

Libra Energy Automation Panel



- **Plug & Play**
- **Non-invasive installation on the system**
- **Connectivity (Ethernet, Wi-Fi, RS485, NFC)**
- **Flexibility (open platform)**
- **Continuous monitoring (e.g. ISO 50001)**
- **Energy efficiency and White Certificates**

Libra represents the advanced technology, 'Plug & Play' solution for monitoring and managing Low and Medium Voltage electrical loads, analyzing Power Quality, measuring Direct Current of production from renewable sources and measuring environmental, process and/or air quality parameters. The **Libra** is configured according to the needs and tailored to the system, consists of **multiple measurement modules** and allows a quick and simple non-invasive installation on the existing system. It is possible to integrate the **Libra** measurement system into an existing **Electrex** monitoring network, or use it as a system head or starting point for more complex supervision systems thanks to the possibility of connecting other **Electrex** devices in the RS485 subnet and/or Ethernet network.

The instrument accuracy is Class 0.5S for Active Energy. It manages the measurements of the single harmonics up to the 51st order and **Power Quality** with functions relating to the EN 50160 standard (peaks, holes, interruptions, harmonics) and to EN 61000-4-30 for Class S with graphic detail of the events, table and time-line of events, measurement campaigns with selectable parameters and programmable sampling rate. The **Libra** is battery-powered (**DC UPS**) to ensure continuous power supply to the measurement system, particularly recommended in cases where automated operations and/or alarms are activated and to ensure continuous monitoring of Energy Quality events. The **Libra** is equipped with an astronomical clock/calendar and non-volatile memory for the synchronous recording of energy and environmental vectors. Via the integrated **Web server** it is then possible to supervise the system by displaying instantaneous and graphical measurements. The **Libra Net** can also be equipped with inputs for **Electrex** environmental sensors (for example temperature, humidity, brightness, pressure, CO2, Air Quality, etc.) and / or digital inputs / outputs (status / counting) and / or inputs / analog outputs.

Versions of Libra

The **Libra** is available in the following versions:

- **Libra ECT UPS:** equipped with high-precision CTs even on small currents, designed for electrical loads up to 50kW and / or non-invasive connection, for integration purpose, to existing and suitable CTs already installed on the system (can be used only with the **ECT Electrex Current Transformers**).
- **Libra F UPS:** uses split and flexible CTs that are easy to install, recommended in those cases where it is not easy to insert standard CTs (can be used only with the **Electrex FCTS series flexible split CTs**).
- **Libra UPS:** can be used with the standard $..1/5A$ or $..1/1A$ output CTs.

Plug & Play

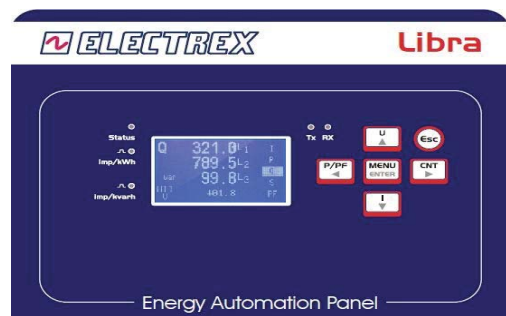
All versions of the **Libra** series are equipped with connectors and pre-wired solutions for a quick, error-free installation; they are preconfigured and / or configurable via web pages or the **Energy Brain** software.

CEI EN 50470 and 62053-22

All versions of **Libra** series meet the essential requirements of the CEI EN 50470-1 + 50470-3 and 62053-22 standards as required for the White Certificates - Energy Efficiency Certificates.

Simplicity

The **Libra** is equipped with a high contrast dot matrix FSTN display with white LED backlighting which allows the simultaneous reading of 4 measurements and their identification symbol with high visibility characters.



The 6-key keyboard arranged as a Joystick and the display menu column for configuration allow a simple and rational use of the instrument. While the first, default page displayed at power up can be defined by the user.

On the front there are two red LEDs for calibration and control that pulse with a frequency proportional to the imported active and reactive energy. A red LED that pulses under the symbol next to **Electrex** indicates its operation, while 2 other LEDs under the white band indicate the communication activity of the RS485 port.

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Measurement list table

Parameters	Type	Range
Voltage	U L-N	20,0V...400 kV
	U L-L	
	U L-N Min	
	U L-L Min	
	U L-N Max	
	U L-L Max	
Current	I	10 mA ...10,0 kA Electrex Flex CTs ⁷ : 1A ... (5A - 500A) 4A ... (20A - 2000A) 8A ... (40A - 4000A)
	I Max	
	I AVG ¹	
	I MD ¹	
Power factor	PF	0,00ind...1,00...0,00cap
Frequency	F	45 ... 65 Hz
Phases sequence	132 CCW	
Harmonic distortion	U THD L-N	0...199,9%
	U THD L-L	
	I THD	
Active Power	P	± 0,00...1999 MW
	P Max ³	
	P AVG ²	
	P MD ²	
Reactive Power	Q Ind	± 0,00...1999 Mvar
	Q Cap	
	Q AVG Ind ²	
	Q AVG Cap ²	
	Q MD Ind ²	
	Q MD Cap ²	
Apparent Power	S	± 0,00...1999 MVA
	S AVG ²	
	S MD ²	
Operating time ⁴	h, h/100	0,01...99.999,99 hours
Active Energy	Ea Imp ⁵	0,1 kWh...100 GWh
	Ea Exp ⁵	
Reactive Energy	Er Ind Imp ⁵	0,1 kvarh...100 Gvarh
	Er Cap Imp ⁵	
	Er Ind Exp ⁵	
	Er Cap Exp ⁵	
Apparent Energy	Es Imp ⁵	0,1kVAh...100 GVAh
	Es Exp ⁵	
Pulse Counter	CNT ⁶	
Temperature	⁶	

Version H: Single Harmonics

Parameters ⁹	Management	
Harmonics analysis	H voltage	Value (H01), % (H02-H51)
	H current	Value (H01), % (H02-H51)
	H Power & dir.	Value (H01), % (H02-H51)

Version PQ - Events U and I, measurement campaign

Parameters ^{9 11 12}	Management
Dips and Swells	Events logged in the internal memory with time-stamp
Overvoltage and overcurrent	
Sags and interruptions	

All instantaneous measurements are calculated over 10 cycles, for example 200ms at 50Hz.

(1) Average value over the integration time (1 .. 60 min. Programmable) and peak (MD).

(2) Average value (moving average) in both Import and Export over the integration time (1 .. 60 min. Programmable) and peak (MD) ie the maximum average value.

(3) Maximum power values in both Import and Export.

(4) Non-resettable life time and four operating times.

(5) The energies in both Import and Export are displayed in 9 digits (one decimal). Internal meters are stored in 64-bit resolution which ensures a minimum definition of 0,1 Wh and a maximum count of 100 GWh

(6) By adding the Electrex Sensor Bus Unit sensors.

(7) With Electrex Flexible CTs, Class 1 overall accuracy, for currents as listed in the brackets.

(8) Three partial counters for each marked measurement.

(9) Calculation with FFT method of harmonics in amplitude and phase up to the 51st for the 3 phase voltages, the 3 phase currents, the 3 phase active powers with direction (accumulated for 10 periods).

(10) Recording of events with date and time, duration of the event, maximum / minimum value. EN 50160 and EN 61000-4-30 programmable thresholds.

(11) Graphic detail of the event: number of samples (programmable e.g. 1 second) taken before and after the event (sag, swells and interruptions).

(12) Distribution table of events based on the threshold exceeded and the duration according to the dictates of the UNIPEDE standard and Time-line of events.

Phase sequence

The Libra permits the identification of the correct phase sequence using the vector diagram (graph on web page).

Versatility

The Libra can be inserted on any type of network: single-phase, two-phase, three-phase with 3 and 4 wires, symmetrical or asymmetrical, balanced or unbalanced, low and medium voltage, with 1, 2 or 3 CTs as well as for measurements on 2 and 4 quadrants (import / export). The voltage inputs and power supply are protected by a fuse. A simple programming from the keyboard or embedded web page (or from Energy Brain software) allows you to set all the operating parameters such as type of network, LV / MV, CT ratio and any VTs (free value), integration time (1-60 min.) And alarms (thresholds, delay, hysteresis).

Ethernet, Wi-Fi and NFC communication

The Libra series is equipped with a 10/100 Base-TX (RJ45) Auto-MDIX Ethernet port for the "http" communications (real-time measurements and memory logs) and "Modbus over IP" (real-time measurements). Static or dynamic IP address (DHCP protocol). Wi-Fi compliant with IEEE 802.11b/g/n and connector with external antenna for already existing Wi-Fi networks. While the presence of NFC opens the possibility for the creation of specific APPs for mobile devices regarding energy management.

RS485 communication for slave devices

The Libra is equipped with a "full compliant" Modbus RTU master RS485 serial port with configurable transmission speed up to 115.200bps, protected against overvoltage, allowing the connection of other slave Electrex devices in the subnet.

Digital Inputs

The Libra can be supplied with opto-isolated digital inputs complete with programmable anti-bounce filter, often used to count impulses such as from gas meters (a galvanic separator according to ATEX regulation is required), water, piece counter, etc. The maximum sampling rate is 500Hz (2ms). When properly programmed, they can also function as remote status indicators (eg ON / OFF of machines and switches) and / or for the selection of tariffs. The inputs are self-powered by the 12Vdc Libra output power supply.

Digital Outputs

The Libra can be supplied with optoisolated transistor outputs with a capacity of 27 Vdc / 27 mA according to DIN 43864. The outputs are programmable for the transmission of impulses or as outputs of internal alarms (see Alarms paragraph) or as output units controlled remotely via serial line and Modbus commands.

Additional I/O modules and/or environmental sensors

The Libra is equipped with eight inputs for environmental sensors (two SIO boards equipped with Sensor Bus I2C) to connect the Electrex Sensor Bus Units (temperature, relative humidity, luminosity, air pressure, CO2, Air Quality and other sensors on request) and/or additional I/O modules. The maximum total distance of the Bus of each SIO board is 20 m.

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Alarms

The Libra outputs can be programmed as alarms, each alarm can be associated with any of the available parameters and can be configured as both a minimum and a maximum alarm. Furthermore, all the alarm outputs can refer to the same parameter to have more alarm thresholds. It is possible to set an activation delay (1-99 sec.), an hysteresis (in% of the threshold value) and the polarity of the output contact (NO, NC). The status of the alarms is always available on the serial line (via Modbus “coils”).

The alarms can be configured from keyboard, embedded web server and/or from Energy Brain software.

DC UPS

The Libra panels can be equipped with a 12Vdc battery (DC UPS) which guarantees continuity for the power supply of the instrument even in the presence of interruptions. This is particularly useful in cases where automated operations and / or alarms are activated and in order to guarantee a continuous monitoring of Power Quality events.

Operating time counters

With appropriate programming, the Libra in addition to energy consumption/production counters is able to log the operating time. The operating time counter can be triggered by the exceeding of a threshold, for example alarm on power measurements, or considering the status of a digital input.

Load curves and data of consumption / production

The Libra net continuously logs the data of consumption / production of energy and power by organizing them into separate daily files, containing the data necessary for the reconstruction of the load profile and the analysis of the trend of buying/selling of energy. The logged data can be downloaded via Ethernet port or Wi-Fi and managed using Energy Brain and/or Upgrade Charts option or via HTTP.

Astronomical Clock Calendar

The Libra net is equipped with a clock / calendar with astronomical real time management of the Coordinated Universal Time (UTC). It manages also the rules for the automatic switching from Standard Time at summer time (Daylight Saving Time) and vice versa. Automatic synchronization via NTP.



15:18
Thu 12/05/2022

System clock	
UTC time	Thu 12 May 2022 13:18:29
Local time	Thu 12 May 2022 15:18:29
UTC offset	+01:00
DST offset	+01:00
Next DST change	Sun 30 Oct 2022 03:00:00
Easter day	Sun 17 Apr 2022
Day begin	05:53
Day end	20:34
Solar noon	13:14
Day duration	14:41
NTP synchronization state	Synced!
Next NTP synchronization	Thu 19 May 2022 14:13:35

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Wi-Fi and NFC (Near Field Communication)

The Wi-Fi version (with connector for external antenna) communicates with the existing Wi-Fi network without the need to be connected to an Ethernet cable while the presence of the NFC opens the possibility to create specific APPs for mobile devices for management of energy.

Libra ECT using ECT type CTs

The Libra ECT use exclusively the Electrex ECT type CT:

- **ECT TA 100A 13MM Power Quality Current Transformer** Code PFAE000-01: external CT for AC loads up to 100A. Plastic shell. Internal size 13 mm.



- **ECT CTS 16-100A Split Core Power Quality Current Transformer** Code PFAE000-02: external CT for AC loads up to 100A. Plastic shell. Equipped with a snap-on closing, screwless mounting system. Internal size 16 mm. Protection on the secondary circuit.



- **ECT CTS 24-200A Split Core Power Quality Current Transformer** Code PFAE000-05: same as previous model but for loads up to 200A and internal diameter 24 mm.
- **ECT CTS 36-400A e 23,4-300A Split Core Power Quality Current Transformer** Codes PFAE000-04 and PFAE000-06. Same as previous model but for loads up to 400A or 300A. Internal window diameter respectively: 35,9x35,9mm and 23,4x23,4 mm.

The Libra F version for Electrex Flexible CTs

The **Libra F** use exclusively the Electrex Flexible split core current transformers FCTS (mV output and appropriate internal linearization in order to maximize measurement accuracy).

WARNING: Do not connect to these current inputs of CT with output in current (eg. ../1A or ../5A) because it may damage both the device and the CT.

Configurable full scale, independently from the internal diameter of the flexible CT used: 250A, 500A, 1.000A, 2.000A or 4.000A (8.000A on request). With flexible CT calibrated and positioned correctly Class 1 of overall accuracy (measurement instrument + flexible CTs) between the full scale current value and five percent of it (minimum measurable current about two percent of the full scale). Measurement accuracy is influenced by several factors including correct positioning which affects +/- 3%.



- **FCTS 070-500:** Internal diameter 7 cm
- **FCTS 120-1000:** Internal diameter 12 cm
- **FCTS 200-2000:** Internal diameter 20 cm
- **FCTS 280-4000:** Internal diameter 28 cm

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ACTIVATING OTHER FUNCTIONS VIA PUK CODES

The Libra includes a WEB Server that can be used for configuring the device remotely and its firmware can be updated remotely at any time. Therefore it is possible to add and / or replace the features already present with new and different functions. New features can be activated by implementing the following Net Upgrades:

Net upgrade WEB (PUK) PFSU940-05

Enables the display of the measurements on Web pages of the same device and of slave Electrex devices / panels connected in the RS485 subnet.

Net upgrade Log 8 (PUK) PFSU940-01

By activating the PUK Log 8 it is possible to record the trend over time (profile curve) of the energy / environmental parameters acquired by Electrex instruments / devices connected to the RS485 port.

A Net upgrade Log 8 enables 1 storage service for 8 'logical' devices. The "service" is characterized by a unique time base (sampling frequency). It is possible to use more Log 8 for different storage services or to expand a single service. A maximum of 8 Net upgrade Log 8 are possible. In the PQ version 2 Net upgrade Log 8 are already enabled.

Net upgrade Charts (PUK) PFSU940-30

Allows you to view the graphs, for a configurable period of time, of parameters such as electricity, gas, steam, air, temperature, luminosity, etc. on the embedded web server. Data is obtained from the files logged in the Libra and exportable in CSV.

Net upgrade Open WEB (PUK) PFSU940-10

It adds to Libra the possibility of uploading customized web pages. The customized web pages can be created by technicians who have completed a specific course.

Net upgrade Energy Automation (PUK) PFSU940-16

Adds the ability to manage Energy Automation functions through programming in Ladder language of ON/OFF switching, alarms / notifications and automation routines conditioned by events and/or calendars (if the option Calendars is activated) and/or sending e-mails and/or SMS (if the relative options PUKs are activated).

Net upgrade Calendars (PUK) PFSU940-20

It allows you to create calendars to be used for time slots and in combination with Energy Automation (if option PUK is active).

Net upgrade eMail PFSU940-15 (and SMS PFSU940-17)

It adds the possibility to send notification / alarm e-mails (and / or SMS by adding a specific modem router Code PFC3510 with data SIM and activating the relative option). It can be used with Energy Automation option (if active).

Net upgrade Log 16 (PUK) PFSU940-01

Expands all Log 8 storage services to Log 16. All 8 Net upgrade Log 8 (PUK) services must be active first.

Net upgrade Open Log (PUK) PFSU940-25

It allows you to modify the logging frequency and the choice of parameters to be stored of an existing Log 8 service. The logging capacity will depend on the logging frequency chosen (minimum 5 / 10 seconds) and on the number of parameters selected.

Example: Open Log service logging every minute will store at least 10 days of data for the three phase voltages, the three phase currents, THD and the single harmonics of the 1st, 3rd, 5th, 7th and 9th order.

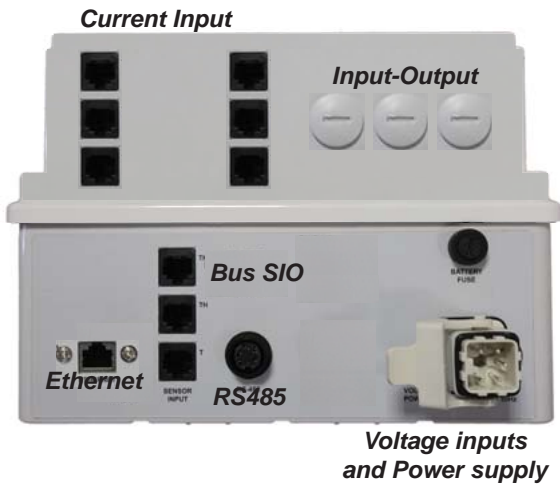
Net upgrade Net to Net Master (PUK) PFSU940-86

The Libra net Web becomes a net Master Web able to communicate with all Electrex gateways in the Ethernet network and the related devices in the subnet.

Net upgrade Sending Files – PFSU940-50

It adds the ability to send standard XML files (customized on request) through the 'FTP report' function or Json strings through the 'HTTP report' function. Additional costs in case of customizations. Requires activation of Energy Automation option PUK.

Libra connectors example (diagram for illustrative purposes and subject to change)

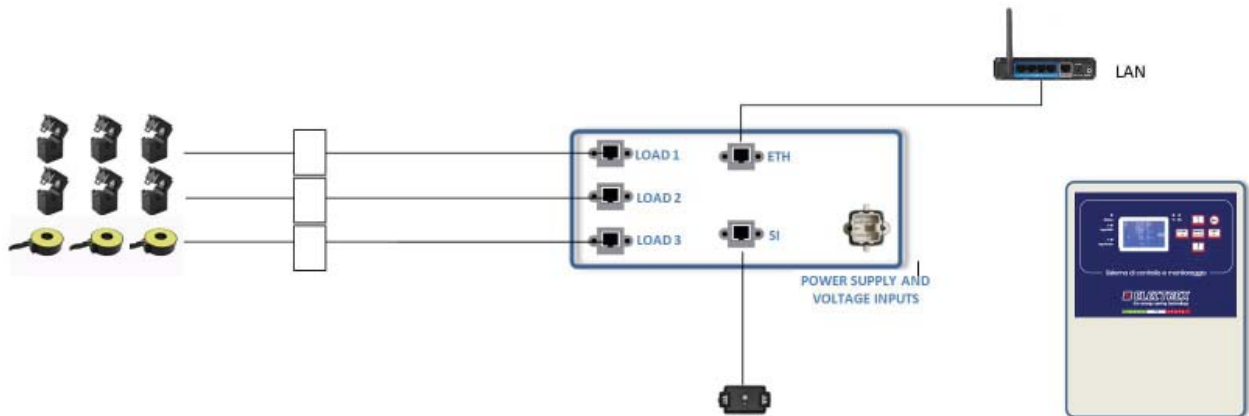


The Libra is characterized by the ease and speed of installation, it is in fact equipped with the following Plug & Play connections:

- 5-pole connector for power supply and voltage inputs
- RJ45 connector for wiring the ECT CTs via data cable cat. 5
- RJ45 connector for connection to the Ethernet network
- 5-pole connector for any RS485 network and a 12Vdc output power supply

Depending on the configuration, RJ45 connectors for the additional modules can be inserted on the SIO Bus as well as cable gland and terminal block for digital and/or analog inputs / outputs prepared for future use.

Example Libra ECT SI Connections (diagram for illustrative purposes and subject to variations)



5-pole connector for power supply and voltage inputs



Accessories

- Included in the Libra package:
- A 5-pole female connector for power supply and voltage inputs with 2 meters of cable
- Not included in the Libra package:
- RJ45 male connector for current inputs connections with data cable cat. 5 of the desired length.
 - Box with short-circuitable terminal block for quick installation of current transformers
 - 5-pole male connector for RS485 network with 1 meter of RS485 cable

Data cable cat.5 and RJ45 connector for current inputs

RJ45 CABLE		ECT type CT	
1	White/Orange	S1 White	I1
2	Orange	S2 Black	
3	White/Green	S1 White	I2
6	Green	S2 Black	
5	White/Blue	S1 White	I3
4	Blue	S2 Black	
7	White/White	NOT USED	
8	Brown	NOT USED	

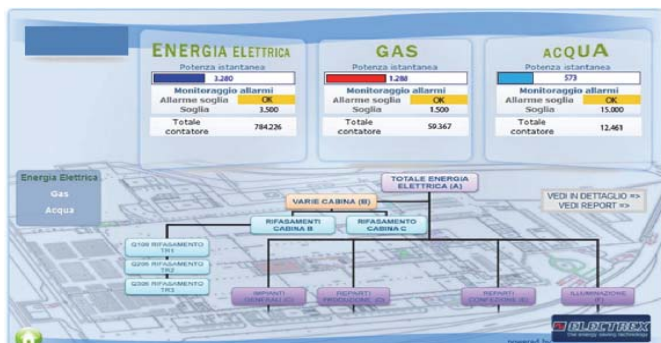
Standard Web pages example - PFSU940-05

Through the 'Net upgrade WEB' function it is possible to view the predefined web pages with instant measurements, average power values and energy total counters of both the Libra and each instrument / device connected to it in the RS485 subnet. The example below shows the page with instantaneous measurements and the page with the average values of the powers and energy meters relating to the general supply of a laboratory with offices.



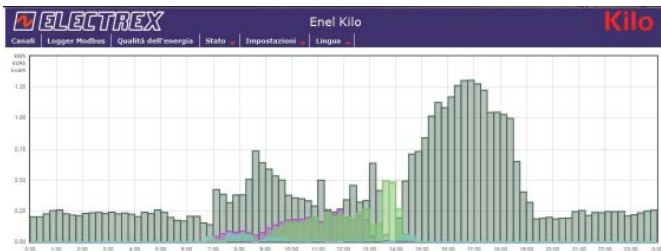
Custom Web page example – PFSU940-10

By enabling both the 'Net upgrade WEB' and 'Net upgrade Open WEB' functions, it is possible to insert customized web pages in the Libra net embedded web server. Below there is an example of real-time supervision of the electricity, gas and water used in a plant with the possibility of defining the thresholds beyond which the alarm is activated. It is then possible to connect to sub-pages detailing the consumption of departments and machinery and via a link to connect to historical data. The pages that reside on the Libra net web server are easily accessible from the browser of any PC, smart phone, etc., by typing the IP address and log in credentials.



Web chart example – PFSU940-30

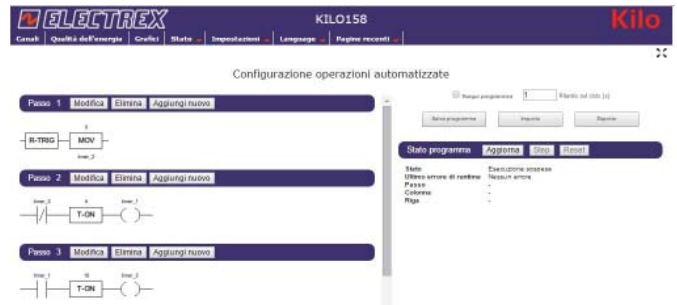
By enabling the 'Net upgrade Charts' function, it is possible to view the graphs obtained from the data stored in the Libra net, via the Web page. In the example, the graph shows the active energy purchased and produced by a PV system.



Energy Automation example – PFSU940-16

By enabling the 'Net upgrade Energy Automation' function, it is possible to automate even complex operations such as switching on / off, alarms / signals and operations conditioned by events.

The logic programming is in Ladder language. It is also possible to combine the programming with personalized calendars (if Net upgrade Calendars is implemented) and / or sending eMail and / or SMS (if the respective Net upgrades are implemented).



Net Upgrade Calendars – PFSU940-20

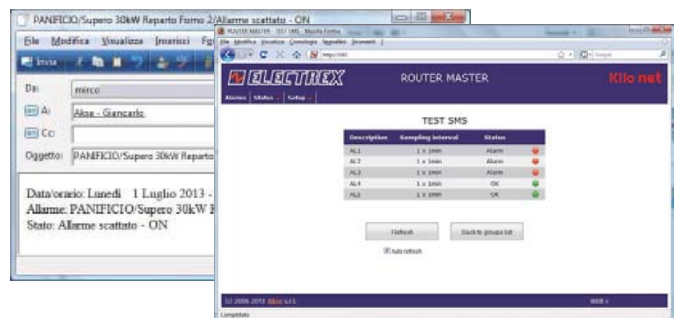
By enabling the 'Net upgrade Calendars' functionality in Libra net, it is possible to configure Calendars to be used, for example, for tariff bands and / or in conjunction with Energy Automation for scheduled switching on / off operations.

The astronomical clock is synchronized via NTP (references from the Internet or from a PC in the internal network).



eMail alarms example – PFSU940-15

By enabling the 'Net upgrade eMail' function, it is possible to configure the Libra net to send notification / alarm e-mails both in relation to the exceeding of the threshold of a measured parameter and in relation to the situation of its entry. The example shows the alarm e-mail of a department in a bakery and a graphic display on the specific web page of the Libra net Web.



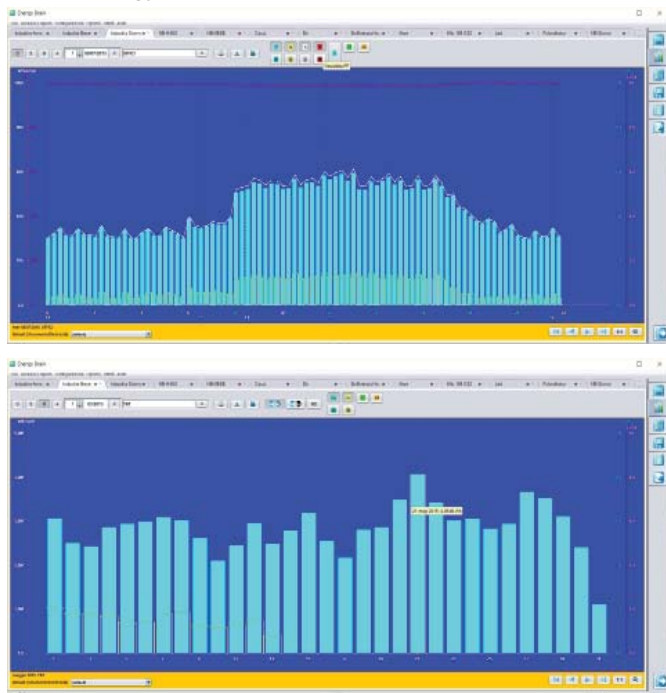
VERSIONS FOR THE POWER QUALITY: ALREADY ACTIVATED OR ON REQUEST

In the Libra net H are displayed the single voltage and current harmonics up to the 51st order. While with the Libra net PQ versions it is possible to record Power Quality events (peaks, dips and interruptions), view their trend, classify them and run measurement campaigns. On request it is possible to switch from version H to PQ (Upgrade H to PQ Version code PFSU940-81). The memory can be read from the Ethernet or Wi-Fi port via the Energy Brain software and / or via the HTTP protocol.

Curves of stored parameters

The Libra continuously store energy consumption / production data, organizing them in daily files consisting of 96 quarters of an hour by default.

The stored data can be viewed by day, week, month and year via the Energy Brain software:



Power Quality (Classe S - EN 61000-4-30): event log

The PQ version detects and stores various events with resolution of a cycle (indication of date / time of each event, type of event, phase concerned, duration, min / max value reached during the event) useful for monitoring the Power Quality (functions also related to EN 50160 and EN 61000-4-30 for class S). The parameters for defining the anomalous event are programmable. Types of events:

- Voltage sags (dip)
- Overvoltage (swell)
- Overcurrent and its direction
- Interruptions

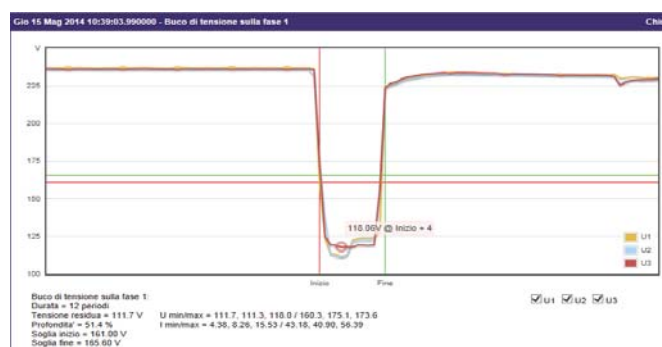
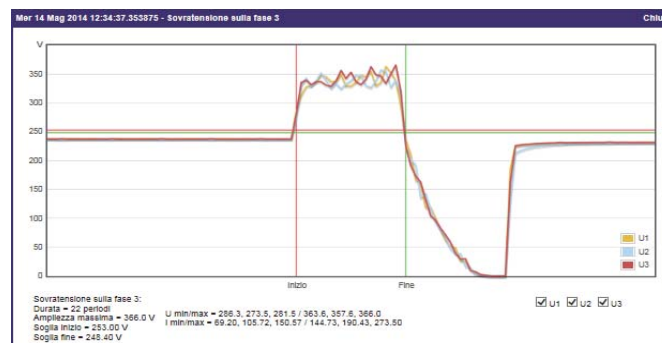
Data/ora	Evento	Fase	Durata (onms/us)	Durata (periodi)	Valore [V]	Classificazione UNIPEDE
2014-05-12 16:15:10.986375	Avvio logger	---	---	---	---	-
2014-05-14 12:34:37.353875	Sovratensione	1	0:00:00.440250	22	363.6	S1
2014-05-14 12:34:37.353875	Sovratensione	2	0:00:00.440250	22	357.6	S1
2014-05-14 12:34:37.353875	Sovratensione	3	0:00:00.440250	22	366.0	S1
2014-05-14 12:34:37.854250	Buco di tensione	1	0:00:00.360125	18	0.2	X2
2014-05-14 12:34:37.854250	Buco di tensione	2	0:00:00.380250	19	0.3	X2
2014-05-14 12:34:37.874250	Buco di tensione	3	0:00:00.360250	18	0.2	X2
2014-05-14 12:34:38.054375	Interruzione	3	0:00:00.160000	8	0.2	-
2014-05-14 12:34:38.074375	Interruzione	1	0:00:00.140000	7	0.2	-
2014-05-14 12:34:38.074375	Interruzione	2	0:00:00.140000	7	0.3	-
2014-05-15 10:39:03.990000	Buco di tensione	1	0:00:00.240125	12	111.7	C2
2014-05-15 10:39:04.010000	Buco di tensione	2	0:00:00.220125	11	111.3	C2

Graphic detail of the event

In the PQ version of Libra net, in addition to the list of events on the web page,

Sovratensione sulla fase 3:
 Durata = 22 periodi
 Ampiezza massima = 366.0 V
 U min/max = 266.3, 273.5, 261.5 / 363.6, 357.6, 366.0
 I min/max = 69.20, 105.72, 150.57 / 144.73, 190.43, 273.50
 Soglia inizio = 253.00 V
 Soglia fine = 243.40 V

the "graphic detail of the event" function is activated, which allows you to record and view the trends of the beginning and end of the event on the web page with a window time (both for the starting and the ending) of one second (programmable).



Timeline of events and UNIPEDE table

The **Libra net PQ** also allows you to view a time line with the succession of events on the web page.



It also create a distribution scheme of events based on the percentage of the parameter considered with respect to its reference value and duration according to the specifications of UNIPEDE (International Union of Producers and Distributors of Energy).

Tabella UNIPEDE (classificazione per valore e durata)						
Tensione residua u [%]	Classificazione dei buchi di tensione					
	1	2	3	4	5	6
A 90 > u >= 80	0	0	0	0	0	0
B 80 > u >= 70	0	0	0	0	0	0
C 70 > u >= 40	0	3	0	0	0	0
D 40 > u >= 5	0	0	0	0	0	0
X 5 > u	0	7	2	0	0	0

Sovraelevazione di tensione u [%]	Classificazione delle sovraelevazioni di tensione		
	1	2	3
S u >= 120	9	0	0
T 120 > u >= 110	0	0	0

Example:

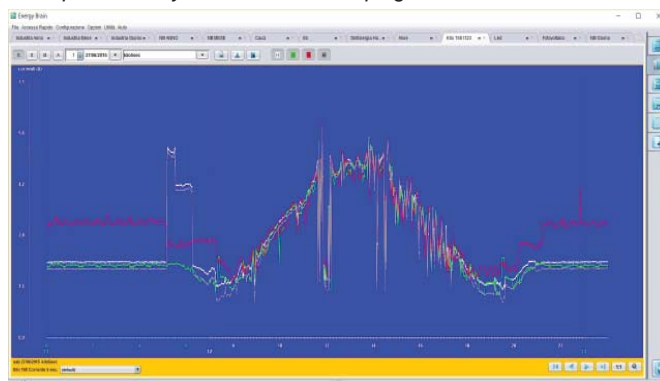
In the last column of the events table below, the S1 corresponds to an Overvoltage with a duration between 10 and 500 mS, while X2 corresponds to a voltage dip with voltage dropped below 5% of the rated voltage and duration between 10 and 200 mS (see Unipede Table above).

Data/ora	Evento	Fase	Durata [oms.us]	Durata [periodi]	Valore [V]	Classificazione UNIPEDE
2014-05-12 16:15:10.986375	Avvio logger	---	---	---	---	-
2014-05-14 12:34:37.353875	Sovratensione	1	0:00:00.440250	22	363.6	S1
2014-05-14 12:34:37.353875	Sovratensione	2	0:00:00.440250	22	357.6	S1
2014-05-14 12:34:37.353875	Sovratensione	3	0:00:00.440250	22	366.0	S1
2014-05-14 12:34:37.854250	Buco di tensione	1	0:00:00.360125	18	0.2	X2
2014-05-14 12:34:37.854250	Buco di tensione	2	0:00:00.380250	19	0.3	X2
2014-05-14 12:34:37.874250	Buco di tensione	3	0:00:00.360250	18	0.2	X2
2014-05-14 12:34:38.054375	Interruzione	3	0:00:00.160000	8	0.2	-
2014-05-14 12:34:38.074375	Interruzione	1	0:00:00.140000	7	0.2	-
2014-05-14 12:34:38.074375	Interruzione	2	0:00:00.140000	7	0.3	-
2014-05-15 10:39:03.990000	Buco di tensione	1	0:00:00.240125	12	111.7	C2
2014-05-15 10:39:04.010000	Buco di tensione	2	0:00:00.220125	11	111.3	C2

Measurement campaign

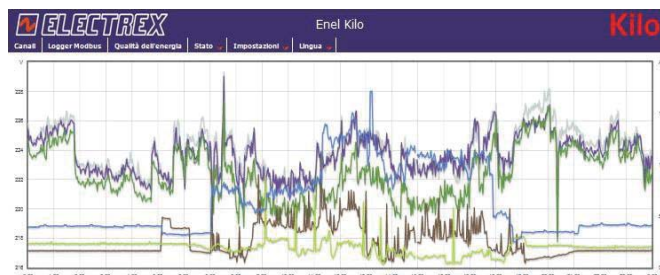
With the **Libra net PQ** it is possible to configure the measurement campaign in order to log, in the built-in memory, the various parameters with a programmable sampling rate, for example every 1 min., for 10 days (FIFO) in daily files. Data logged: U, I per each phase (per each parameter will be logged the nominal value and the % value of the fundamental; while the % value for the 3°,5°,7°,9° harmonic and THD). The data can be displayed using Energy Brain software.

Example of a daily measurement campaign of the 3 currents:



With the **Libra net PQ** it is possible to display on the web interface the measurement campaigns.

Example of a daily measurement campaign of the 3 voltages every 15 seconds:



Functional Logs

The instrument's memory is used also for other operative functions such as:

- Functional log for the recording of all the operations that alter the functioning of the instrument since the first use.
- Tariff Calendar file for the management of the tariffs and other files for memory configuration.


Considering the quantity and the complexity of the data contained in the memory, the memory management and the configuration of the services can be made exclusively via Ethernet port or Wi-Fi using FTP and HTTP commands, more simply by using Web pages and/or the software Energy Brain.

TECHNICAL SPECIFICATIONS LIBRA

Electrical characteristics		
Connection	three-phase, single-phase and two-phase, LV, MV, HT balanced, unbalanced, 3 and 4 wires	
Voltage inputs	Direct insertion	from 20 to 500V phase-phase (max. 1.7 crest factor)
	With external VT	(max. 400 kV primar.) VT value: programmable
	Sovraccarico	max, 900 Vrms peak per 1 sec.
Current Inputs	External CTs ECT	max. 400A primary secondary mA output
	TA apribili flessibili FCTS	max. 4000A primary secondary mV output
	Traditional external CTs	max. 10kA primary .../1A and .../5A secondary CT value: programmable
	Load on the CT	< 0,5 VA
	Overload	max. 100 Arms peak per 1 sec
Power supply	230 Vac (other types on request)	
Frequency	45-65 Hz	

Functional characteristics		
Measurements	True-RMS up to the 51st harmonic	
Quadrants	2 or 4 quadrants (programmable)	
Accuracy	Active Energy	Class 0,5S CEI EN 62053-22 Class C EN 50470-3
	Reactive Energy	Class 1 CEI EN 62053-24
Sampling	continuous at 8kHz of the voltage and current waveforms	
Compensation	Automatic of the amplifiers' offsets	
Scale Change	Automatic on the current inputs (highest resolution)	
Insulation	Galvanic on all the inputs and outputs	
Standards	Safety	IEC EN 61010 class 2
	E.M.C.	IEC EN 61326-1A

Mechanical characteristics		
Operating temperature	-20/+60 °C	
Humidity	95% R.H. non condensing	
Enclosure	Self-extinguishing plastic material class V0	
Protection degree	IP40	
Weight – Libra net	around 5,1 kg net, 5,7kg package	
Size (WxLxH)	236x316x190 mm	236x316x130 mm

Front Panel	
Display	LCD, FSTN dot-matrix 128 x 64 points
Visible area	22x44 mm (HxL)
Backlight	White Led
Keyboard	6 keys keypad Joystick positioned
Calibration LED	2 red for the Ea and Er
Functioning / State LED	1 red under the symbol 
Communication RS485 LED	1 green and 1 red under the white band

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The Energy Brain 6.x and PRO 6.x software (additional option)



Energy Brain is the software created for the creation of instrument networks, even very complex ones, both locally and remotely. It is suitable for application with all Electrex instruments equipped with a communication port and provides all the necessary functions for the monitoring and accurate management of **energy efficiency** (consumption / production of electricity, gas, water, etc.), of the **environmental** (temperatures, humidity, brightness, CO2, etc.) and **process parameters**.

MAIN FEATURES

Configuration

The available options allow maximum flexibility in adapting the software to the network of instruments (even to different types of networks connected simultaneously) and to the needs of the operator.

- Remote instrument configuration (CT, TV, alarms, etc.)
- Network configuration (per instrument, per customer, in groups, per location) with autonomous setting of the type of local connection (direct RS485, Ethernet, E-Wi) or remote (Internet, Wi-Fi) and of the communication parameters (speed, etc.).
- Configuration of the data download frequency divided by location, by customer, on a daily, weekly or monthly basis via programmable agenda.

Display of graphs and consumption / production curves

- Graphs of daily, weekly, monthly, yearly power curves.
- Graphs of daily, weekly, monthly, yearly consumption curves.
- Electrex environmental sensor graphics and / or commercial transducers with pulse / analog output (light, temperature, gas, calories, etc.).
- Graphs of powers, power peaks and energies divided by tariffs.
- Up to 4 simultaneous graphs
- Export and printing of graphs and numerical data.

Parameter display

- Online display of all the measurements provided by each of the instruments in the field.

Data storage

- Automatic or manual download of power, energy and other variables data from connected instruments and automatic archiving in PostgreSQL® database.
- Data export to other DBs via ODBC module or txt or xls format.

Tariffs

- Data management by tariffs
- Tariffs and calendar configuration editor

Virtual and Multiple Channels

- Creation of virtual channels that is "groups" of instruments (example "summation" of various departments) and their display, in graphic form, in the same way as a physical channel
- Creation of multiple channels to be able to view overlapped graphs of multiple instruments for quick comparison.
- Insertion of variables and mathematical formulas, even very complex ones, particularly useful, for example, for simulations.

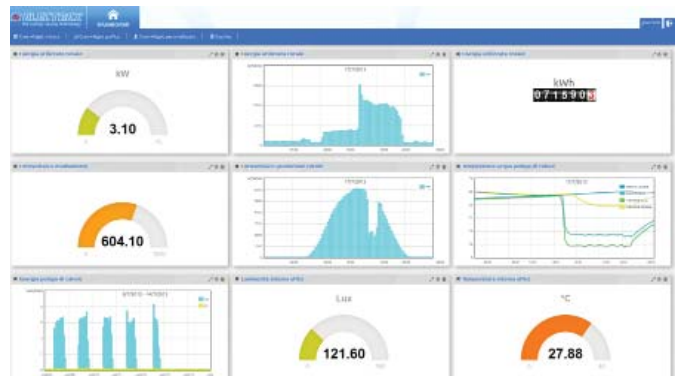
ENERGY BRAIN CLOUD

Energy Brain Cloud is the software that allows to display and manage via a web browser, on a variety of devices such as PCs, tablets, Smart phones, data, measures and real-time and historical charts acquired by Electrex instruments.

Taking advantage of the technology of cloud computing, users can manage the data collected through a standard Internet browser without installing any software on their computer or mobile device.

Energy Brain Cloud can be used in three modalities:

1. Energy Brain Cloud is installed and managed directly by the end user of the Electrex monitoring networks
2. A third party (Energy Consultants, Energy Saving Company, associations, etc.). Installs and manages Energy Brain Cloud and makes available to its customers/members the access to their data as a service
3. Electrex offers to the end users of the monitoring solutions access to their data through Energy Brain Cloud as a service.



Energy Brain PRO 6.x software

For a description of all the additional functions introduced by the PRO 6.x version, refer to the product sheet of the Energy Brain software.

The Energy Brain software is available in various versions according to the functions and the number of channels required. For more details on the software: www.electrex.it/en

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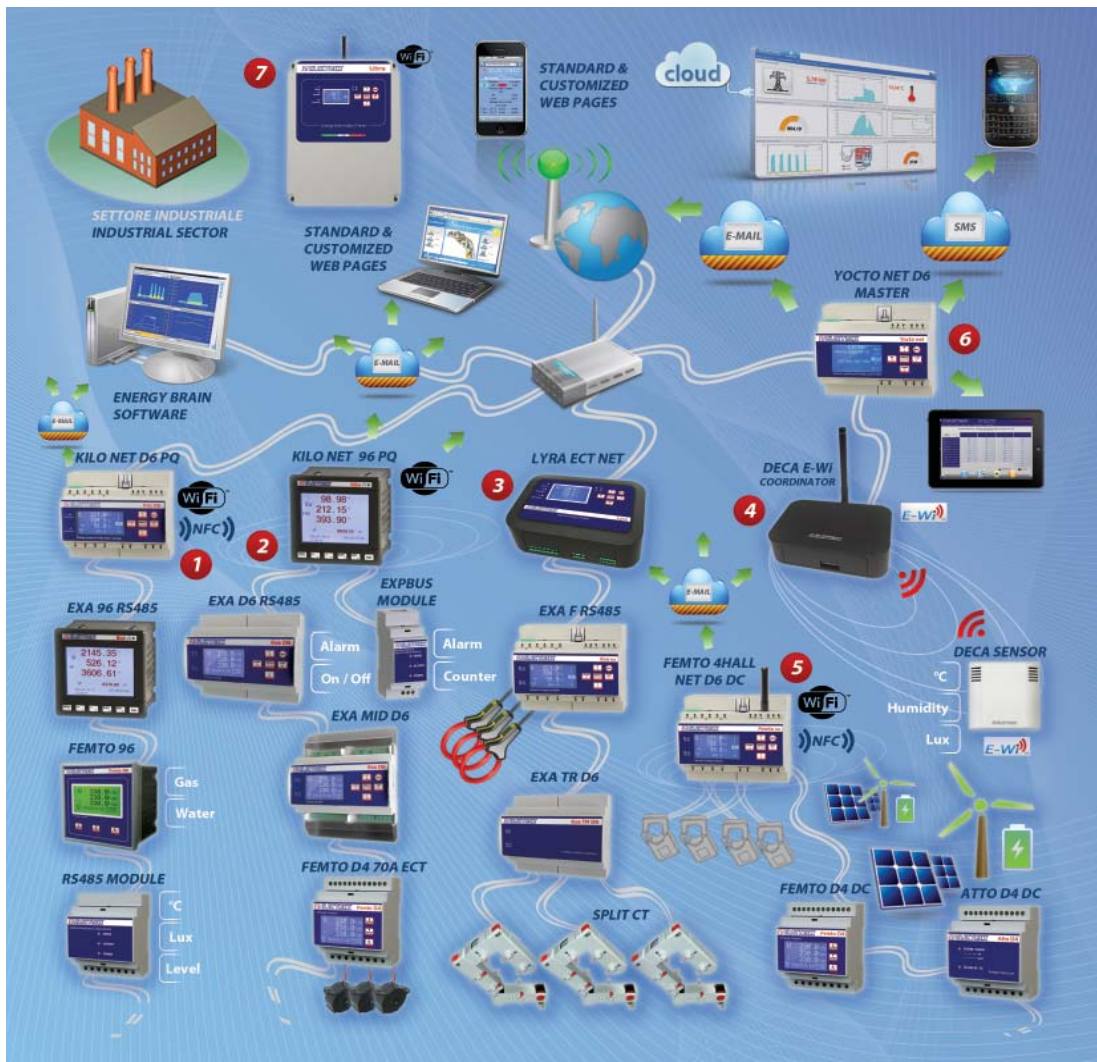
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Electrex Monitoring Solutions

Production plant energy monitoring solution example



The diagram above represents a part of a monitoring solution in a production plant powered by a main MV load and equipped with 2 MV/LV transformers (one of them replaced recently) that serves 2 production lines, while the offices are powered by a LV system. The monitoring system consists of branches 1 and 2 to monitor the transformers and a part of the production lines, while branches 3, 4, 6 and 7 take care of the building with the offices, the testing department, a Photovoltaic on the roof and R & D building. These branches are connected to the company Ethernet network via the Kilo net D6 PQ (branch 1), the Lyra ECT net (branch 3) and the Yocto net D6 Master (branch 6) and via Wi-Fi the Kilo net Wi-Fi EDA 96 PQ (branch 2) and the Femto 4Hall net Wi-Fi EDA D6 DC (branch 5). The various instruments and sensors inserted in each branch are responsible for monitoring the relevant main users.

- **In branch 1** the Kilo net D6 PQ (gateway and datalogger) monitors the quantity and power quality under the transformer 1 and the Exa 96 RS485 in sub-grid RS485 to the Kilo net controls a machining center, while the Femto 96 is equipped with digital inputs in addition to taking care of lighting consumption and also of gas and water consumption. The RS485 Module detects some parameters from existing analogue probes.
- **In branch 2** the Kilo net Wi-Fi EDA 96 PQ (gateway datalogger) monitors the quantity and power quality under the transformer 2; one of the several Exa D6 RS485 in sub-network RS485 under the Kilo 96 detects a compressor while the Exa MID D6 is used to de-tax the energy of a galvanic processing. The ExpBus module connected to the Kilo net 96 deals with alarms and counting. There is also a Femto D4 ECT for monitoring an area with LED lighting. In Kilo net 96 the Energy Automation was activated to automate and make more efficient the switching on and off of three compressors by piloting the digital outputs of the same number of Exa D6 RS485.
- **In branch 3** that starts from the technical room there is a Lyra ECT net (gateway datalogger) that takes care of the general lighting of the offices having in RS485 sub-network an Exa F D6 Rs485 TA opening flexible (easier to insert) for the testing desk of large engines and an Exa TR D6 for testing of smaller engines..

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- **In data-point 4** there is a Deca Coordinator E-Wi 868 that acts as an E-Wi 868MHz radio gateway for a Deca Sensor E-Wi 868 that detects the environmental parameters of a laboratory. The Deca Coordinator is connected in RS485 to the Yocto net Master which acts as the datalogger of the branch.
- **Branch 5** deals with continuous side monitoring (Femto 4Hall net DC, Femto D4 DC and Atto D4 DC) of a 50kWp photovoltaic system placed on the roof of the building.

In the Ethernet network, the Yocto Net D6 Web Master, **branch 6**, has enabled customized web pages (including those of the HVAC) to display the supervision pages on the PCs, tablets and smart-phones of the managers and maintainers as well as sending alarms via eMail to warn in case of anomalies.

To monitor the Research & Development building across the street, a Libra (quick to install) panel was used connected to a router with data SIM, **data-point 7**.

The Energy Manager uses his notebook both when it is in the plant (locally) and when it is out (remotely), to connect to the company Lan network and evaluate the effectiveness of energy efficiency interventions through data that the software Energy Brain PRO periodically downloads from Electrex devices. Recently, in order to continuously improve in terms of energy efficiency (ISO 50001), the Energy Manager has also involved in the Energy Management System the department managers, making available their consumption data that can be viewed from a PC, tablet and smart-phone at any time via the Energy Brain Cloud which is also active in the **Control Room**. The management is implementing different levels of interconnection (hardware and software) with a view to **Industry 4.0**.

Monitoring network example using Libra panels for the multi-site, commercial or public buildings



In the image here above are shown two examples of use of the Libra panels.

In the first one the monitoring solution includes two Libra panels placed in two shopping malls part of an international retail chain (but can be also two shops, offices or restaurants, etc.).

The Libra 1 retrieves and logs the consumptions of 5 electrical loads (mains, the PV system, the HVAC, internal and external lighting), the internal and external temperature and humidity.

The Libra 2 retrieves and logs the consumptions of 3 electrical loads (refrigerated counters, cold stores and the oven) and the alarm status of the refrigerated counters and cold stores.

In the second example in a bank branch has been installed a Libra net for the monitoring of the mains, internal temperature, humidity and external temperature. While for the lighting and the HVAC systems has been used a Libra Expansion. In both cases the Energy Manager uses the software Energy Brain in order to control and monitor the energy consumptions while the maintenance team is supported from the real-time measurements and alarm statuses displayed on the embedded Web interface. In a second stage of the project is has been scheduled the activation of the Energy Automation function in order to automate the switching (On/Off) of some loads in order to optimize the system's management and be more efficient.

Subject to modification without prior notice.
 Datasheet Libra
 2022 05 17-ENG