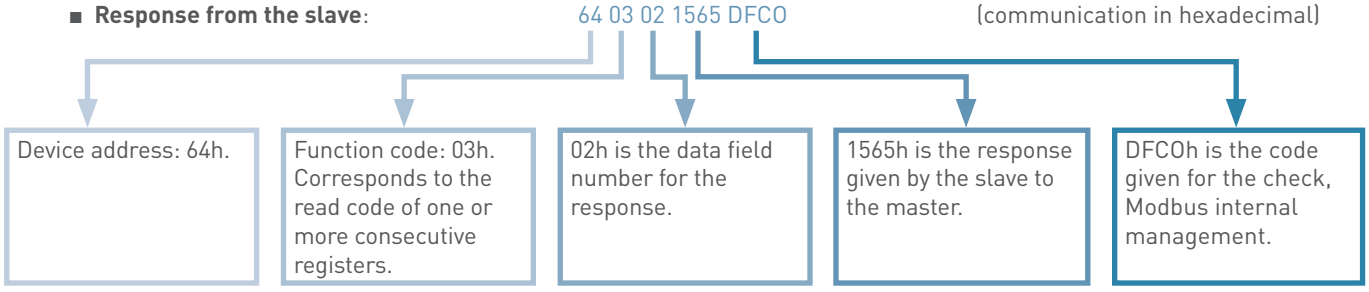


EXAMPLE OF FRAME

■ **Request from the master**: 64 03 8010 0005 DFCO (communication in hexadecimal)



■ **Response from the slave**: 64 03 02 1565 DFCO (communication in hexadecimal)



ERROR CODES

During transmission or a request from the master, errors can occur. In the event of an error, during the response, inside the "function code" string, you will have a value consisting of the function code added to 80h and followed by a data field on a byte, which indicates the type of error encountered.
List of possible errors:

01 h	The function is not handled	The function code received in the request is an action which is not authorised by the interrogated device.
02 h	The data register address is out of range	The data address received in the request is not an address known by the interrogated device. Neither the register address nor the data length is correct.
03 h	The data are not significant	The value contained in the request data field is not a value authorised by the interrogated device.
04 h	An error in execution of the function	An error occurred during execution of the requested action.

Example:
During a write request (code 06h), the response signals an error 01h.
The "function code" string should therefore contain the following message "86h 01h".
• 86h = 80h + 6h write code requested
• 01h "function not managed" error

IP ADDRESSING

DEFINITION

A network is a set of hardware and software devices allowing 2 machines or more to communicate.

The IP (Internet Protocol) network is a family of computer network communication protocols designed to be used over the internet. IP protocols provide a unique addressing service for all connected terminals.

An IP address is an identification number which is assigned permanently (static IP address) or temporarily (automatic or dynamic IP address) to every device connected to a computer network which uses internet protocol. Some devices such as PCs allow the user to choose whether to assign a static or automatic IP address; others, such as certain Legrand devices (Energy web server, RS485/IP converter) can only be assigned static IP addresses.

For a device to be assigned an automatic IP address, it must be connected to a network connected to a DHCP (Dynamic Host Configuration Protocol) server. It is this server which will assign the IP address automatically on connection of the device to the said network.

The advantage for the service provider, in this case, is that they can assign the same IP address to several customers, knowing that statistically not all customers are connected at the same time.

Another reason for choosing to connect the device to the network with automatic addressing: having a static IP address makes you an easy target for pirates since your computer constantly has the same address, giving them time to hack into it. With an automatic IP address, it is more difficult to hack a moving target.

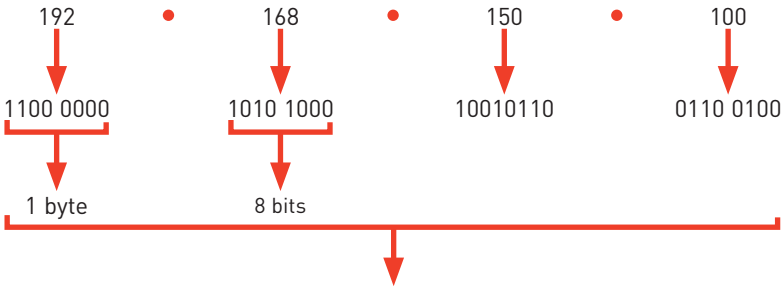
BASIC PRINCIPLE

■ **An IP address:**

An IP (Internet Protocol) address is an identification number which is assigned permanently (static IP address) or temporarily (automatic IP address) to every device connected to a computer network which uses internet protocol. Version 4 and version 6 IP addresses are available.

Version 4 is currently the most commonly used. It is represented in decimal notation with 4 numbers between 0 and 255, separated by dots, for example 192.168.150.100.

• **IP version 4**: 32-bit addressing, 4 bytes



• (**IP version 6**: addressing on 128 bits, 16 bytes)

Since version 4 IP address ranges are close to saturation, operators are encouraging a transition from version 4 IP addresses to version 6 IP addresses.

■ **A subnet mask:**

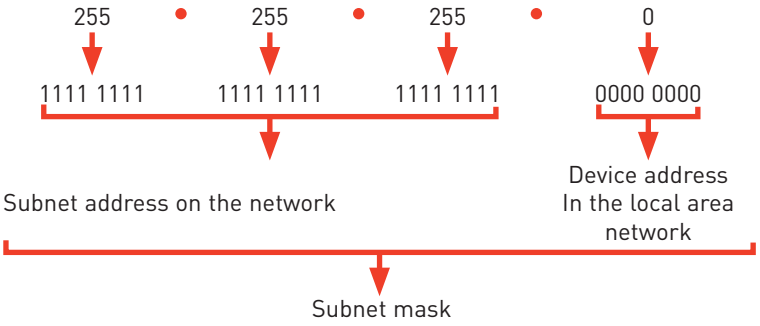
A subnet is a logical subdivision of a larger network.

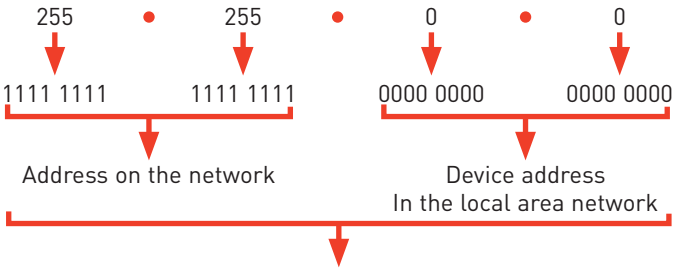
The subnet mask is used to distinguish the part of the address used to address the network and that reserved for addressing an IT product connected inside the logical local area network.

The subnet mask indicates to the local area network software the number of bytes corresponding to the web address which constitutes the network address.

255 = 1111 1111 when the byte is reserved for network addressing

0 = 0000 0000 when the byte is reserved for addressing the device on the local area network





• Example 3

If we consider the following subnet mask: 255.255.255.0, the first 3 bytes are reserved for the subnet address in the network and the 4th byte is reserved for addressing IT devices in the subnet, local area network.

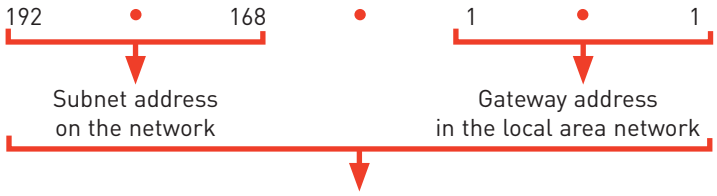
In this example, we could consider that we can connect between 0 and 255 different devices on the local area network from address 0, address 1, address 2, ... address 255.

But be careful, some addresses are reserved. You should therefore ideally consult the company's IT department before choosing one.

BASIC PRINCIPLE (CONTINUED)

■ **A default gateway:**

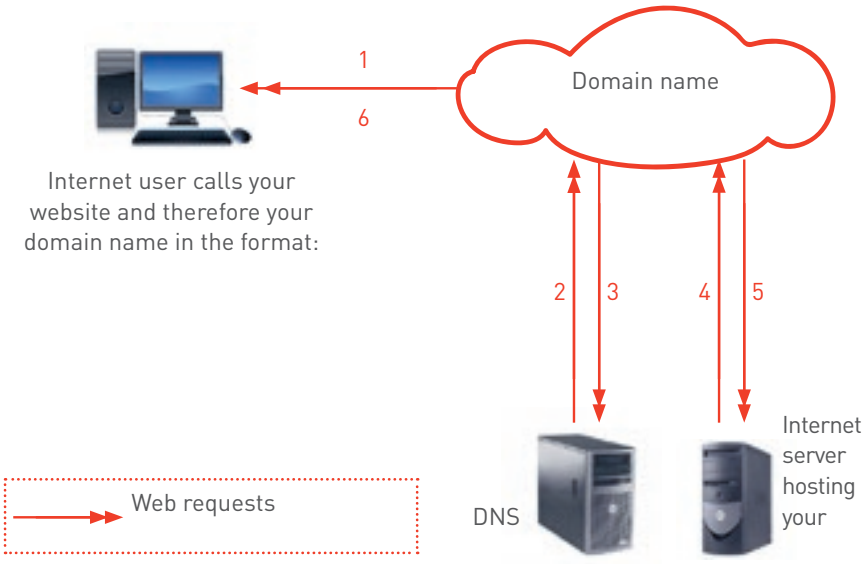
In computing, a gateway is the name given to the device used to link 2 different computer networks, for example a local area network and the internet. This term usually denotes the modem-router, which is used to link several computers, or the whole of the local area network can access the internet via the gateway.



■ **A DNS server:**

A **DNS** (Domain Name System) server is a service used to translate a **domain name** into information of various types associated with it, including **the IP address**.

Computers connected to an internet have an IP address. These addresses are digital. To simplify access to these systems, a mechanism has been put in place so that a name (called a domain name) can be associated with an IP address, as it is easier to remember. The mechanism consists of finding the IP address. Domain names can be associated with other information than IP addresses.

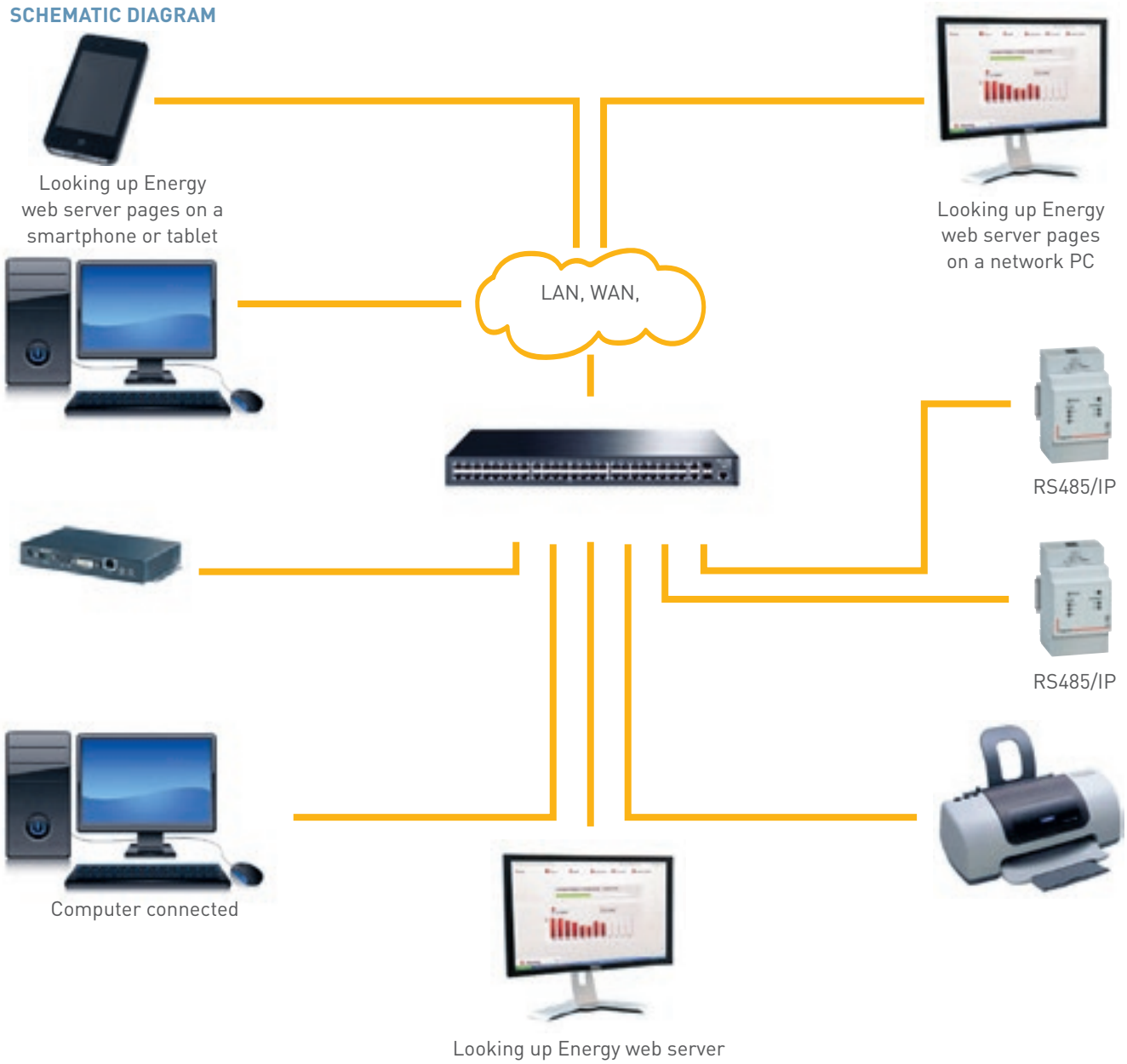


In the example above, the internet user calls, via their browser (request 1), the domain name of the website they wish to connect to. This interrogates its DNS server (requests 2 and 3) in order to find the IP address of the internet server hosting your website. The domain name will be able to exchange with the web server (requests 5 and 6) to make the

Some important rules to remember:

- You must contact the IT department of the website where the measurement system will be hosted in order to follow their recommendations.
- Connection to the computer network uses an RJ45 cable, whose characteristics should be specified by the website's IT department.
- RS485/IP converters such as the Legrand Energy web server use static IP addresses, from a list issued by the website's IT department.

SCHEMATIC DIAGRAM



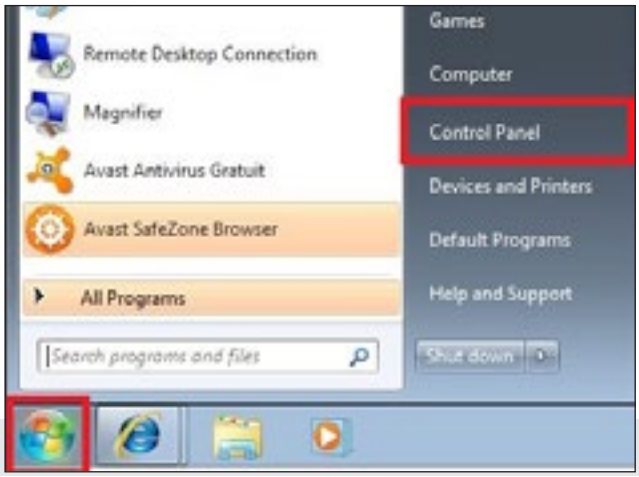
Installation conditions and practical advice for wiring the IP network

You must contact the IT department of the website where the measurement system will be hosted in order to follow their recommendations.

USE

■ **Procedure for modifying a computer's IP address**

• Procedure in Windows 7 environment:



1
Select "Start" at the bottom left of the screen, then "Control Panel".

2
Click "View by" and select "Category".

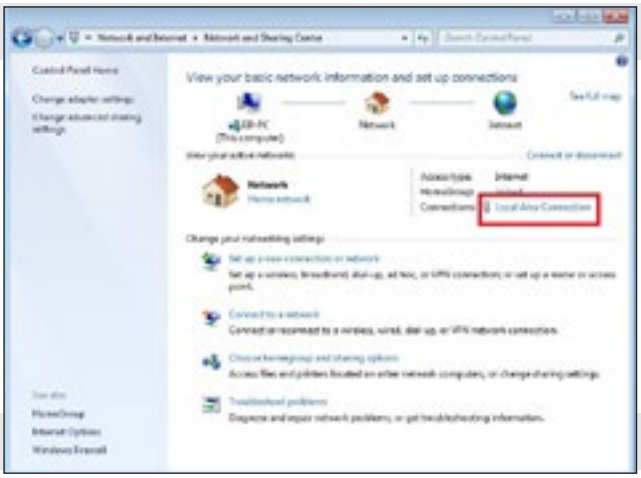
3
Select "View network status and tasks".

4

Before continuing, make sure you have connected your PC to an RS485/IP converter or an Energy web server, using an RJ45 cable.

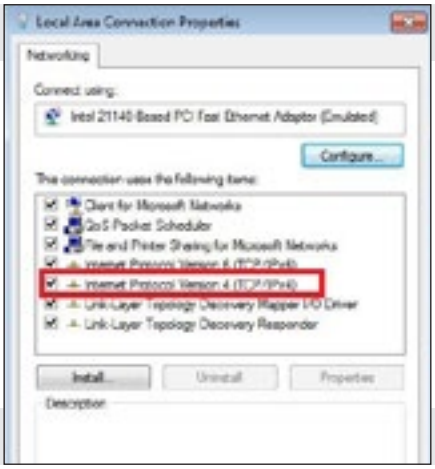
5

Select "Local Area Connection".



6

Select "Properties".



7

Select "Internet Protocol Version 4(TCP/IPv4)".

USE (CONTINUED)

8
Select “Use the following IP address”.

9
Enter the static IP address values given by the website's IT department, then press OK to confirm.

10
The PC static IP address is then changed, don't forget to replace it with an automatic IP address once the service is complete.

• Procedure for other versions of Windows:
The procedure is the same as that for a Windows 7 environment, the only variant possibly being access to the control panel.
You can find it with the search function by typing “Control Panel”.

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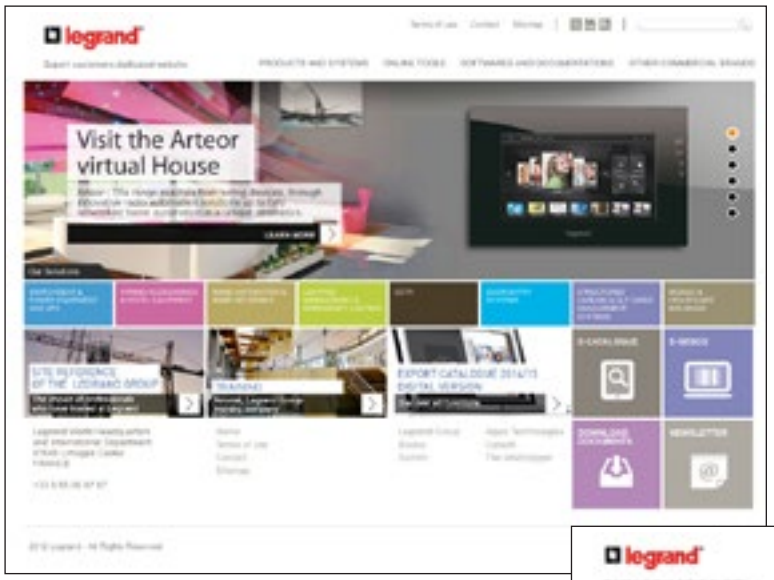
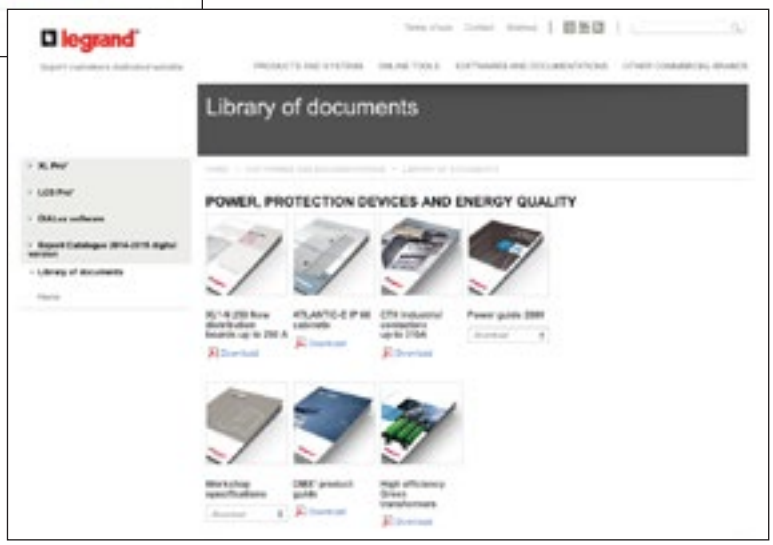
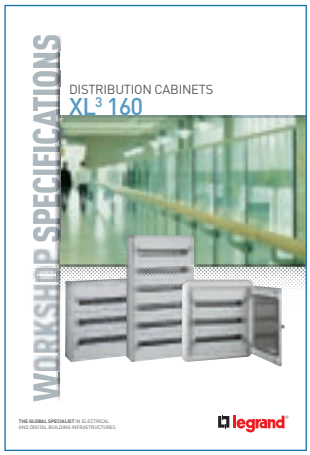
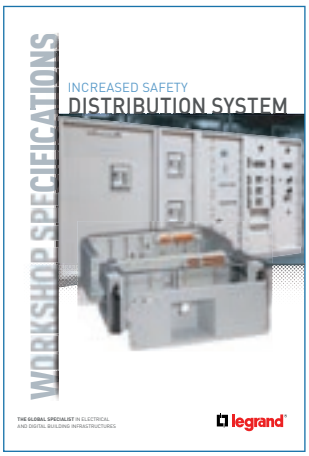
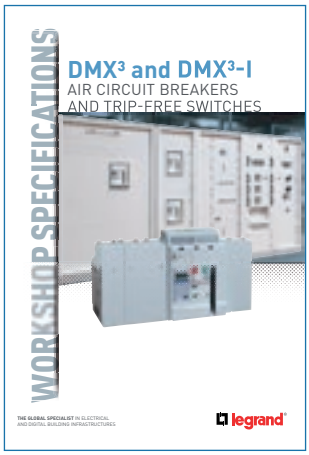




Workshop specifications and technical guides







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