



**Energy efficiency monitoring and active control solutions**

**Controls**

# Energy efficiency

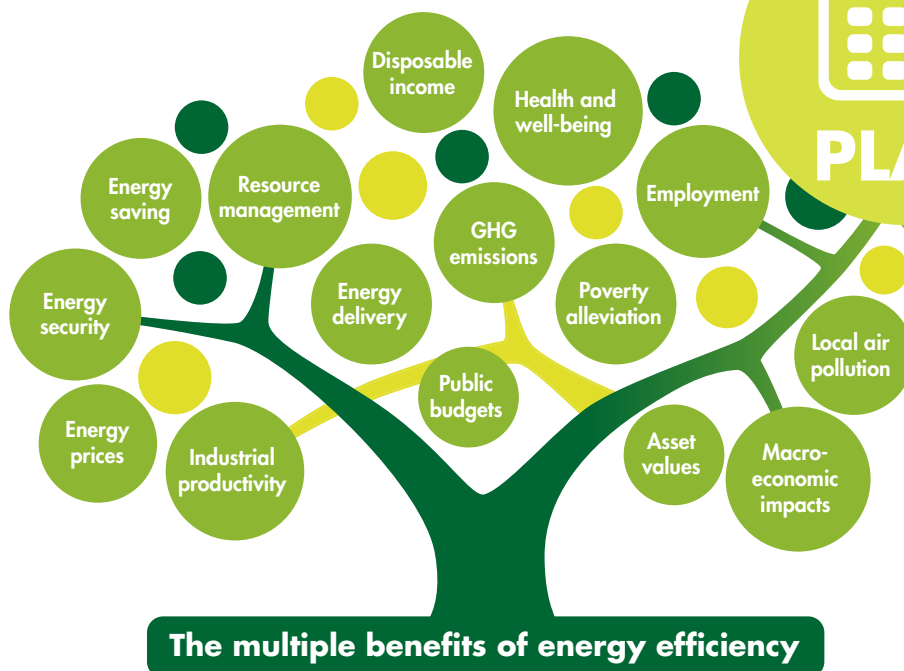
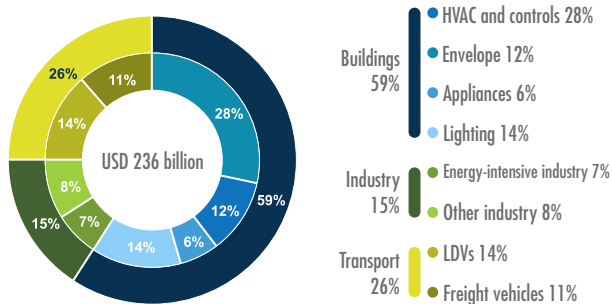
## Cultural changes drive energy savings

### ■ The new challenges for the energy sector

As stated by IEA, the International Energy Agency, "Energy efficiency is a vital component to meet the challenges faced by the energy sector, which range from ever increasing global energy demand, to concerns about energy safety, climate change, local air pollution, and the affordability of the energy supply". Therefore, the monitoring of energy consumption is an important first step, for the achievement of energy efficiency goals. Energy efficiency is "the first fuel": it is the key for cost effective energy transitions and the single energy resource that all countries own in abundance. Strong energy efficiency policies are vital to achieving the key energy-policy goals.

### ■ Global spending on energy efficiency

Spending related to energy efficiency improvements has grown strongly in recent years. A total of USD 236 billion was invested in energy efficiency across the buildings, transport and industry sectors. The increase was largely due to investments in heating, cooling and lighting. See the picture below, source: IEA – World Energy Investments 2018 (HVAC = heating, ventilation and air conditioning; LDV = light-duty vehicles).



## ■ Why the plan-do-check-act cycle

In order to achieve Energy Efficiency mandatory regulations and goals, and therefore realizing both Energy and cost savings, it is important to plan a proper "Energy Efficiency Plan", which has to be based on a PDCA (Plan-Do-Check-Act) cycle.

An Energy Efficiency plan, for medium or large installations go through an Energy audit which will assess:

- **critical issues** within a site;
- **priority** of the corresponding resolution;
- **areas of action** to be developed which can be implemented either during the design phase of a new system or during the renovation of an existing one.

## ■ The three major steps

An Energy audit and subsequently an Energy efficiency plan is split in three major steps: checking, monitoring, and analysing the actual use of Energy. If the statement: "do not estimate when you can calculate, do not calculate when you can measure" is obvious, the logical consequence is splitting the whole facility into main and sub-metering to identify where electrical energy is wasted.

## ■ All areas have to be fully implemented

But such a plan is not complete if the identified areas of actions are not fully implemented. This means that lighting, cooling, space heating controls and a proper BACnet communication capability to an HVAC system are mandatory conditions to achieve the needed Energy and cost savings.

## ■ The right solution

Thanks to its comprehensive solutions, including meters, data analysis, communication technologies, and controls, Carlo Gavazzi provides all the information necessary to implement, an Energy Efficiency Plan. Key Performance Indicators (KPIs), benchmarking, and reporting of key measurements are quickly and easily obtained, providing the tools necessary to achieve continuous improvement.



# Energy efficiency

## UWP<sub>3.0</sub> the paradigm shift

### ■ How can you implement an effective Energy Efficiency plan?

Meters are useless if relevant data cannot be collected remotely, and remote collected data is useless if not fully automated and properly filtered for a focused analysis!

Likewise, an energy efficiency plan is not effective, and savings cannot be achieved if the automatic data analysis does not act properly on loads. Therefore the paradigm is to be able to generate useful information and to automatically convert it into saving actions. A System Integrator in such a situation would combine components from different suppliers to achieve the requested model. The paradigm shift is to be able to provide to the same user a unique complete, flexible and scalable platform.

### ■ Why a unique platform?

A System Integrator using a standard monitoring and control architecture would face many problems including: system complexity, high cost, a long commissioning time, and a long learning time. The same System Integrator, using UWP 3.0 SE as the core of the Energy monitoring system would benefit from architecture simplicity, short commissioning time, cost reductions, error proof configuration, expandability, and scalability.

The UWP 3.0 SE platform with full functionalities meets today's Energy Managers and Energy Service Companies requirements to achieve energy efficiency goals.

### ■ An open system!

UWP 3.0 SE is the core of a powerful system, but also a Web-Server, a gateway which embeds different communication protocols, such as Modbus TCP/IP, BACnet, SFTP, Rest-API, just to mention some of them. To meet the Industry 4.0 rising integration demand based on IoT and Cloud technologies, UWP 3.0 SE is Microsoft® Azure Certified for IoT.

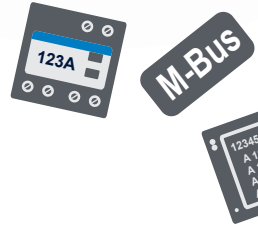
More in detail: FTP, SFTP, FTPS for pushing data to standard FTP servers, in a secure and reliable way according to a schedule. Rest-API to inter exchange data with a remote system with all the necessary flexibility.

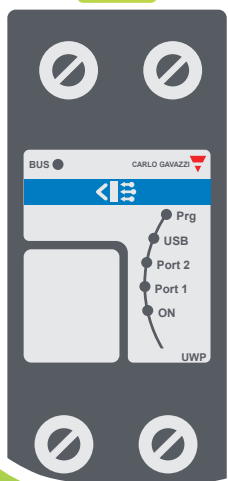
Modbus/TCP and BACnet bridging of the available data points, using UWP 3.0 SE as a flexible data-hub among field-buses.

UWP 3.0 SE is Microsoft® Azure certified for IoT. The available data points are sent via MQTT to the Azure IoT platform allowing users to stream data from multiple UWP 3.0 SE units to a centralized SQL or non-SQL database and from here to leverage the powerful tools from the Microsoft® Azure marketplace to analyse, organize, aggregate, and display data. UWP 3.0 SE + Microsoft® Azure IoT HUB + Microsoft® PowerBI allow users to create a scalable dashboard focused on the desired KPIs without the need for a software developer, and then share and publish online.

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# UWP3.0

## Gateway

Monitoring, data analysis and reporting

Wide control possibilities

Parking guidance

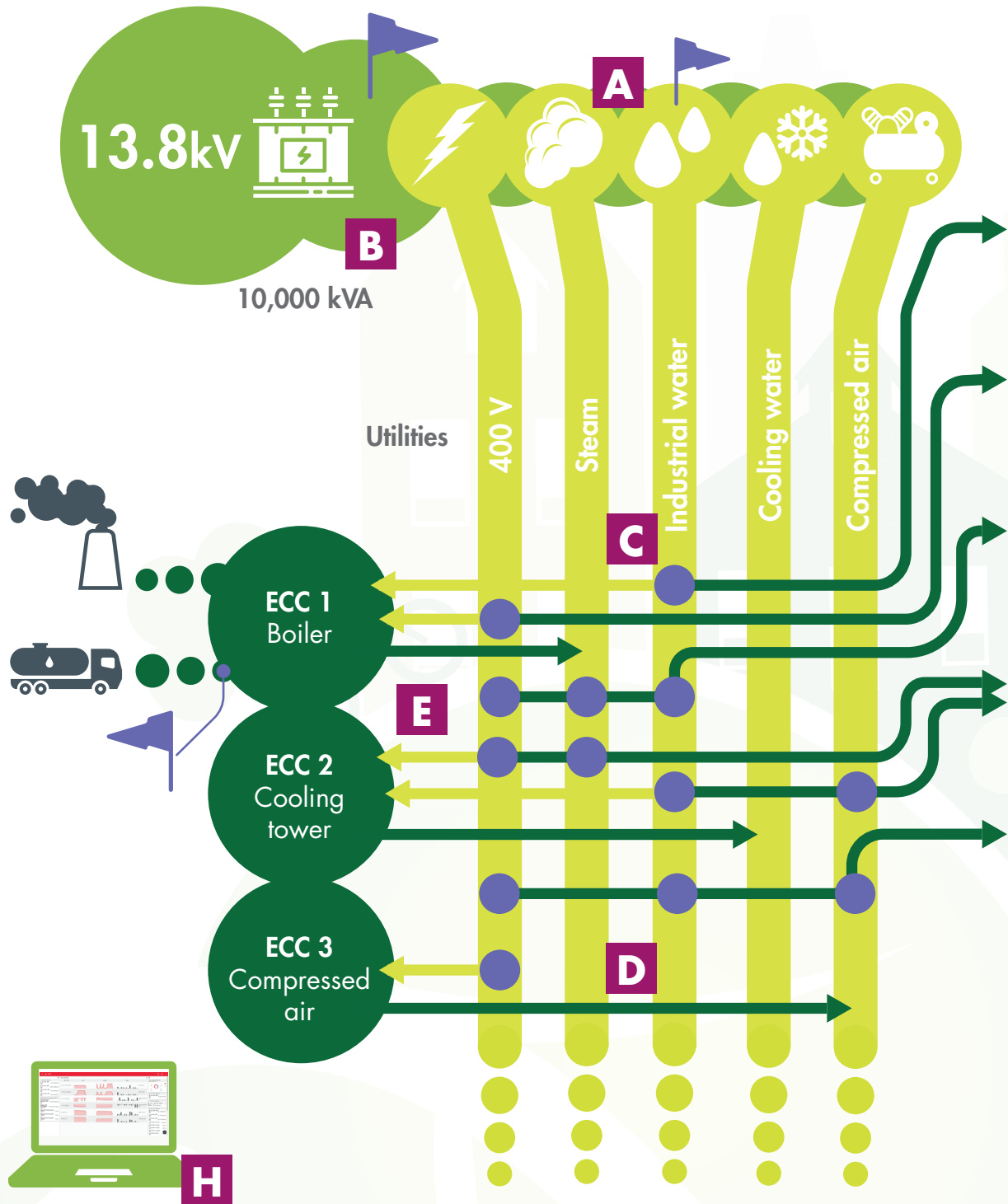
Cost streamlining and energy saving

# Monitoring

## The map

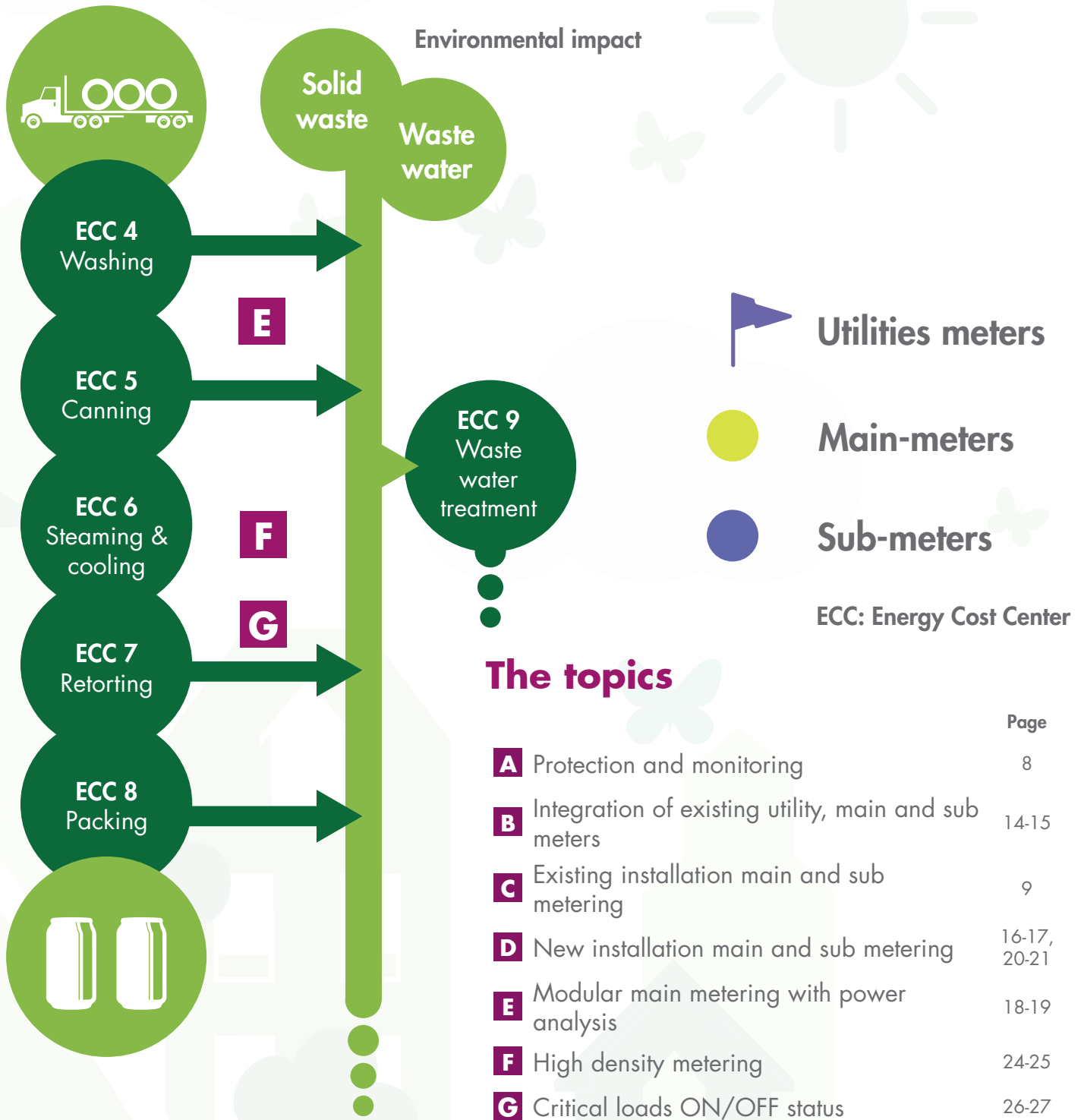
### ■ The Carlo Gavazzi Energy Efficiency Monitoring competencies

This map guides you, in this example, through the Carlo Gavazzi competencies and product solutions. A journey through protections, EScO analysis tools, core units, utility meters data acquisition and integration solutions, integration of main and sub-metering systems in existing and new installations!





To grant the full interoperability of some of its meters, Carlo Gavazzi is now member of the OMS Open Metering System group.



## The topics

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# Monitoring

## Protection and monitoring

### Electrical safety is part of the efficiency solution

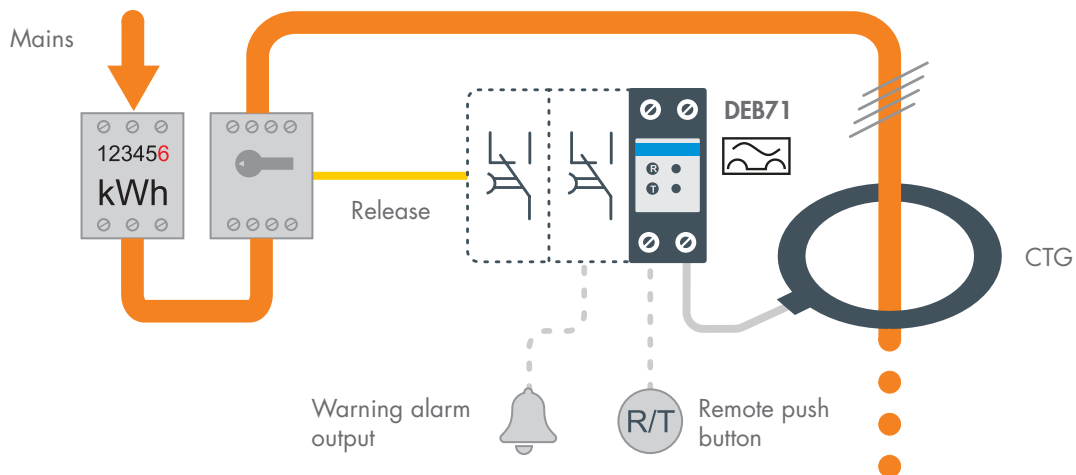
#### Why installation protection?

**How to prevent injury?** In the wide range of protection devices, there is a family of units called RCD Residual Current Device. The purpose of an RCD is to protect machinery and assets from the devastation of fire caused by earth faults.

**How to detect dangerous earth leakage currents?** In industrial and commercial applications, due to their specific requirements, the device used is called an MRCD Modular Residual Current Device. More specifically, it is an earth leakage current relay which can detect earth leakage current by means of an external core balance transformer.

**How to avoid power supply interruption?** Both RCDs and MRCDs are prone to nuisance trips from normal harmless earth leakage. Those are due to external factors, such as a high current discharge due to lightning or to an earth rod placed close to a nearby earth rod on a building. A nuisance trip would affect the availability of power supply, which for example in a production facility, because of its nature, is not allowed.

**The Carlo Gavazzi solution is made of two models:** DEA71 and DEB71, combined with CTG, our core balance transformer family. Our MRCDs comply with IEC60947-2, allowing them to avoid nuisance trips and fulfil the "A" type operating characteristic so to work in case either of presence or absence of dc component of residual currents.



#### DEA71

- Fixed current setting: 30 mA or 300 mA
- 2 relay outputs for warning and alarm
- Input for remote Reset / Test
- 24 – 240 V ac power supply

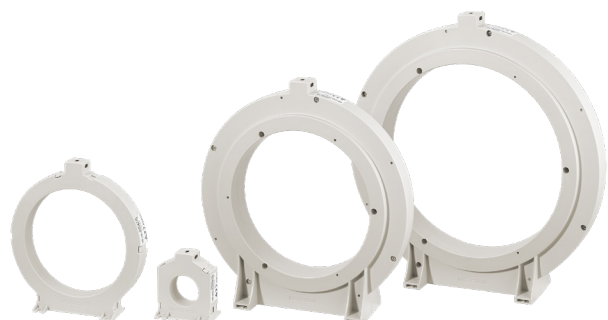
#### DEB71

- Adjustable setting from 30 mA to 5 A
- Adjustable delay up to 5 s
- Leakage level LED bar
- 2 relay outputs for warning and alarm
- Input for remote Reset / Test
- 24 – 240 V ac power supply

#### CTG, core balance transformer

- Easy installation
- High accuracy and sensitivity

Model	Hole size
CTG35	35 mm
CTG50	50 mm
CTG70	70 mm
CTG120	120 mm
CTG160	160 mm
CTG210	210 mm

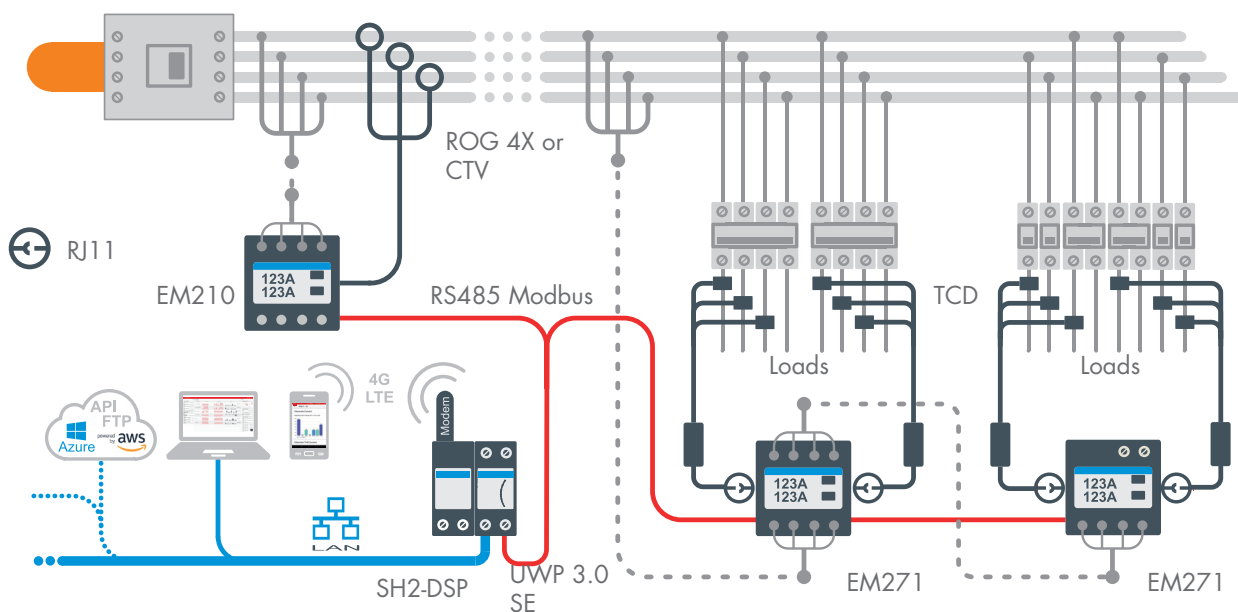




# Retrofit main and sub-metering

The “check” part of the PDCA process starts here!

Identifying areas of energy wastage with a quick installation. This solution is suitable for ESCOs, being possible to easily remove equipment from a place where it has been installed, and re-install it somewhere else. But it can also be the ideal solution as a part of a permanent monitoring system in a plant where space and communication capabilities may be restricted.



## EM210, main metering solution

- Patented meter, 4-DIN and 72x72 mm solution in the same housing for DIN-rail or panel mounting. Detachable 3\*3-DGT/7-DGT display
- Up to 415 V L-L ac and CT/CTV/ROG-based current measuring inputs
- 5 A CT (AV version), 333 mV from CTV 1X-2X-3X-4X-6X-8X sensors (MV version), Rogowski current sensors (MV version)
- Measurements: V, A, Hz, PF, W, VA, var, bi-directional kWh
- An (calculated), THD up to 15th harmonics
- Pulse output and RS485 Modbus RTU (up to 115 kbps) port
- Self powered (230 V ac)
- Basic accuracy (V/A):  $\pm 0.5\%$  RDG, kWh class 1 (IEC 62053-21)

## CTV and ROG 4X series, sensing solutions

- **CTV 1X-2X-3X-4X-6X-8X.** Split-core current sensing unit, 333 mV output.

Model	Primary (A)	Hole size (mm)
CTV 1X and CTV 2X	60 and 100	9.6 and 15.5
CTV 3X, CTV 4X and CTV 6X	200 and 400	15.5, 20.5 and 36
CTV 8X	800	50*89.8

- **ROG 4X.** Rogowski coil current sensors. Primary: 20 to 4000 A, diameters: 90, 120, 200, 290 mm

## EM271, sub metering solution

- Patented meter, 4-DIN and 72x72 mm solution in the same housing for DIN-rail or panel mounting. Detachable 3\*3-DGT/7-DGT display
- Up to 415 V L-L ac and TCD-based current measuring inputs
- Current measurement by two basic TCD units with quick RJ11 plugs (see TCD xM series)
- Quick configuration by automatic recognition of TCD units
- 2\*3-phase energy analysers with sum function in the same unit
- Measurements: V, A, Hz, PF, W, VA, var, bi-directional kWh
- RS485 Modbus RTU. 2 pulse outputs (loads 1 and 2)
- Self powered (230 V ac)
- Basic accuracy (kW):  $\pm 2.0\%$  RDG (meter + TCD xM unit), kWh: class 1 (IEC 62053-21)

## TCD 0M-1M-2M-3M, MM sensing solutions

- Combination of three single split-core current sensing units

Model	Primary (A)	Hole size (mm)
TCD 0M and TCD 1M	60 and 100	9.6 and 15.5
TCD 2M and TCD 3M	200 and 400	15.5 and 20.5
TCD MM	Up to 10000(*)	See CTV series

- Basic TCD xM unit (connected to three current sensors) for panel and DIN-rail mounting. (\*) Compatible with current sensors with 333mV output



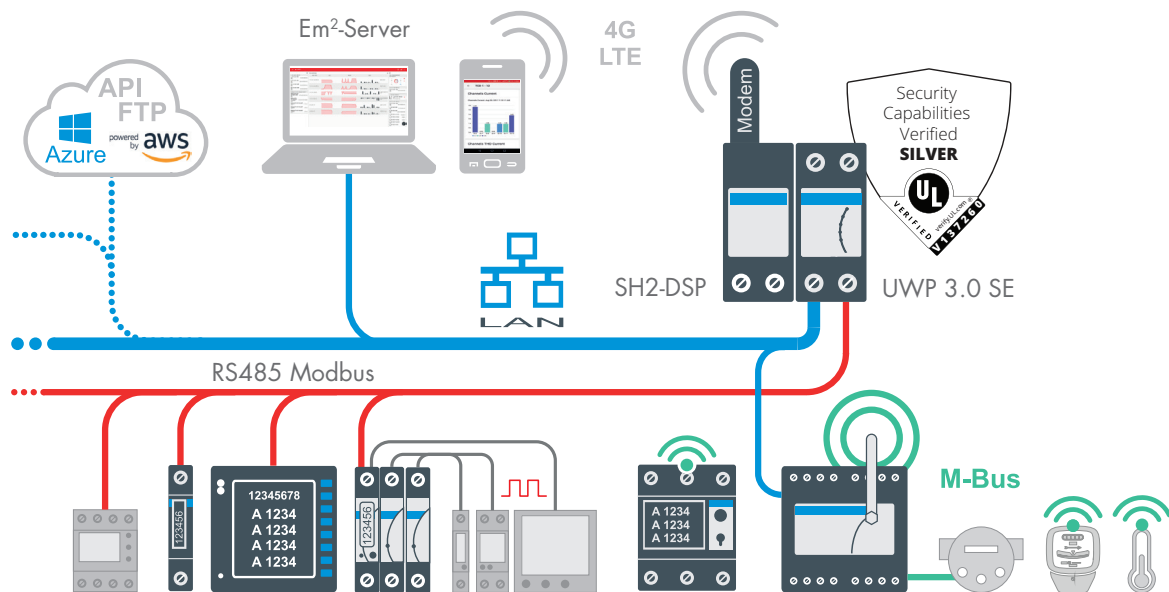
# Monitoring

## One platform, many solutions

### Communication, analysis and reporting in one unit

**UWP 3.0 SE provides the platform for analyzing the data for achieving energy efficiency goals.**

UWP 3.0 SE is the core of the entire system and can provide, as a first step, all the remote, on-premise, or cloud functionalities. Simple architecture, short commissioning time, cost reductions, error proof configuration, expandability and scalability are the distinctive characteristics of this unit. UWP 3.0 SE is a Web-Server but also a gateway. UWP 3.0 SE is Microsoft® certified for IoT. One or many UWP 3.0 SE pushing their data to the Microsoft® Azure IoT Hub will allow System Integrators to extend the level of integration to other systems. Data can be shared locally via Modbus/TCP or BACnet, while M2M makes integration with other systems possible via Rest-API or standard FTP, SFTP, FTPS communication. Excel® reports can be generated online or via the embedded scheduler. Whenever ESCOs and Energy Managers need a solution for taking control to achieve their Energy Efficiency goals, UWP 3.0 SE provides a solution to match the existing scenario.



#### UWP 3.0 SE

- Micro PC with embedded Web Server, WEB services and data logger functions
- Ethernet Modbus TCP master/slave function
- 2 x RS485 ports, both of which support up to 64 Modbus devices
- Data display (charts and tables)
- Real time or scheduled data export to Excel, CSV and HTML formats
- 4GB internal memory, Back-up memory on micro SDHC and USB
- Energy analysis of each load
- Configurable dashboards with data analytics and real time display functions
- Embedded Modbus editor for compatibility with any Modbus meter
- Alarm management (e-mail or SMS by means of SH2-DSP)
- 2-DIN module housing
- 12 – 28 V dc power supply



#### SH2-DSP

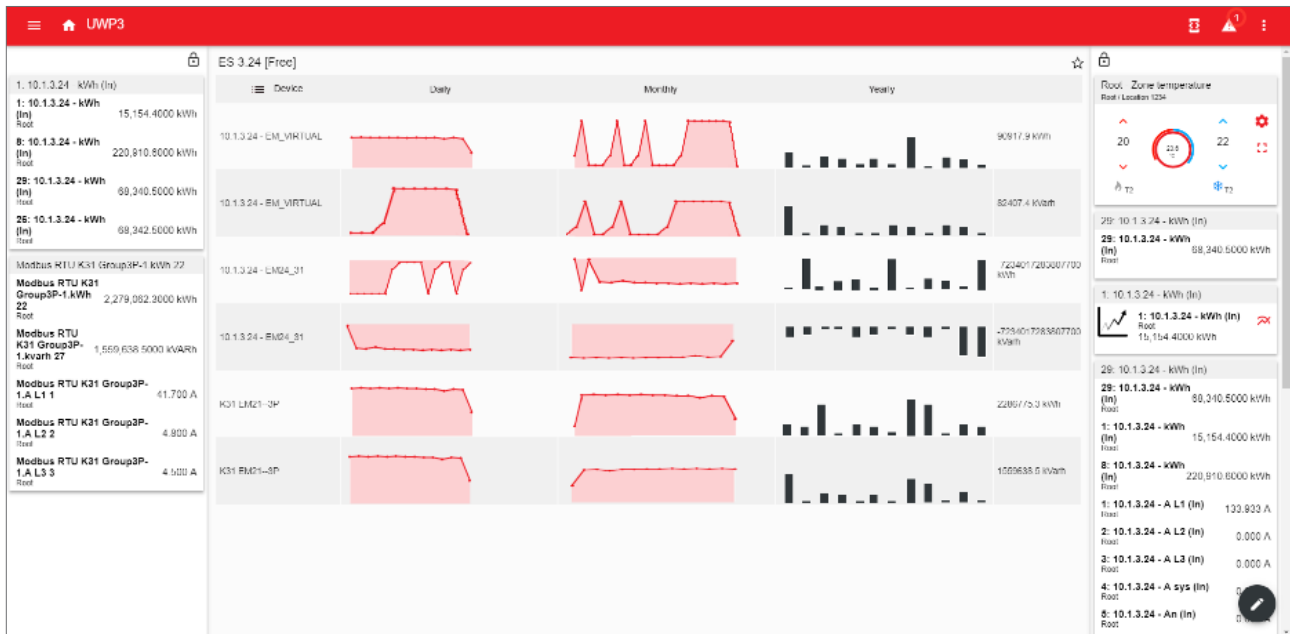
- Modem extension unit for UWP 3.0 SE
- 3G or 4G Mobile Internet connectivity with SMS alerts and SMS commands management
- 2-DIN module housing
- 20 – 28 V dc power supply



# Tools to properly display key variables

The UWP 3.0 SE unit allows you to automate the process of collecting data from multiple meters.

The embedded Web-Server allows you to remotely display key plant variables using analysis tools such as tables, trends, histograms, pies, comparison functions, and others. The system allows gathering, displaying, and logging variables from any connected meter or device Dashboards mixing both history and real time data allow users to take control of their data.



# Monitoring

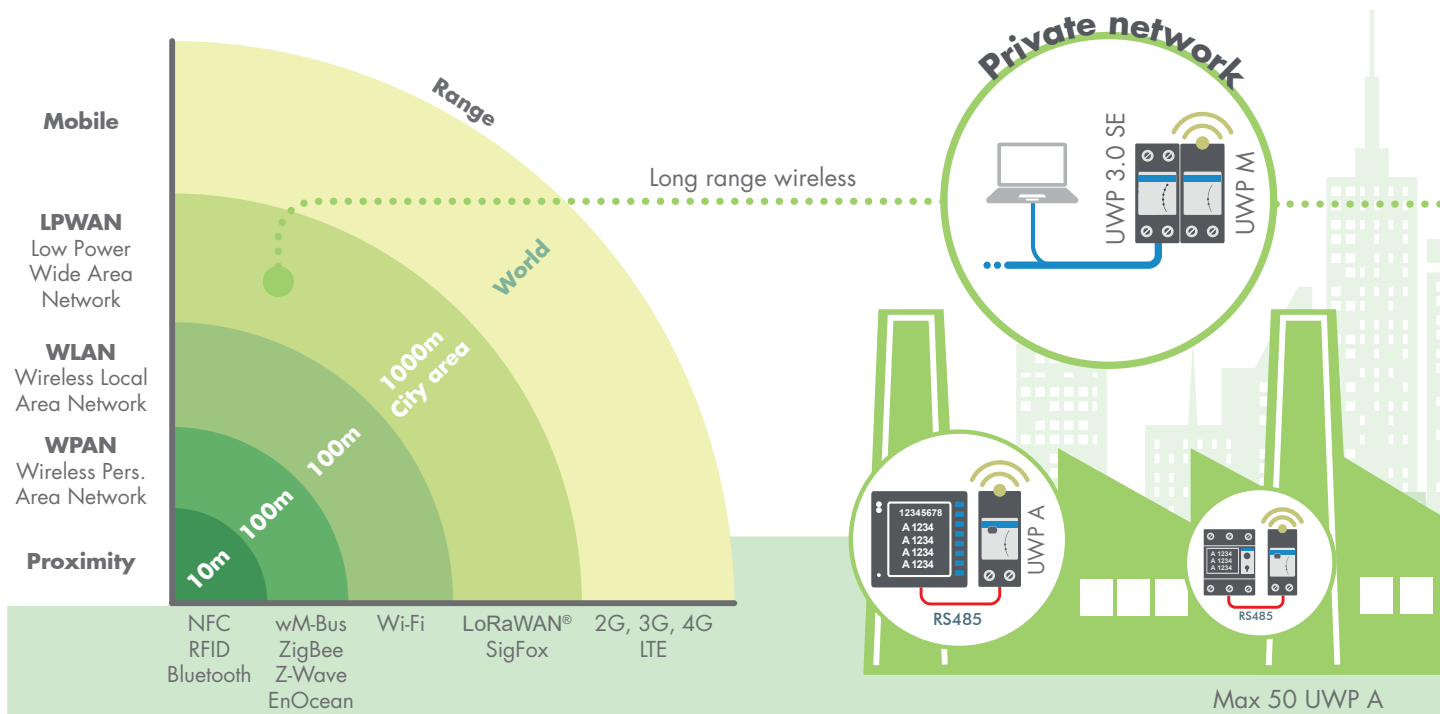
## Long range wireless communication

### The wireless technology

**Choosing the right wireless technology is dependent on the application!**

Gathering data in a secure, automatic and economic way is always difficult. There are a variety of different applications which may change according to the size of the meter network and of the area to be covered. Moreover, there are many available wireless communication technologies with some advantages, such as minimizing the wiring and installation costs also in case of retrofitting an existing installation, but also some limits, such as obstacles and interferences which may be fixed by skilled installers, and also cyber-security issues (if encryption is not carried out correctly). The "Range" graph below highlights, based on different technologies, the coverage distance, which can vary from just a few meters to global coverage using mobile communication.

However, the most popular wireless technologies are limited in terms of signal range or suffer from cost disadvantages, as they require a mobile phone contract for each measurement point. Moreover, in urban areas the situation is particularly complicated due to the restrictions of the rule concerning band occupation and interference with other devices. In all these cases the answer is LoRaWAN®, the long-range wireless communication technology.



#### ■ Long Range Communications or LoRaWAN® integration

Leveraging an existing standard LoRaWAN® network to send metering data to a remote system or creating from scratch a Long Range Wireless network in the license free band are both scenarios available to system integrators. In the former case UWP A converts meters into LoRaWAN® enabled IIoT units. In the latter, UWP A + UWP M + UWP 3.0 SE are the 3 tiers of a complete energy monitoring system capable to cover wirelessly both dense urban/indoor regions and rural areas (up to 10 km range in open air, 1 km in typical applications).

#### ■ Easy commissioning and diagnostics

Standardized set-up for connecting any LoRaWAN® gateway, or plug and play tools to build-up and maintain a system based on Carlo Gavazzi's UWP 3.0 SE platform, are the key factors to preserve users from headaches. Plug and play deployment of either small or large networks is possible for both private and public networks.

#### ■ Security

UWP A and UWP M embed end-to-end AES128 encryption so to provide the necessary data security.

#### ■ Low operating expenses

Wireless solution (US 915MHz ISM band) with no SIM card or annual fees and a long communication range, allows users to deploy a wireless monitoring network from scratch by themselves.

#### ■ Reliable communication

Long communication range, immunity to interferences and embedded security allow engineers and installers to build reliable wireless monitoring networks.

# Private and Public network solutions

**LoRaWAN®**, the long range, fast configuration, easy commissioning, secure, competitive, and reliable communication solution.

Energy efficiency monitoring and cost allocation, sub-metering in large buildings, industry, energy farms and cities are the best examples for long range wireless Carlo Gavazzi solutions. Thanks to LoRaWAN® long communication range, security and robustness, wireless networks can be easily set-up, without the high expense associated with the use of SIM cards or repeaters.

Whenever the user deals with a project focused on sub-metering, cost allocation, or the energy efficiency monitoring realm, the need for minimizing the TCO (total cost of ownership) is always a consideration. The long-range wireless solution of Carlo Gavazzi simplifies this scenario.



## UWP M

- Comprehensive energy monitoring solution
- Wireless solution with no SIM card (ISM band)
- Data concentrator for up to 50 WUP A endpoints for each WUP M
- Communication range: up to 10 km in open air
- Fast commissioning
- Robust and secure communication
- Integrated into WUP 3.0 SE's ecosystem
- Power supply from the WUP 3.0 SE auxiliary bus

## UWP A

- LoRaWAN® adapter for Carlo Gavazzi meters
- Communication range: 10 km in open air, 1 km in typical applications
- USB port for easy set-up via UCS Software
- Universal power supply (19 – 29 V dc and 115 – 240 V ac)
- Configurable LoRaWAN® communication
- OTAA or ABP authentication
- Communication interval from 5 min to 24 h
- Plug and play integration into the WUP 3.0 SE ecosystem via WUP M

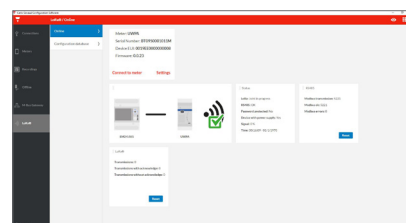
## UCS freeware software

- Easy deployment of WUP A based wireless networks
- Configuration of any Carlo Gavazzi meter/analyzer
- Diagnostic functions

For Mexican market only



For Mexican market only



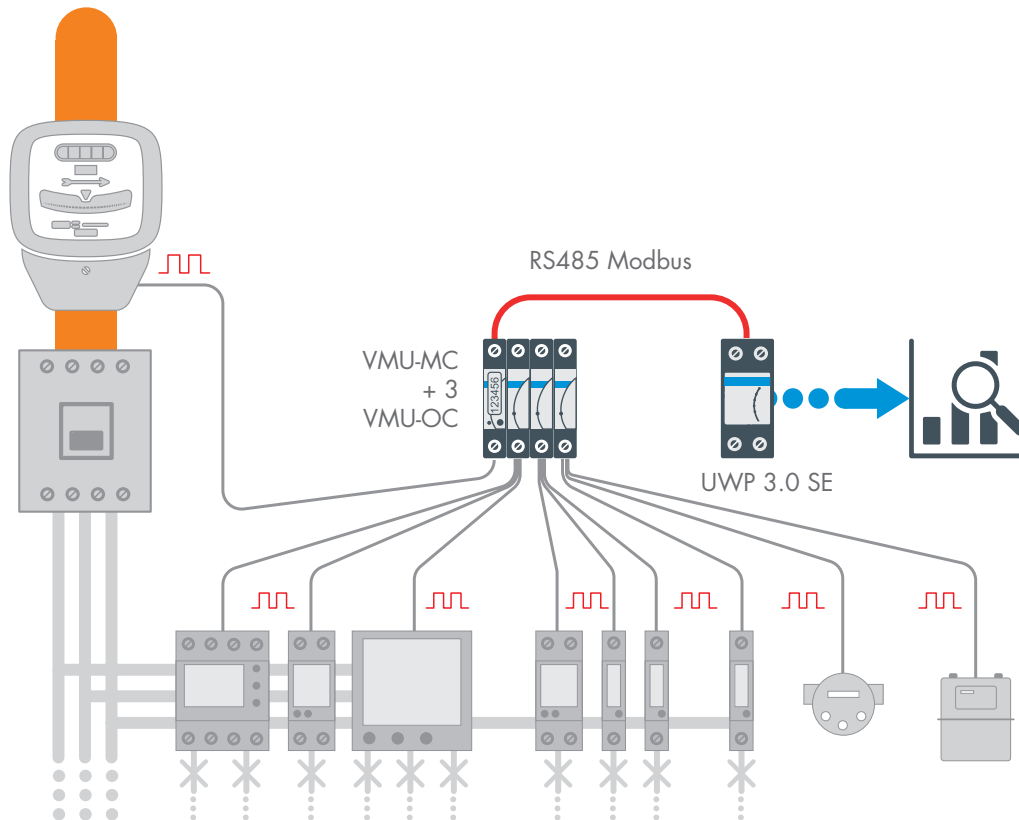
# Monitoring

## Utility, main and sub meter integration

### Existing meters

**Currently installed pulse output-based meters can still be part of a data collection system!**

In many installations, old fashioned meters are still working properly but energy information is still collected manually with both high data collection costs and potential transcription errors. Now, concentrating on multiple meters' pulse outputs and making them available as RS485 Modbus counters is possible, thanks to the modular VMU-MC + VMU-OC solution ranging from 2 to 11 pulse inputs (counters). Pulse to Modbus conversion is the key to automatic data collection, which ensures quality, granularity, and full management of data.



#### VMU-MC

- Master unit
- 1-DIN module housing
- RS485 communication port
- 2 inputs available (2 for pulses or up to 4 for tariffs management)
- Unit of measure: kWh, kvarh, kVAh, kJ, kcal, m<sup>3</sup>, h, pcs, kg
- LCD for status, counter and any active tariff displaying
- Tariff management
- One VMU-MC master unit can manage up to 3 VMU-OC slave units for maximum 2 + 9 counting inputs



#### VMU-OC

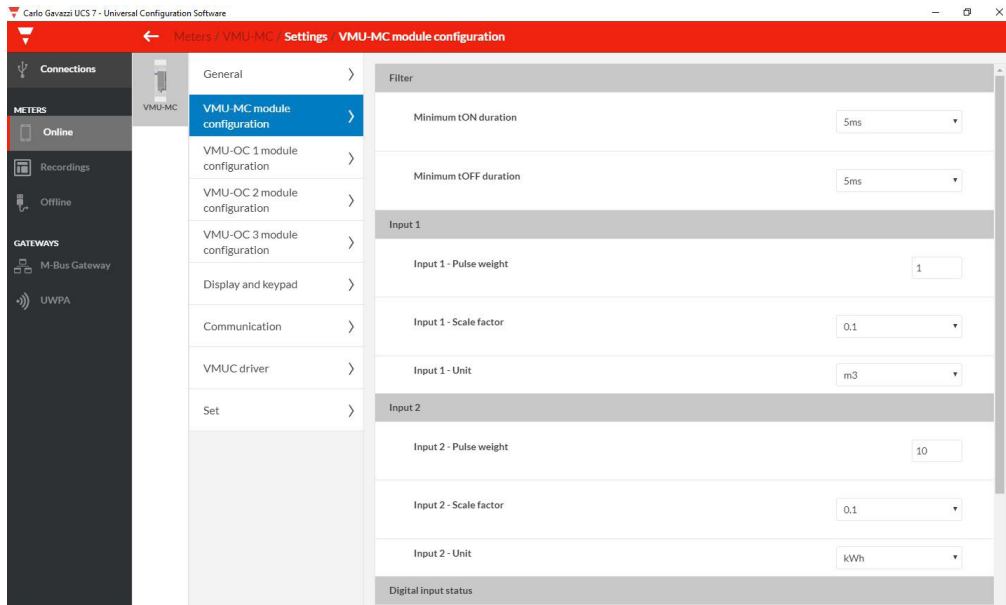
- Slave unit
- 1-DIN module housing
- Auxiliary communication bus
- 3 inputs available (for pulses only)
- Unit of measure: kWh, kvarh, kVAh, kJ, kcal, m<sup>3</sup>, h, pcs, kg



# The universal configuration software - UCS

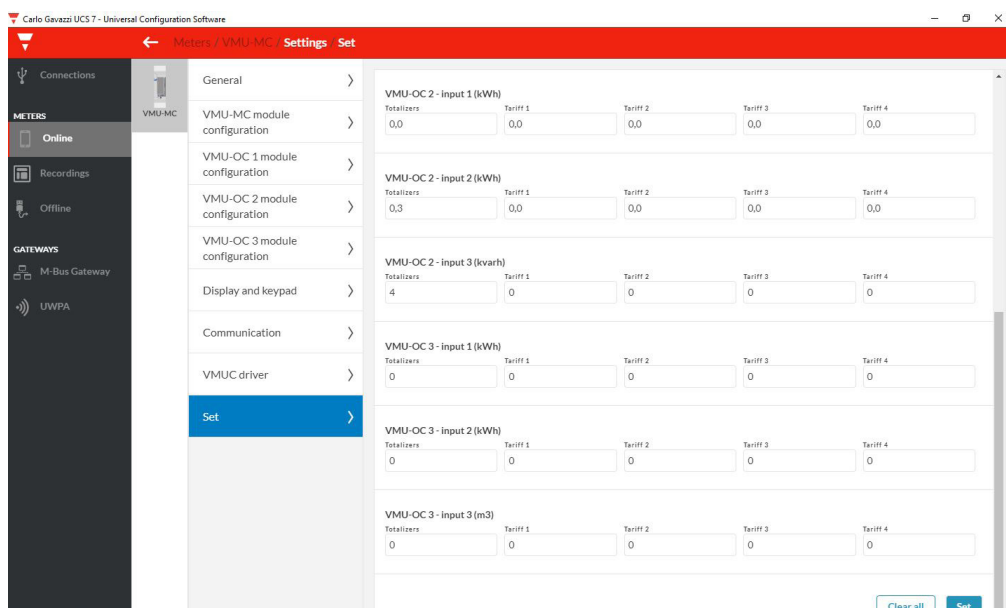
The UCS software configuration advantages are available for VMU-MC and VMU-OC!

UCS desktop features, including configuring devices, storing configurations into a database, sharing configurations and logs among users and checking the device status, are available also for VMU-MC/OC. Therefore: the two VMU-MC inputs can be set as counters, or one as a counter and one as a digital input for tariff change, managing automatically the energy increase for both tariff 1 and tariff 2. Every counter input and function have an independent configurable pulse weight.



The pulses generated by both utility and sub meters are very important for monitoring energy efficiency, since the data produced drives the corrective actions for energy saving. That's why UCS desktop allows you to configure in both VMU-MC and VMU-OC the pulse signal inputs, allowing you to choose a proper ON and OFF duration time so that no pulse is lost, thus granting the highest quality and reliability of the acquisition.

But often pulse generations come not only from watt-hour meters but also from other utility meters such as gas meters and water meters, UCS desktop software addresses this need by configuring the pulse weight, the scale factor and the engineering unit of every available input.



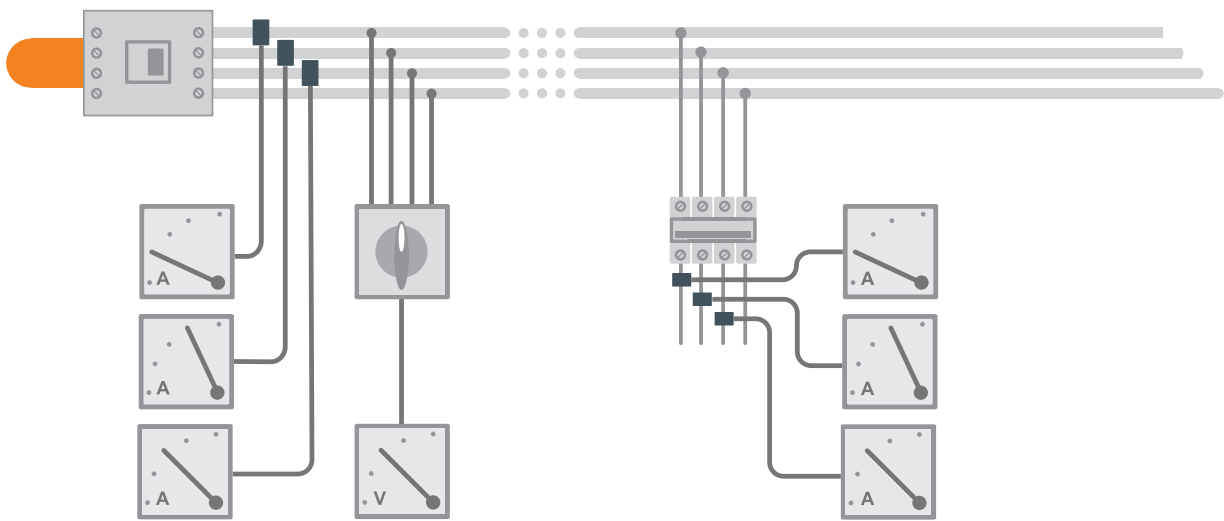
# Monitoring

## Panel mount meters

### The evolution of user needs

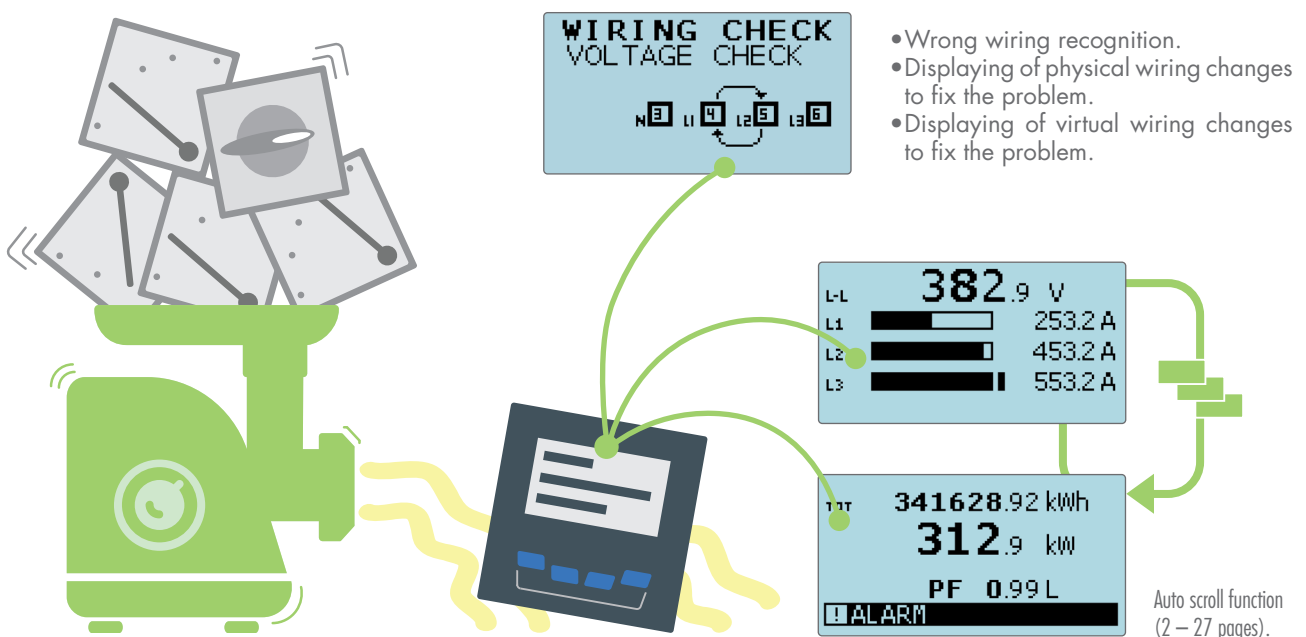
#### The use of analog panel meters is not only linked to cost reasons

Even today, analog ammeters and voltmeters are frequently installed in distribution panels. The choice is almost always dictated not only by cost reasons, but by the need to make any anomalies visible at a glance. The maintenance personnel in fact need to have immediate feedback on the main operating parameters in order to operate in optimal conditions both in routine and emergency situations.



#### Users' needs change and with them the technical solutions proposed

The position of the pointer in an analog scale and the comparison among other analog panel meters in the same distribution panel is preferred for the reduced effort of the user in processing the information he is voluntarily searching for (intrinsic cognitive load). But we know that the world evolves, becoming more complex and demanding. The ideal answer to this change is to offer a solution that features an analog comparative display, providing a rough but immediate understanding of the variable being measured but also, by means of a digital display, a proper accurate visualization of the same variable.

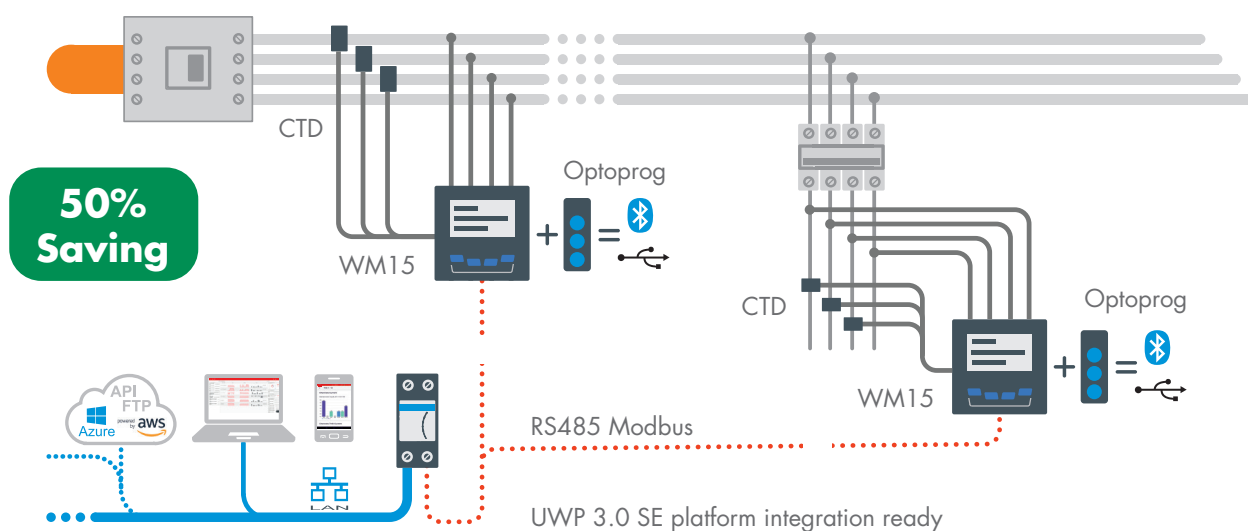




# Immediacy of visualisation and integration

## The answer to the traditional use of analog panel meters is WM15.

WM15 is also the answer to the growing need for additional electrical variables to make more in-depth analysis. This solution condenses the information of four analog panel meters into a single meter, but also provides an accurate measurement of power and energy thanks to the continuous and simultaneous sampling of all phases. When it is installed in a distribution panel or on a machine, it can relate the energy consumption to the time the load is operating. Moreover, if an alarm is set, it can display it locally and transmit automatically and remotely all needed variables to validate the implemented energy efficiency policies or provide data to start a preventive maintenance plan.



## How to reduce installation and commissioning costs

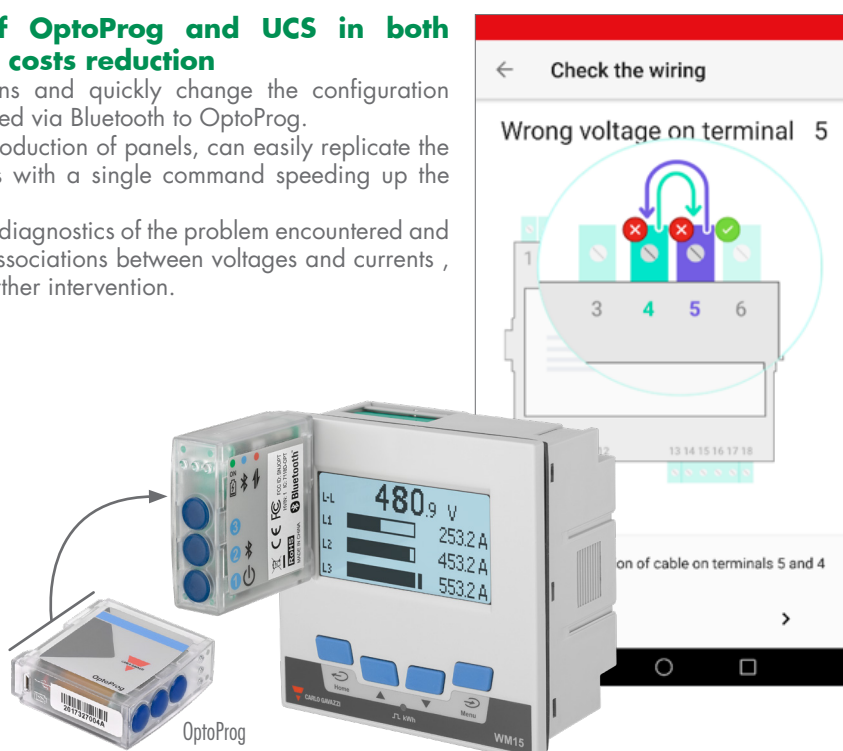
Installation and commissioning of advanced panel meters often have additional and hidden costs compared to standard analog panel meters. WM15 reduces these costs by 50% compared to a standard 4 analog meters installation and even more versus a standard power analyser installation thanks to its advanced wiring-control algorithm and its improved usability.

## The additional benefits of OptoProg and UCS in both installation and commissioning costs reduction

- The installer can check the connections and quickly change the configuration parameters using a smartphone connected via Bluetooth to OptoProg.
- The panel builder, in case of a series production of panels, can easily replicate the same configuration on all WM15 units with a single command speeding up the production process.
- In case of wiring errors, UCS provides a diagnostics of the problem encountered and can virtually correct the proper phase associations between voltages and currents, thus fixing the error without requiring further intervention.

### WM15

- 5 A current inputs for current transformers
- Up to 477 V L-L measuring inputs (self-power supply)
- Up to 690 V L-L measuring inputs (auxiliary power supply)
- 120 - 240 V ac/dc
- 96\*96 panel mounting, 59 mm depth
- 4\*4-DGT + 3-bargraph backlit matrix display
- Bidirectional kWh and kvarh, run hour meter
- System and phase: V L-L/L-N, A, W, var, VA, PF, Hz, THD (V-A)
- Current and power demand calculation
- Static output for pulse transmission or alarm
- RS485 Modbus RTU port (100 ms data refresh)
- Basic accuracy (V/A):  $\pm 0.5\%$  RDG, kWh class 1 (IEC62053-21)

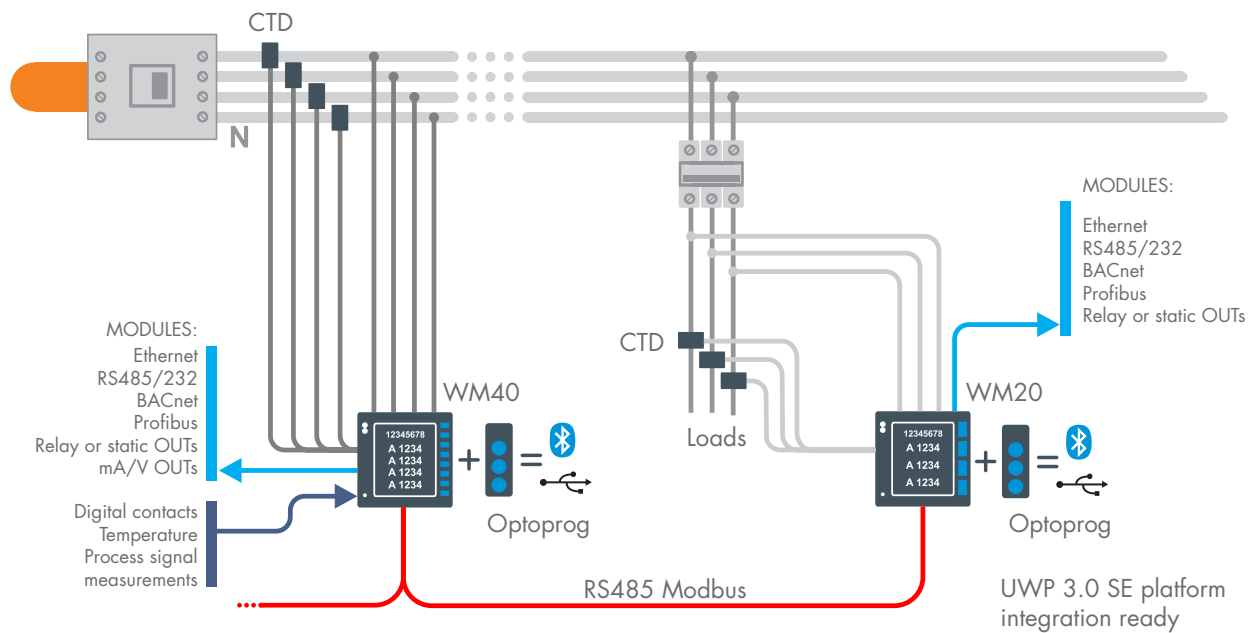


# Monitoring Beyond panel mount meters

## Modular main metering with power analysis

**A high-spec meter is often time demanding due to its installation and commissioning complexity: can you make it time and cost effective?**

Yes, by selecting the most appropriate device to meet the different installation and application needs among the three available power analyser models. Metering capabilities, and control functions, as well as a common modular system are the key features. Panel Builders, System Integrators and Installers enhance and speed up their activities of initial meter configuration, communication diagnostics and commissioning with the help of the combination of new and innovative tools like OptoProg, UCS desktop, and UCS mobile. This family, due to its very high accuracy class is also the answer to "Green Mark" and other green building benchmarking schemes requirements.



### WM20

- 96\*96 mm panel mounting housing with front protection degree IP65
- 5 A current inputs for current transformers
  - Up to 793 V L-L measuring inputs
  - Basic accuracy (V/A):  $\pm 0.2\%$  RDG
- Single and three-phase measurements: V, A, An, Hz, PF, W, VA, var, run-hour, kvarh, bi-directional kWh (cl. 0.5s IEC62053-22)
  - 9+1-DGT counter variables, backlit LCD display
  - Modular housing (see the modules list besides)
  - Optical port for fast data reading and configuration
- Universal power supply (90 - 264 V ac/dc, 21 - 55 V ac/dc)
- THD analysis up to 31st harmonics with source detection, single harmonics via Modbus
- 3\*4 DGT instantaneous variables, LCD display
- Max values of all power variables
- Automatic scrolling pages
- 2 freely configurable virtual alarms

### WM30

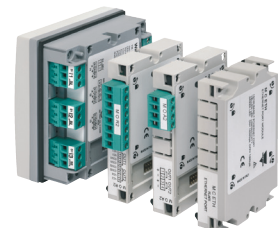
- 4\*4 DGT instantaneous variables, LCD display
- Avg and max values of all system and single phase variables
- 4 freely configurable virtual alarms
- Real time clock
- Other features, same as WM20
- 4-tariff management
- Factor K and TDD metering
- 16-alarm PLC logic and digital inputs for utility metering, built-in event and data stamping for instantaneous variables and load profiling
- Other features, same as WM30

### WM40

- 4-tariff management
- Factor K and TDD metering
- 16-alarm PLC logic and digital inputs for utility metering, built-in event and data stamping for instantaneous variables and load profiling
- Other features, same as WM30

### Modules

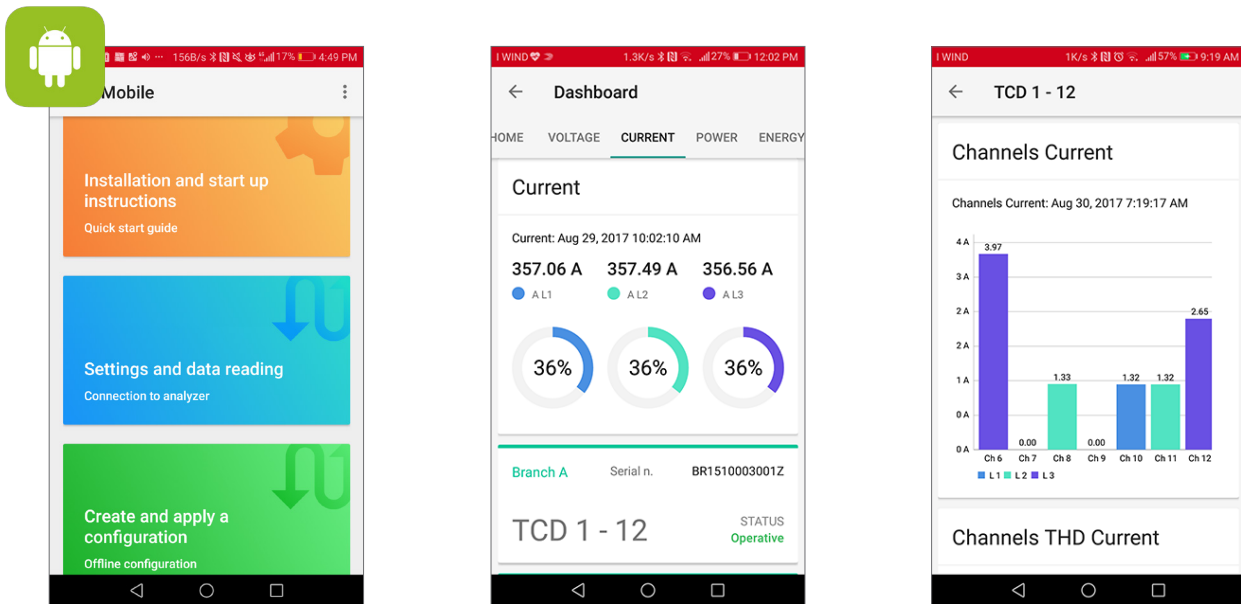
- WM20/WM30/WM40**
- RS485/RS232 Modbus RTU
  - BACnet IP
  - BACnet MS/TP
  - Ethernet (Modbus TCP)
  - EtherNet/IP (WM20 excluded)
  - Profibus DP-VO
  - 2-static and relay outputs
- WM30**
- 2\*20 mA dc or 2\*10 V dc outputs
- WM40**
- Up to 4\*20 mA dc or 10 V dc outputs
  - 6-channel digital inputs, up to 6 relay/8 static outputs + OR/AND alarm logic management
  - Direct An + Temperature + Process signal measurements



# Advanced configuration and commissioning tools

**An innovative solution to drastically reduce both configuration and commissioning time!**

The installation, the configuration, and the commissioning of a power analyser has an intrinsic complexity which is due not only to the product itself, but also to the sequence of events which usually starts in the workshop of a Panel Builder and moves to the plant for the final installation. Hence, one product, which for different reasons and in different contexts moves through different professionals. To be able to be effective, there is the need to be able to supply a tool matching the skills and needs of different people. OptoProg, with its App, or simply as desktop software, is the best answer to simplify the whole process.

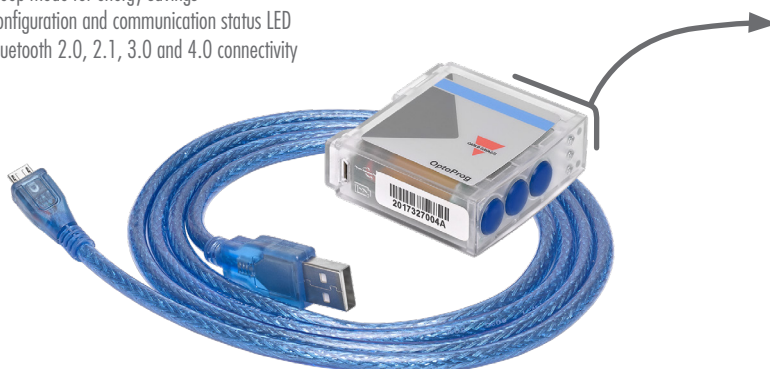


## How do you do it? OptoProg + UCS is the solution!

OptoProg, the optical port-based coupling unit with built-in rechargeable battery, provided with both USB and Bluetooth communication capabilities to be used in combination with either UCS desktop or UCS Mobile (Android), with its excellent usability, allows the Panel Builder to set all initial metering parameters without physically using the meter front keypad. If the panel is produced in series with the same overall characteristics and meter settings, by using the configuration upload and download function, the process is further shortened and error free. Once the distribution panel with the power analyser is on site, the System Integrator using its OptoProg unit and UCS software can download the meter configuration parameters, change them, add alarms and upload the new configuration to the power analyser again to complete the process. With the same UCS it is possible to test the communication to other devices in the same Modbus network. The whole OptoProg process can be performed without opening the distribution panel door, making this process more efficient, effective and safe. Once everything is done, just remove OptoProg from the power analyser and install it on another meter.

### OptoProg

- Bridge mode use with embedded optical port
- Built-in lithium battery for one month operations
- Sleep mode for energy savings
- Configuration and communication status LED
- Bluetooth 2.0, 2.1, 3.0 and 4.0 connectivity
- Micro-USB B port
- FCC and IC certified



OptoProg is compatible with: WM15, WM20, WM30, WM40, WM50, ET330.

# Monitoring

## Current adapters and quick-fit solutions

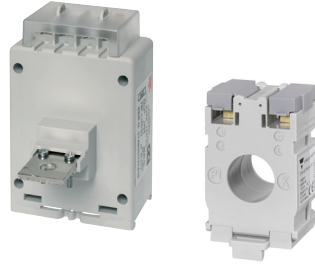
### Solid-core and split-core current adapters

From compact sizes to high currents and from solid-core to split-core, these are the current adapters for Carlo Gavazzi meters and the appropriate solution for any kind of installation.

#### TAD K/K2

TAD	from (A)	to (A)
K	1	40
K2	1	250

- Wound primary/fixed bar
- Secondary: 5 A (standard), 1 A (available upon request)
- Sealable terminal covers
- IEC 61869-2 compliant



#### CTD 1Z

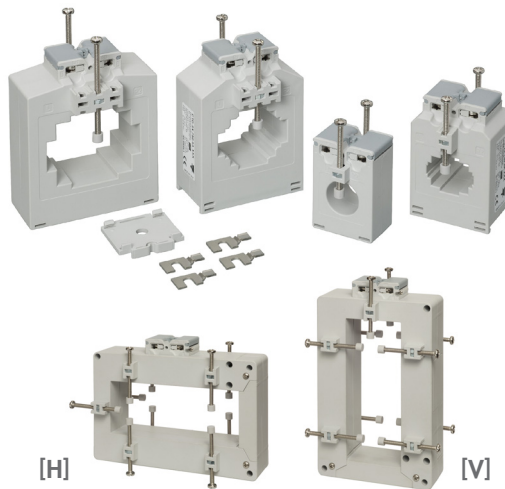
CTD	from (A)	to (A)
1z	50	200

- Solid core for cable or bus-bar
- Cable diameter: 22 mm
- Secondary: 5 A
- IEC 61869-2 compliant

#### CTD 1/2/3/4-X

CTD	from (A)	to (A)
1x	50	300
2x	40	600
3x	50	800
4x	150	1600

- Solid core for cable or bus-bar
- Cable diameter: 23 mm to 51 mm
- Bus-Bar: 20\*5mm to 64\*20 mm or 51\*43 mm
- Secondary: 5 A (standard), 1 A (available upon request)
- Sealable terminal covers
- IEC 61869-2 compliant



#### CTD 8/9/10/11/12-V-H

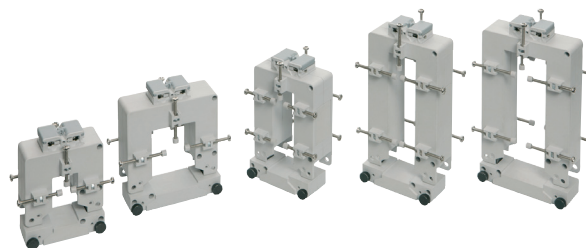
CTD	from (A)	to (A)
8 V/H	150	1600
9 V/H	400	2500
10 V/H		2000
11 V/H	1000	3200
12 V/H	1000	4000

- Solid core for cable or bus-bar
- Bus-Bar: 37\*125 mm to 53\*125 mm
- Secondary: 5 A (standard), 1 A (available upon request)
- Sealable terminal covers
- IEC 61869-2 compliant

#### CTD 5/6-S

CTD	from (A)	to (A)
5 S	100	400
6 S	150	1000

- Split-core for cable or bus-bar
- Bus-Bar: 26\*32 mm, 50\*52 mm
- Secondary: 5A (standard), 1 A (available upon request)
- Sealable terminal covers
- IEC 61869-2 compliant



#### CTD 8/9/10-S

CTD	from (A)	to (A)
8 S	150	1600
9 S	400	2500
10 S		2000
		3200

- Split-core for cable or bus-bar
- Bus-Bar: 31\*81 mm to 50\*125 mm
- Secondary: 5 A (standard), 1 A (available upon request)
- Sealable terminal covers
- IEC 61869-2 compliant

#### CTA 5/6

CTA	from (A)	to (A)
5 X	100	300
6 X	200	600

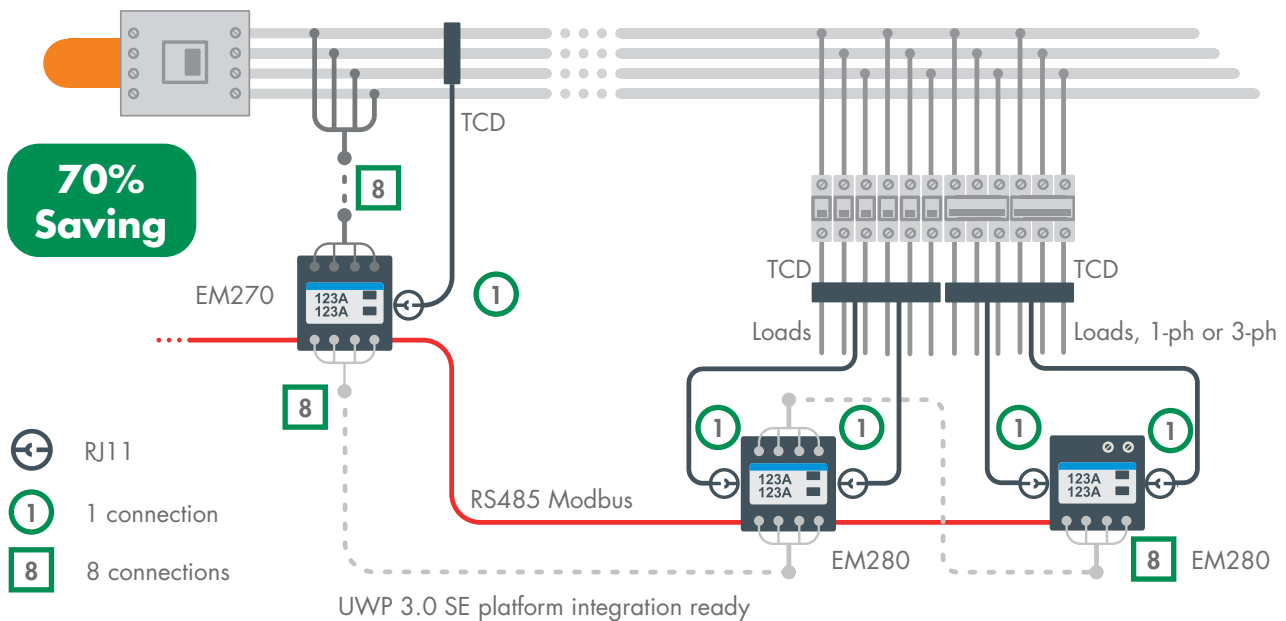
- Split-core for cable
- Secondary: 5 A
- Cable diameter: 24 mm (5x), 36 mm (6X)
- IEC 61869-2 compliant



# Main and sub-metering for new installations

## Quick-fit solutions.

When installation time, meter configuration, and commissioning are a concern, Carlo Gavazzi Quick-fit is the solution. In a typical installation (lighting, HVAC, heating, refrigeration) using 1+4 regular meters you can achieve a time reduction of about 70% using 3 quick-fit meters instead.



### EM270, main metering solution

- Patented meter, 4-DIN and 72\*72 mm solution in the same housing for DIN-rail or panel mounting. Detachable 3\*3-DGT/7-DGT display
- Up to 456 V L-L ac and TCD-based current measuring inputs
- Current measurement by two triple solid-core sensing units with quick RJ11 plugs (see TCD X series)
- Quick configuration by automatic recognition of TCD units
- 2\*3-phase energy analysers with sum function in the same unit
- Measurements: V, A, Hz, PF, W, VA, var, bi-directional kWh
- Basic accuracy (kW):  $\pm 1.25\%$  RDG (meter + TCD x unit). kWh: class 1 (IEC 62053-21)
- RS485 Modbus RTU. 2 pulse outputs (loads 1 and 2)
- Self powered (230 V ac)

### TCD 1X-2X-3X, sensing solutions

- Triple solid-core current sensing unit

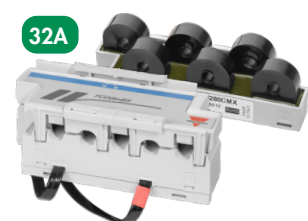
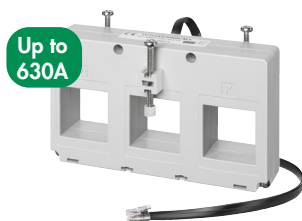
Model	Primary (A)	Bus-bar sizes (mm)	Centre-to-centre distance (mm)
TCD 1X	3*160	15.5*25	25
TCD 2X	3*250	21*25	35
TCD 3X	3*630	31*31	45

### EM280, sub metering solution

- Patented meter, 4-DIN and 72\*72 mm solution in the same housing for DIN-rail or panel mounting. Detachable 3\*3-DGT/7-DGT display
- Up to 456 V L-L ac and TCD-based current measuring inputs
- Current measurement by one 6-channel solid-core sensing unit with quick RJ11 plugs (see TCD 06 series)
- Quick configuration by automatic recognition of TCD units
- 2\*3-phase/6\*1-phase energy analysers with sum function in the same unit
- Measurements: V, A, Hz, PF, W, VA, var, kWh
- Basic accuracy (kW):  $\pm 1.25\%$  RDG (meter + TCD-06 unit). kWh: class 1 (IEC 62053-21)
- RS485 Modbus RTU. 2 pulse outputs (loads 1 and 2)
- Self powered (230 V ac)

### TCD 06BX-06BS, sensing solutions

New installation, TCD 06BX	Retrofitting, TCD 06BS
6-channel solid-core current sensing unit	6-channel split-core current sensing unit
<ul style="list-style-type: none"> <li>• Primary: 6*32 A, hole size: 7 mm. Centre-to-centre distance: 17.5 mm. RJ11 cable length: 80, 150 or 200 cm</li> </ul>	



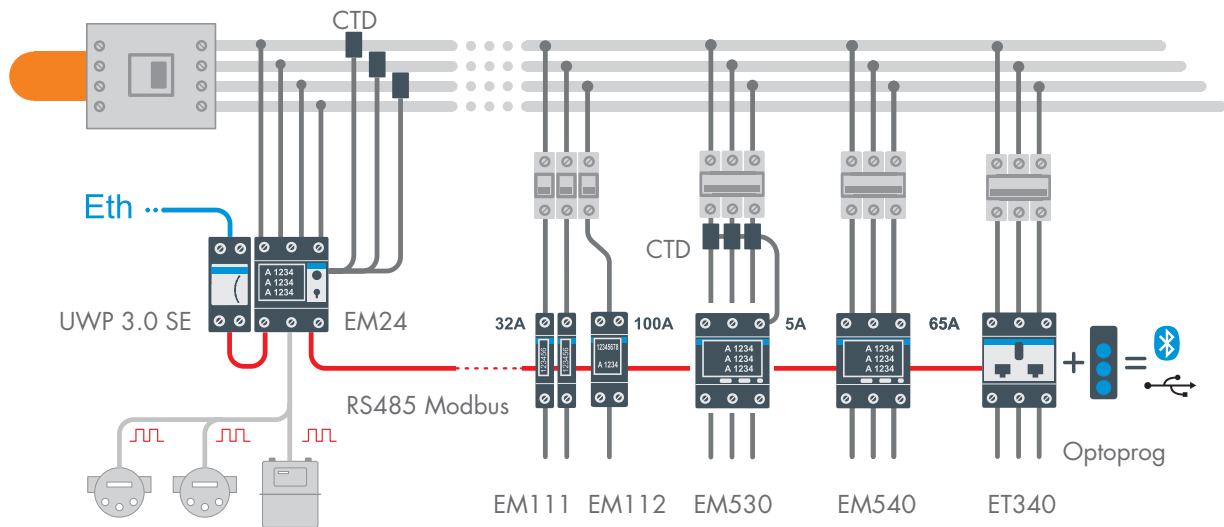
# Monitoring

## A compact range of DIN rail mount meters

### Main and sub-metering for new installations

#### Full energy analysis capability

This range offers you both CT connection inputs and direct connection capabilities. The three key features of this offer are: housing compactness – they can fit wherever you have a minimal space and display data completeness with 0.001 energy resolution – most important variable information available at a glance; full electric variables set availability also through the communication port – capability to know the single load behaviour so to perform a concise analysis. In addition, the EM500 series provides, based on Carlo Gavazzi's long design and application expertise, the best meter configuration and installation experience.



#### EM24

- CT 5 A, 230 – 400 V L-L ac measuring inputs, 115 – 230 V ac power supply
- 65 A, 230 – 400 V L-L ac measuring inputs, self-power supply
- 4-DIN modules housing
- 3 counter digital inputs
- 2\*8-digit LCD
- Single and three-phase measurements: V, A, Hz, PF, W, VA, var, run-hour, kvarh, 4-tariff, 3\*1-phase kWh
- Basic accuracy (V/A):  $\pm 0.5\%$  RDG
- Bi-directional kWh, class 1 (IEC62053-21)
- Pulse output or RS485 Modbus RTU, or Ethernet

#### EM110-111-112

- EM110 and EM111**
- 32 A (max 45 A) - 1-DIN module housing - 7-digit (EM110 electromechanical) counter, class 1 (IEC62053-21), pulse output.
- EM112**
- 100A, 2-DIN modules housing, display backup by supercapacitor.
  - Backlit touch 8-digit LCD.
- EM111 and EM112**
- 115 – 230 V ac measuring inputs
  - Basic accuracy (V/A):  $\pm 0.5\%$  RDG
  - Self powered (230 V ac)
  - Measurements: V, A, Hz, PF, W, VA, var, run-hour, kvarh, dual tariff
  - Bi-directional kWh, class 1 (IEC62053-21)
  - Pulse output or RS485 Modbus RTU

#### EM530, EM540

- EM530**
- CT 5 A, self powered
  - Basic accuracy (V/A):  $\pm 0.25\%$  RDG
  - Bi-directional kWh: cl. 0.5S (IEC62053-22)
- EM540**
- 65 A, self powered (230 V ac)
  - Basic accuracy (V/A):  $\pm 0.5\%$  RDG
- EM530 and EM540**
- 3-DIN modules housing
  - Backlit 11-digit + 2\*10-digit LCD
  - 230 – 400 V L-L ac measuring inputs
  - Single and three-phase measurements: V, A, Hz, PF, W, VA, var, run-hour, kvarh, kWh, dual tariff, 3\*1-phase kWh
  - THD analysis up to 15th harmonics by current and voltage
  - Bi-directional kWh (cl. B EN50470-3 MID approved)
  - Pulse/Alarm output or RS485 Modbus RTU or M-Bus port

#### ET112, ET330/ET340

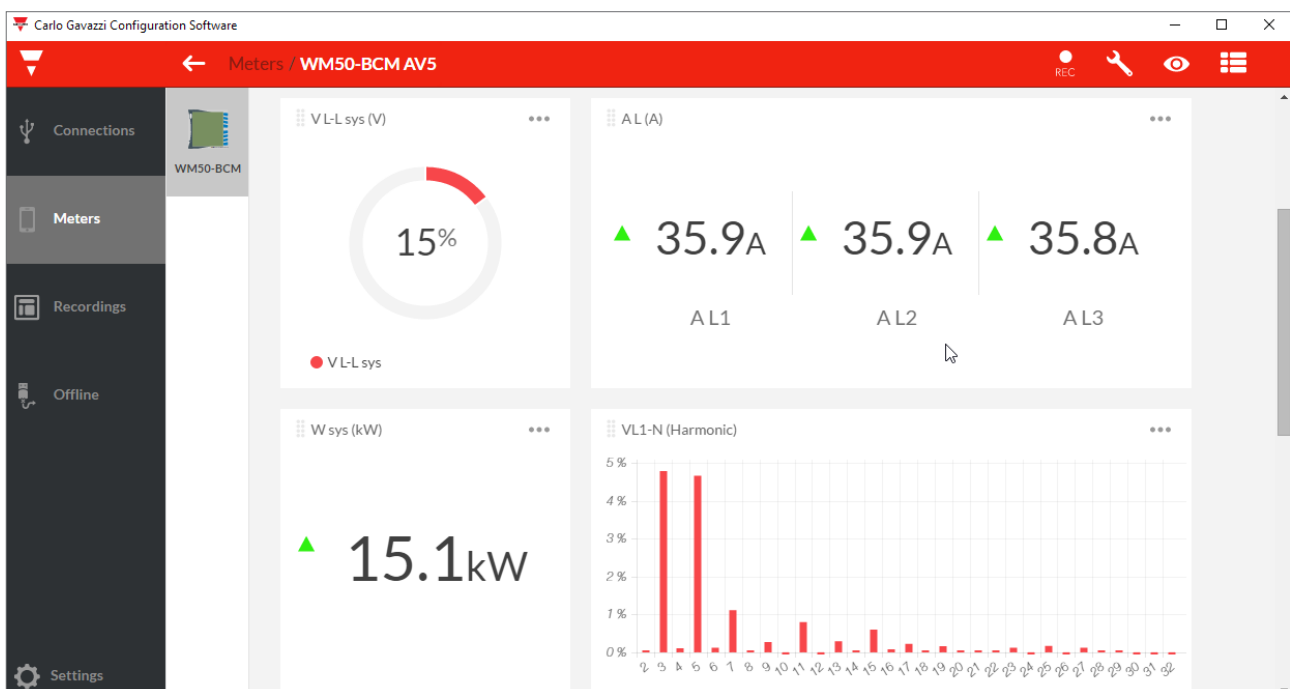
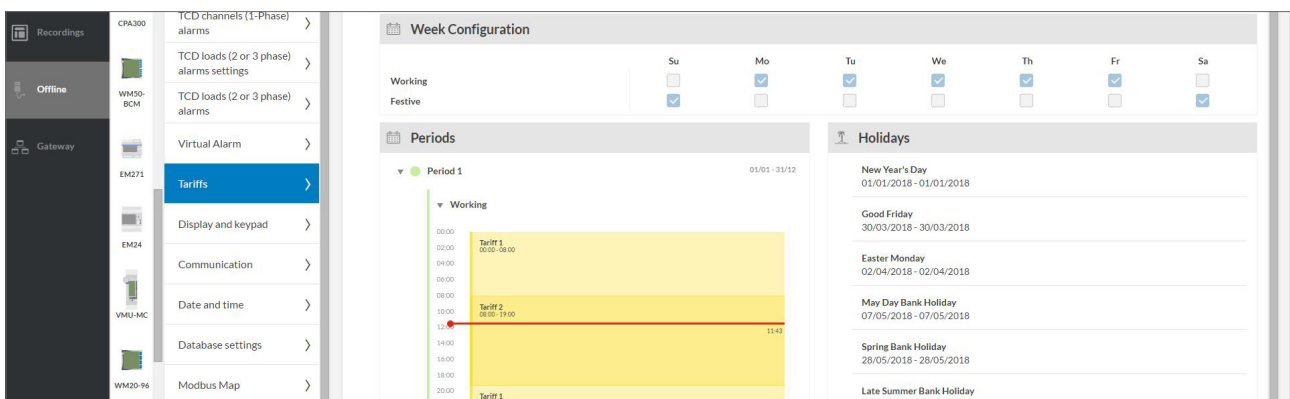
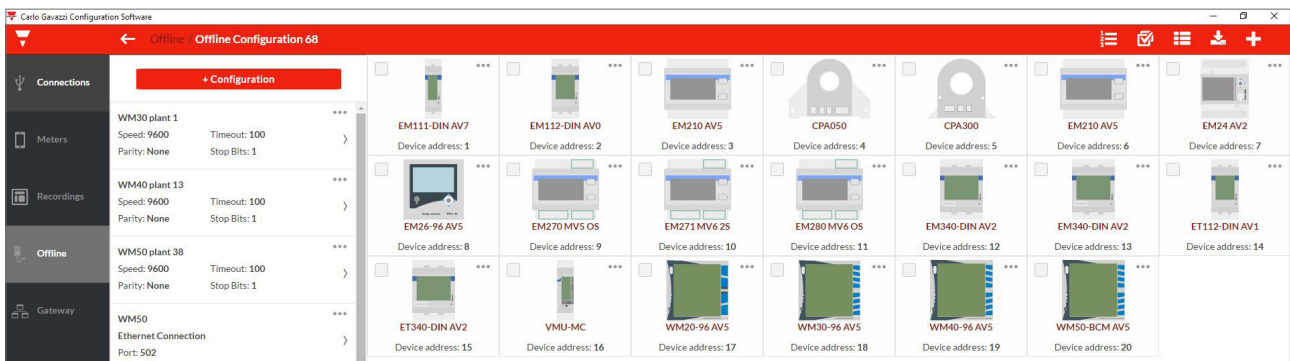
- ET112**
- 100 A, 115 – 230 V ac measuring inputs, 2-DIN modules housing
- ET330**
- CT 5 A, 230 – 400 V L-L ac measuring inputs, 90 V to 260 V ac/dc auxiliary power supply, 3-DIN modules housing
- ET340**
- 65 A, 230 – 400 V L-L ac measuring inputs, 3-DIN modules housing
  - Single and three-phase measurements: V, A, Hz, PF, W, VA, var, run-hour, kvarh, dual tariff, 3\*1-phase kWh, An
  - Basic accuracy (V/A):  $\pm 0.5\%$  RDG
  - ET330 only: kWh class 0.5S (IEC62053-22)
  - Self powered (230 V ac)
  - RS485 Modbus RTU port (RJ45 daisy chain and screw terminal block connections)



# The universal configuration software

**UCS, the universal configuration tool continuously upgraded and compatible with all Carlo Gavazzi meters.**

In addition to the standard display of variables, functionality and configuration parameters, it is common the need to be more effective and efficient during first meter configuration (by the Panel Builder) and site commissioning (by the System Integrator). UCS, the Universal Configuration Software, is the answer, providing a full set of effective tools for meter configuration, variable displaying and communication diagnostics. These tools are aimed to be quick and to help the different professionals, such as Panel Builder, Installer, System Integrator, and End-user, to limit and fix any installation, configuration, and commissioning error.



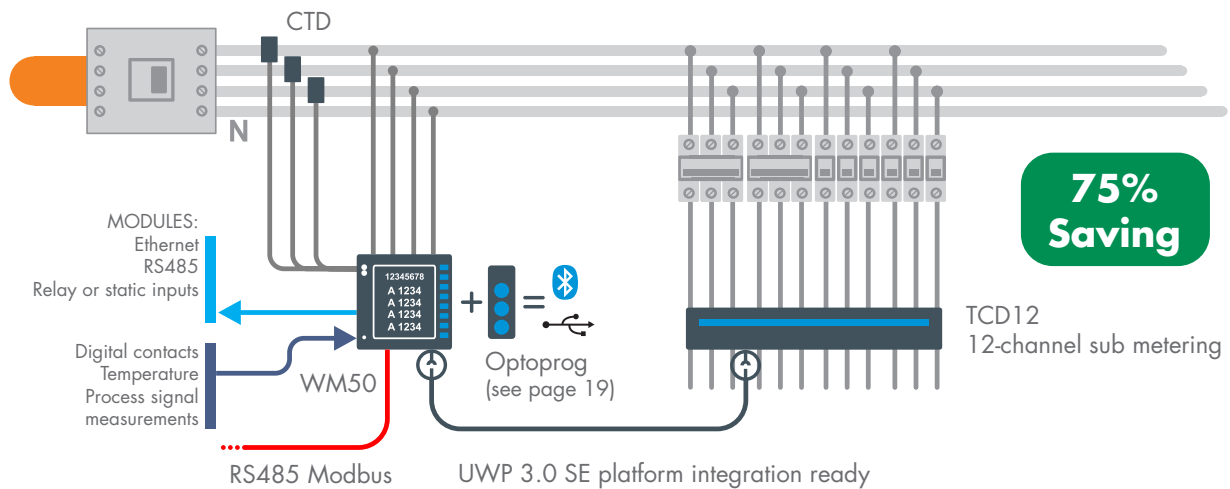
# Monitoring

## Quick-fit high-density metering solution

### Distribution board-based solution

In a single solution the combination of a three-phase main meter with CT inputs and 65A integrated TCD sub-meter units with up to 96 single-phase channels or 32 three-phase channels.

When the electrical system is different from a bus-bar trunking or bus-duct system, and numerous loads are fed from a common distribution board, than WM50-96 is the ideal solution for branch circuit monitoring. The solution is based on one core unit WM50, which is usually installed and connected on the mains, and some TCD12 units as combined meters installed downstream the MCBs for single phase or three-phase loads. As the whole installation cost derives not only from the cost of the components, but even more by installation and commissioning costs, this innovative solution allows you to achieve more than 75% installation and commissioning savings vs. standard solutions.



#### WM50, main metering solution for distribution boards

- 96\*96 mm panel mounting meter with IP65 front protection degree and modular housing
- Up to 480 V L-L ac and 5 A CT measuring inputs
- Single and three-phase measurements: V, A, An, Hz, PF, W, VA, var, run-hour, kvarh, bi-directional kWh (cl. 0.5S IEC 62053-22), THD analysis up to 31st harmonics, single harmonics via Modbus
- Basic accuracy (V/A):  $\pm 0.2\%$  RDG
- 9+1-DGT totalized and 4-DGT instantaneous variables LCD display
- Optical port for fast data reading and configuration
- Universal power supply (90 – 260 V ac/dc)
- 4-tariff management
- 16-alarm PLC logic and digital inputs for utility metering, built-in event and data stamping for instantaneous variables

#### WM50, I/O optional modules

- RS232/RS485
- Ethernet (Modbus TCP)
- 6-channel digital inputs, up to 4-relay/6-static outputs + OR/AND alarm logic management
- Direct An + Temperature + Process signal measurements

#### TCD12, sub metering

- Primary: 12\*65 A
- Hole size: 8.5 mm
- Centre-to-centre distance: 17.5 mm
- RJ cable length: 30 – 500 cm
- 12-channel split-core current sensing unit
- Basic accuracy (V/A):  $\pm 0.5\%$  RDG, class 2 (kWh) according to IEC 62053-21 (meter + TCD unit)
- Up to 96 channels: kWh, W, var, VA, PF, A, THD A
- Data available via communication module on board of WM50

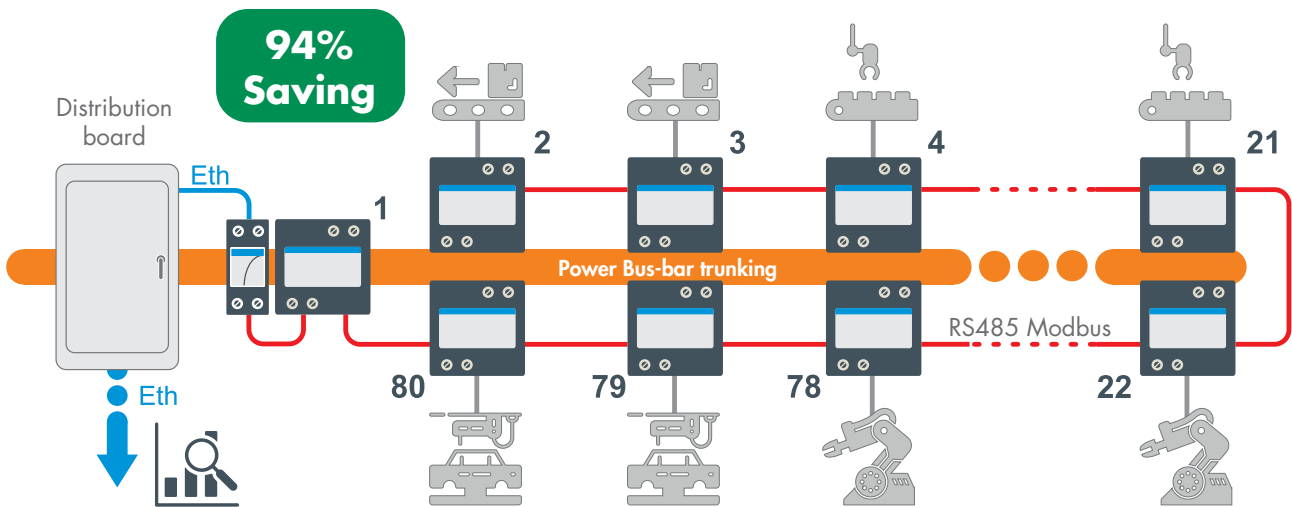




# From main metering to submetering

## Why a high-density metering solution?

In an industrial or commercial installation, in the same facility, the purpose of metering is not only load monitoring but also to establish energy cost centres for cost allocation, and when the machines/loads to be monitored are numerous, a standard metering solution is not the best answer. The point is not metering by itself, but more the need to shorten the payback time for this investment. How can you do it? By using a specific solution which has been designed, based on the application conditions mentioned above, to reduce the whole installation and commissioning time. It is the combination of ET272 meters (suitable to be used in both existing or new installations) with VMU-C (which automates meter addressing and in general reduces the whole commissioning process by 94%).



### ET272, main and sub metering solution for tap-off boxes

- Patented meter, 4-DIN modules for DIN-rail mounting
- Up to 415 V L-L ac and TCD-based current measuring inputs
- Current measurement by two basic TCD units with quick RJ11 plugs (see TCD xM series)
- Quick configuration by automatic recognition of TCD units
- Self addressing in a Modbus system (in combination with VMU-C)
- 2\*3-phase energy analysers with sum function in the same unit
- Measurements: V, A, Hz, PF, W, VA, var, bi-directional kWh
- Basic accuracy (kWh):  $\pm 2.0\%$  RDG (meter + TCD xM unit). kWh: class 1 (IEC 62053-21)
- Data format: 3-DGT (instantaneous variables)/7-DGT (totalizers)
- RS485 Modbus RTU. 2 pulse outputs (loads 1 and 2)
- Universal power supply (230 V ac)

### TCD 0M-1M-2M-3M-MM, sensing solutions

- Triple split-core sensing unit for panel and DIN-rail mounting

Model	Primary (A)	Hole size (mm)
TCD 0M and TCD 1M	60 and 100	9.6 and 15.5
TCD 2M and TCD 3M	200 and 400	15.5 and 20.5
TCD MM	Up to 10000(*)	-

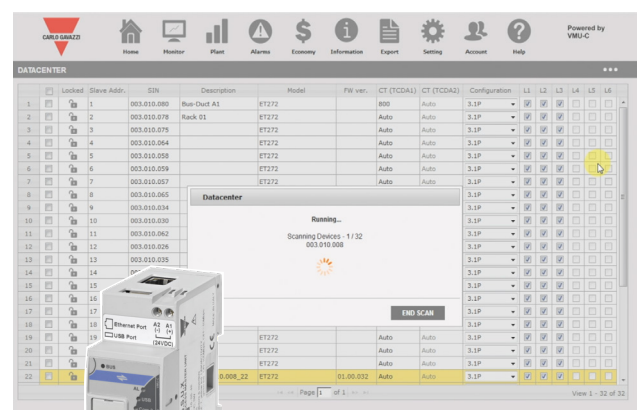
(\*) using CTV current sensing units.



Up to 10kA

### VMU-C gateway and web-server solution

- VMU-C EM and ET272 are mandatory parts of the bus-duct solution
- 2-DIN module housing. 12 – 28 V dc power supply
- Micro PC with embedded Web Server, WEB services and data logger functions
- Ethernet Modbus TCP master/slave function
- One RS485-Modbus port for the management of up to 80 ET272
- Data display (charts and tables). Real time or scheduled data export to Excel, CSV and HTML formats
- 4GB internal memory, Back-up memory on micro SDHC and USB
- Energy analysis of each load. Costs analysis
- Virtual meter with sum function
- Alarm management (e-mail or SMS by means of SH2-DSP)



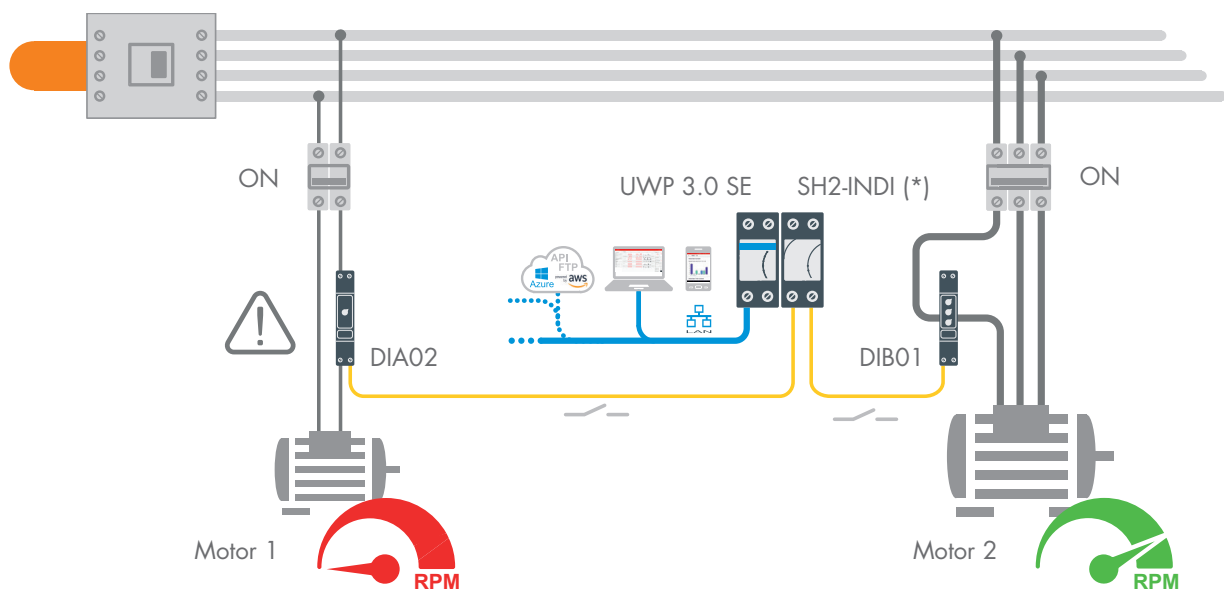
# Monitoring

## Load control

### Critical loads ON/OFF status

Turning a motor ON doesn't automatically mean that it is running.

There may be failures around and the control system (a PLC or a Building Management System - BMS) must be informed that the action is not being delivered. The usual point is "how valuable is to know this early?", to trigger the actions to deploy as countermeasures. To deliver an answer to this question, Carlo Gavazzi has designed a critical loads ON/OFF status detection solution range, split in different models to meet the different installation needs. In a low-voltage switchgear, this range, with its compact size, saves space, with its through wiring simplifies installation and settings so as to reduce the total cost of ownership. Energy efficiency is not simply monitoring consumption, in fact low consumption doesn't mean the installation works properly because maybe motors are stopped for any reason, hence this can impact the efficiency of the whole plant.



(\*) see page 50

#### EIS-H

- Combined solid-state NPN/PNP 24 V dc or 230 V ac output
- Up to 60 A input current
- Built-in current transformer with 12 mm diameter hole
- Fixed setpoint: 200 mA (24 V) or 400 mA (230 V)
- 22.5 mm DIN-rail housing
- Self powered



#### DIA 53

- Combined NPN/PNP 24 V dc output
- Up to 100 A ac input current
- Built-in current transformer with 12 mm diameter hole
- Adjustable setpoint
- 17.5 mm DIN-rail housing
- Self powered



#### DIA 02

- Potential free change-over relay output
- 20 mA minimum load current to monitor very small loads
- 22.5 mm DIN-rail housing
- 24–48 V ac/dc or 115-230 V ac power supply



#### DIB 01 100 A

- Potential free change-over relay output
- Up to 100 A ac input current
- Built-in current transformer with 12 mm diameter hole
- 22.5 mm DIN-rail housing
- 24-240 V ac power supply

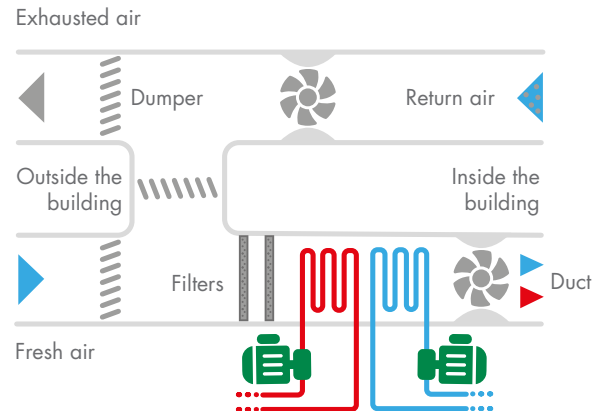


# Load control in different applications

Some examples of applications where the benefits are widely larger than the costs.

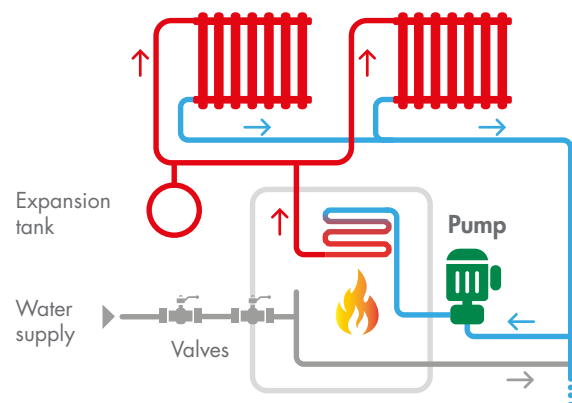
## Water circulation pumps in heating or cooling systems

These pumps are usually small, so the current to be detected may be below 1A. If used for hot water, when they fail the temperature of the building decreases quickly and some of the pipes run the risk to freeze. If with chilled water, the temperature of the building grows quickly and the quality of the ambient drops. In both cases, the building may need to be evacuated as non-compliant to be used as a working environment. Knowing immediately that there is a fault, that is as soon as the pump stops working, rather than when the air temperature change is perceived, gives time to the service team to fix the issue even before it's time to evacuate the building, avoiding the corresponding loss.



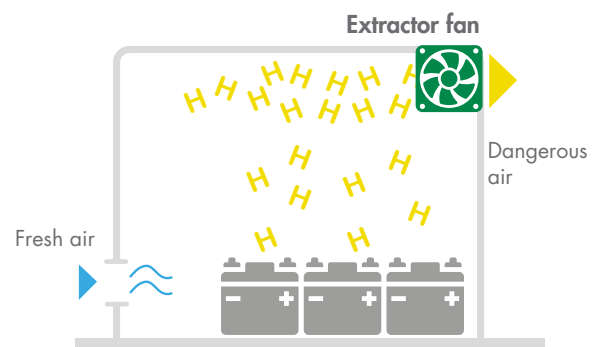
## Chiller water circulation in Air Handling Units

Chilled water is provided using a pump. If it fails, the easiest and quickest way to detect the failure is to check if the pump is running. With this information the service team can be alerted to fix the issue before the quality of the air in the building isn't acceptable.



## Fans in UPS battery rooms

The batteries in UPS rooms may release hydrogen and oxygen through their valves. If the gas concentration arises above the ignition point, the ambient becomes explosive. That's why battery rooms are equipped with a small extractor fan to ensure air exchange in the room. Failure of the fan means potential danger, and has to be addressed immediately, so knowing if it is working is crucial.



# Monitoring

## On premises and Cloud solutions

### A scalable architecture made of building blocks

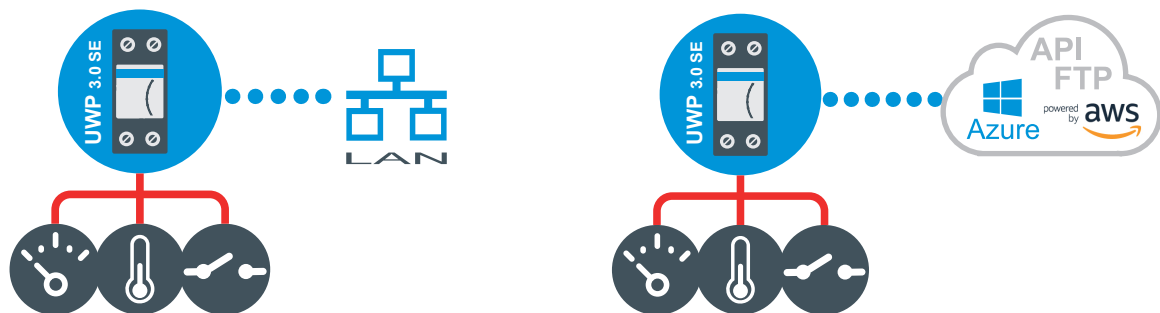
**Small to medium companies, or a large multinational have different needs in terms of organization and management.**

There is a connection between facility dimensions, management complexity and quantity of data being generated. At the end, the management of needs, becomes sooner or later the management of problems. In the specific case of data, it is therefore important to prevent the problems so to avoid fixing them afterwards, since problems are always costs.

#### ■ The data sources

In our case, data is generated by the field devices – meters, sensors and I/Os – which are the sources to be used to implement an energy efficiency plan, a load monitoring solution or simply cost centers for cost allocations.

#### ■ FDBB the Field Data Building Block

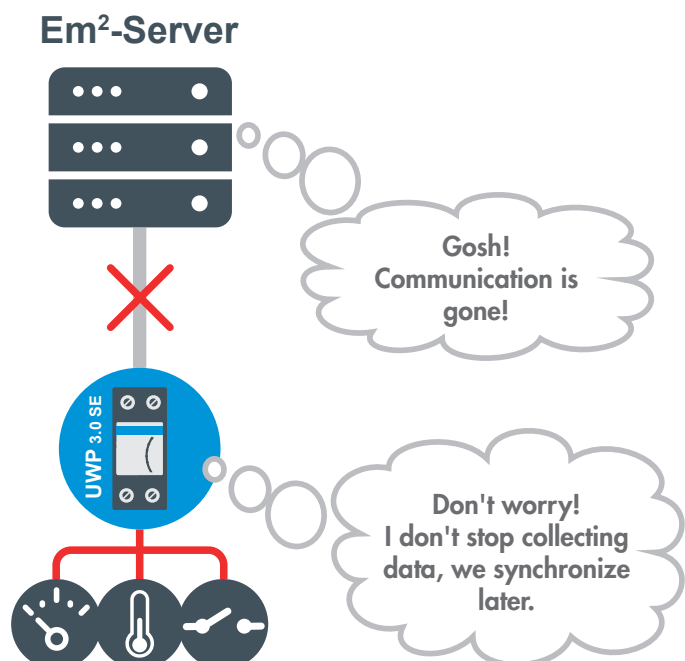


The fact that Carlo Gavazzi can provide field devices equipped with simple communication buses that can be connected to an UWP3.0 is the core of the solution but also the prevention of problems.

UWP3.0, through its field buses, wired Modbus, Dupline, and BACnet as well as various wireless solution, collects and manages data locally. Our FDBB, Field Data Building Block solution embeds data generation and edge computing as illustrated above.

#### ■ The solution is to decentralise the monitoring system

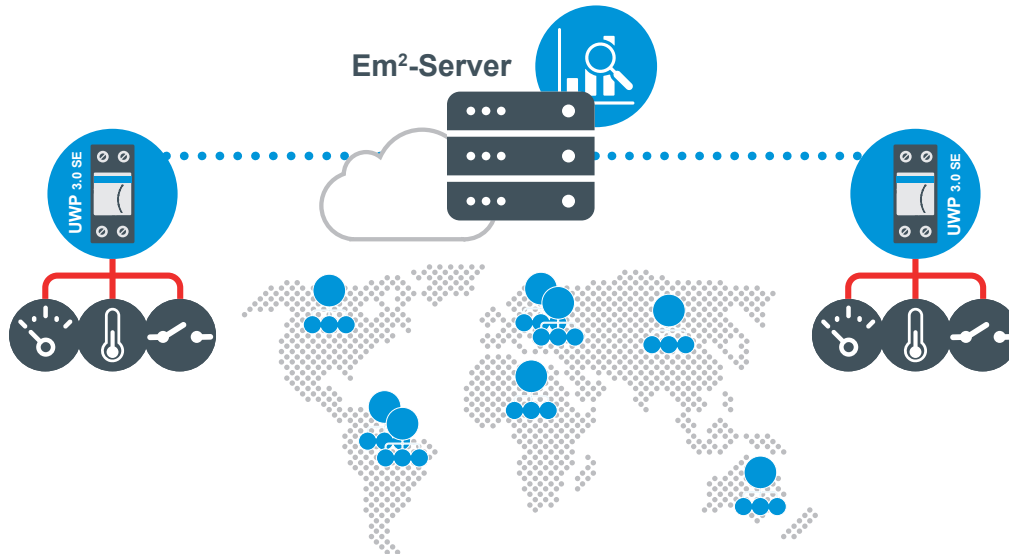
By using FDBBs (Field Data Building Blocks) the system becomes scalable and in case of missing communication to either the PC or the Cloud where the management software is running, the single FDBBs will continue to work and to manage data locally. As soon as the communication is restored, the Em<sup>2</sup>-Server will synchronize the data again and update its database.



# Data aggregation and standard web-browser access

## Single-site or multi-site unique solution.

Em<sup>2</sup>-Server solution is scalable and therefore suitable to be used in small installations but also in large facilities or spread geographically in different locations in the same country or in different countries. It can scale up to 100 FDBBs which means up to 100 UWP 3.0s and up to 3,200 Modbus meters. Em<sup>2</sup>-Server allows to aggregate information replicated by UWP 3.0 SE within a single centralized database and the relevant information may be accessed by users from wherever by using a standard Web-browser.



### Em<sup>2</sup>-Server has:

- a multilingual Web based user interface
- user rights management
- concurrent access from multiple locations
- integrated MAP view and interactive mapping feature
- movable and resizable dashboards fitting the needs of a control room
- hierarchical tree to navigate data with ease
- alarms view (only in case of combined use with VMU-C)
- Excel<sup>®</sup> reporting and PDF billing simulation

Status	Category	Message	Module	Meter	Middle Level	Date	Resolved on	Variable	Acknowledged on	Acknowledged
Alarm	Reserved alarm	Power analyser AC	WM40	M1 - New Upper Changi Road		01-01-2020 08:39:52 AM	01-01-2020 10:40:21 AM	PF sys	01-01-2020 11:12:00...	M1 - New ...
Alarm	Reserved alarm	Power analyser AC	WM40	M1 - New Upper Changi Road		01-13-2020 09:15:16 AM	01-13-2020 11:15:44 AM	PF L3	01-13-2020 11:45:00...	M1 - New ...
Alarm	Reserved alarm	Power analyser AC	WM40	M1 - New Upper Changi Road		01-27-2020 01:49:29 PM	01-27-2020 03:49:57 PM	PF L3	01-27-2020 04:20:00...	M1 - New ...
Alarm	Reserved alarm	Power analyser AC	WM15	B2 - Jalan Anak Bukit, Bukit Timah Plaza		02-02-2020 12:48:19 PM	02-02-2020 01:48:49 PM	kw sys		
Alarm	Reserved alarm	Power analyser AC	WM40	M6 - Orchard Turn		02-04-2020 10:21:43 AM	02-04-2020 11:22:14 AM	V L1	02-04-2020 11:52:00...	M6 - Orch...
Alarm	Reserved alarm	Power analyser AC	WM15	B1 - Ang Mo Kio Avenue		02-05-2020 09:40:34 AM	02-05-2020 11:41:02 AM	PF 1	02-05-2020 12:09:00...	B1 - Ang...
Alarm	Reserved alarm	Power analyser AC	WM15	B1 - Ang Mo Kio Avenue		02-05-2020 10:07:08 AM	02-05-2020 12:01:38 PM	V L1	02-05-2020 12:28:00...	B1 - Ang...
Alarm	Reserved alarm	Power analyser AC	WM40	M6 - Orchard Turn		02-07-2020 02:44:55 PM	02-07-2020 04:31:25 PM	V sys	02-07-2020 05:00:00...	M6 - Orch...
Alarm	Reserved alarm	Power analyser AC	WM15	M7 - Jurong East Central		02-10-2020 01:32:45 PM		kw sys	02-10-2020 01:50:00...	M7 - Juro...
Alarm	Reserved alarm	Power analyser AC	WM15	B2 - Jalan Anak Bukit, Bukit Timah Plaza		02-11-2020 09:12:04 AM		kw L1		
Alarm	Reserved alarm	Power analyser AC	WM40	B4 - Marina Boulevard, MBFC Tower		02-13-2020 08:29:35 AM	02-13-2020 10:19:05 AM	PF L3	02-13-2020 10:50:00...	B4 - Man...
Alarm	Reserved alarm	Power analyser AC	WM40	B4 - Marina Boulevard, MBFC Tower		02-13-2020 01:02:50 AM	02-13-2020 03:05:46 PM	PF L3	02-13-2020 03:35:00...	B4 - Man...
Alarm	Reserved alarm	Power analyser AC	WM15	M4 - River Valley Road		02-17-2020 02:32:30 AM	02-17-2020 03:50:56 PM	V L3	02-17-2020 04:19:00...	M4 - River...

# Monitoring

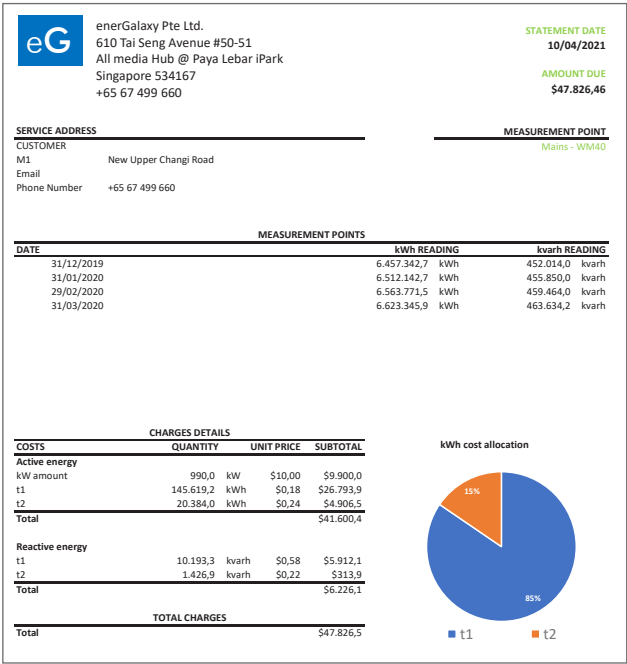
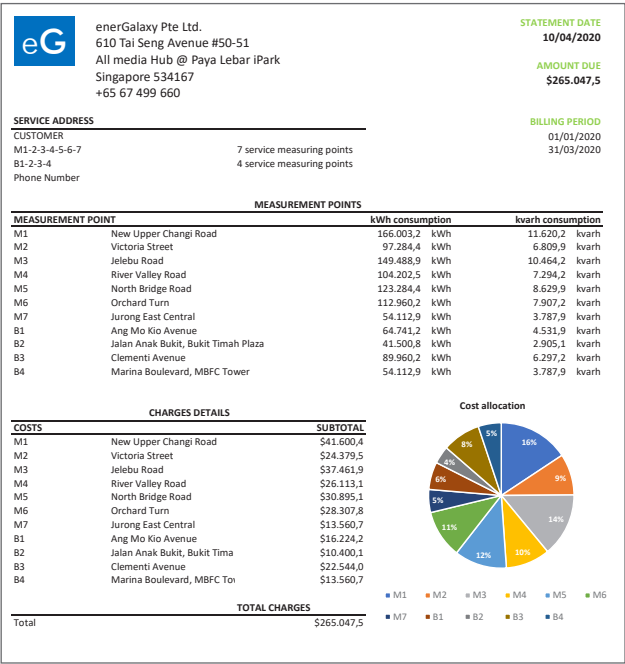
## On premises and Cloud solutions

### Energy cost centers and other cost analysis tools

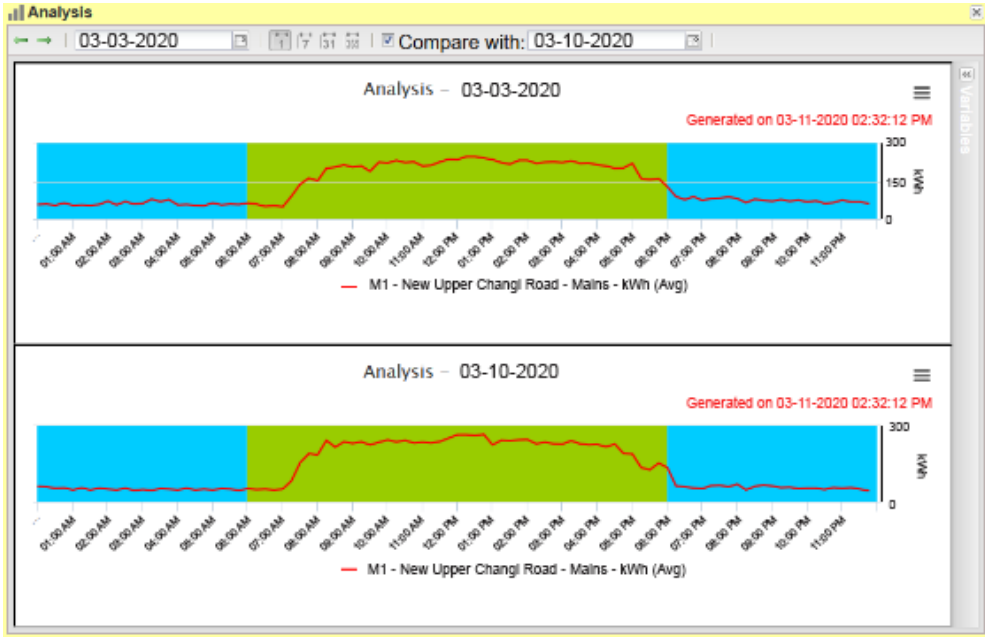
Em<sup>2</sup>-Server is a multi-function solution that manages field-sensor data of any type.

Energy efficiency and cost allocation are important goals to achieve, being part of an OPEX (Operating Expenses) reduction strategy of a company. To understand how energy is consumed and where it can be saved, it is important to have specific tools and dashboards which allow to perform an adequate analysis.

It does not matter if the need is to know on time, energy data to perform a cost analysis or to sell energy services, Em<sup>2</sup>-Server provides you the tools you need. This solution may generate billing documents but may also produce a simulation of a monthly or yearly energy bill based on existing consumption and utility supplier vs. same consumptions but based on another utility supplier to evaluate the real convenience to change over.



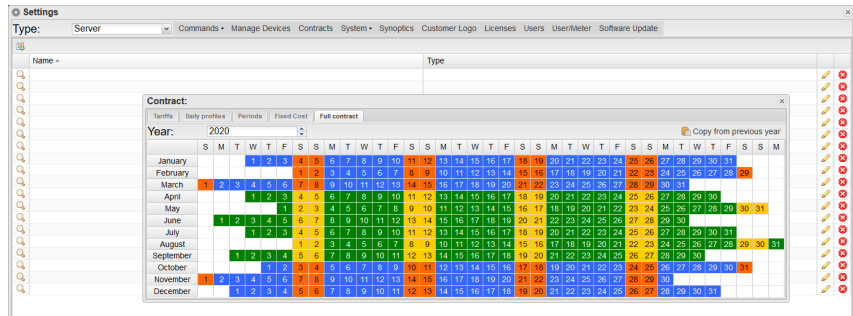
So, Em<sup>2</sup>-Server embedded essential tools are capable to perform a budget, comparative or summarized into a billing simulation PDF file and monthly balance analysis. Moreover, data can be exported using powerful Excel<sup>®</sup> export embedded analysis tool.



# From cost analysis to advanced load profiling

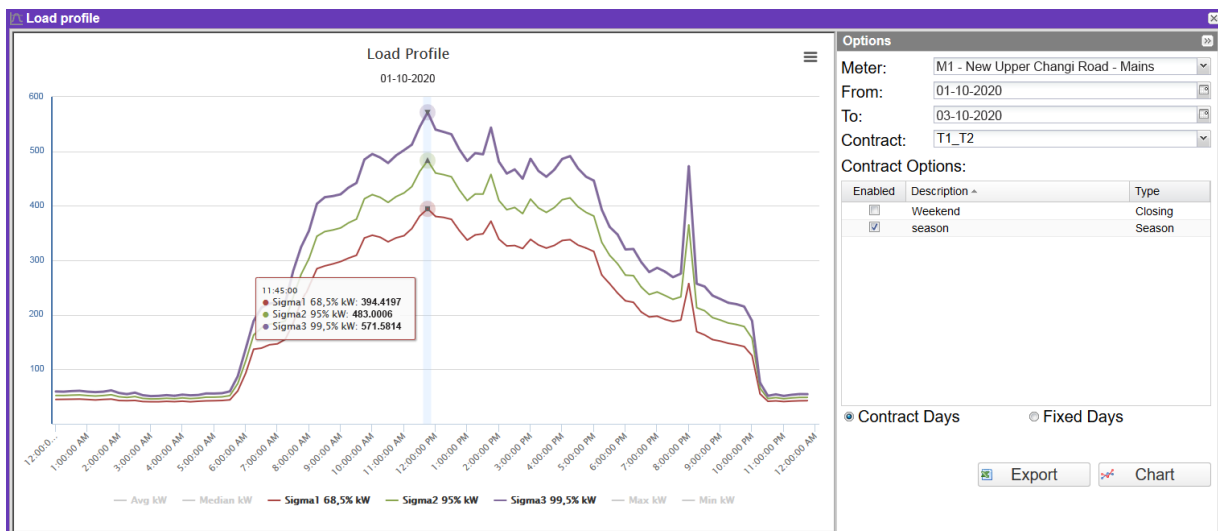
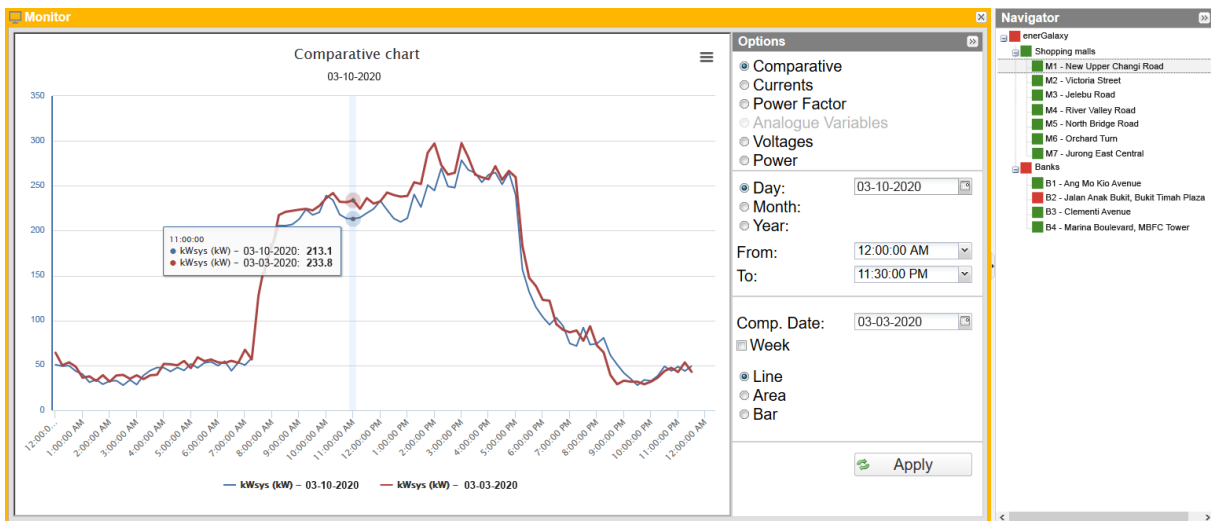
Cost of energy in business activities is connected also to a tariff management.

Em<sup>2</sup>-Server manages multiple tariffs, multiple profiles, and multiple calendars to make the entire analysis more accurate. This means, in a global business activity, to be able to manage automatically different energy costs in different geographical areas but also different working calendars at the same time producing, at the end, a common document.



## Advanced Load profile analysis

As important part of Em<sup>2</sup>-Server tools, there are also the specific load profile statistical (average, median, min, max, Sigma standard deviation) analysis which maybe based, on the set time, on hundreds of thousands of data and is aimed to discover at a glance, the load behavior differences, thus discovering anomalies and suspicious consumptions.



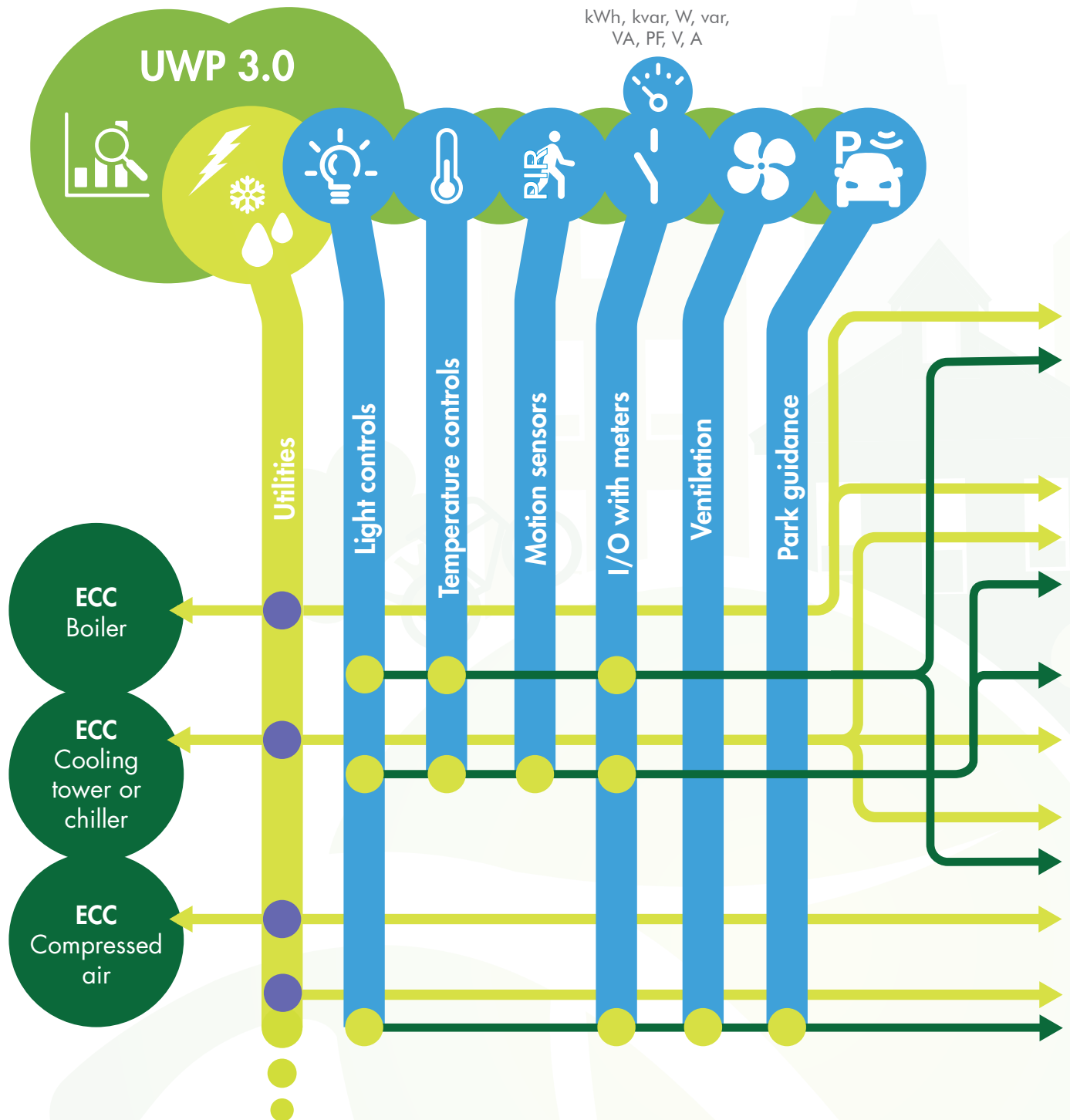
# Active control

## The map - multiple and different needs

### ■ Not only utilities and users but also buildings and occupants

The key objective of an energy efficiency plan is:

- minimizing consumptions (TOE, tons oil equivalent);
- minimizing costs;
- minimizing environmental impact (tons of CO<sub>2</sub>);
- as a mandatory condition, ensuring the same productivity level!

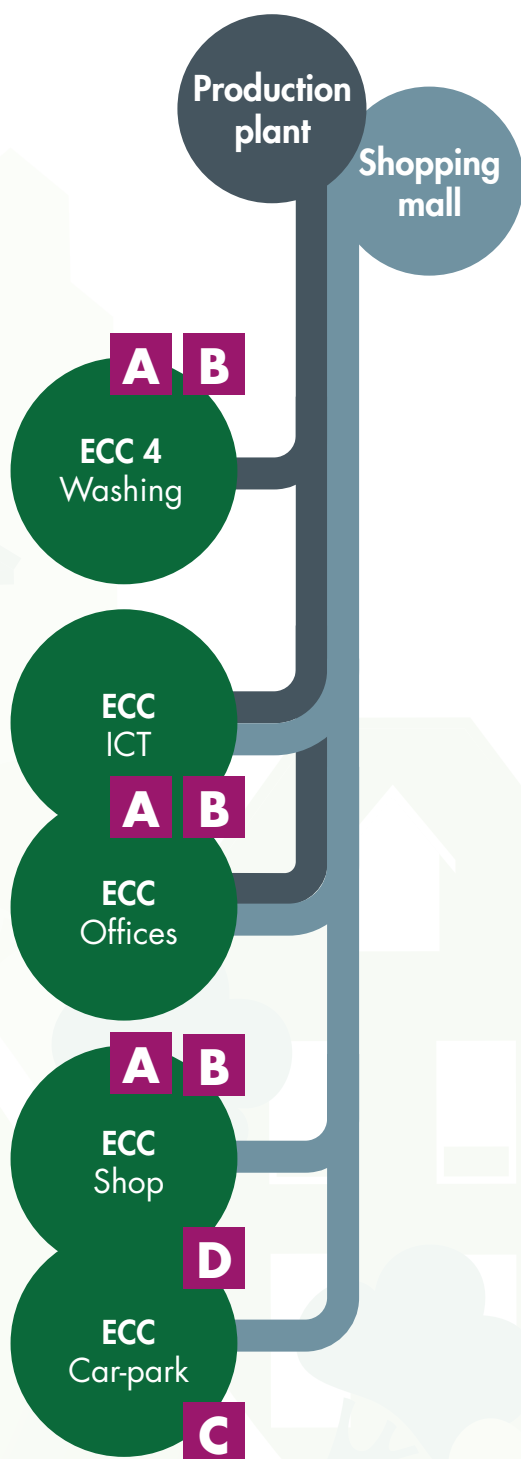




● Active controls

● Measurements

ECC: Energy Cost Center



### ■ The energy performance of the building

Building Automation and Control Systems (BACS) can have a significant impact on the energy consumption of any kind of building and their occupants.

• a list of control, automation, and technical management functions that ACEEE building policies, LEED Leadership in Energy and Environmental Design voluntary sustainability programs for buildings and Should include the EnergyStar TM as a government-backed labeled program that helps people and organizations to save money and reduce greenhouse gas emissions by identifying factories that have superior energy efficiency are the guides to achieve the planned energy efficiency goals.

Those standards are aimed to provide:

- affect the energy performance of buildings;
- a method for defining the minimum requirements for the control, automation, and technical building management functions implemented in different types of buildings;
- detailed procedures for quantifying the impact these functions have on the energy performance of a building;
- a simplified method to obtain an initial estimate of the impact these functions have on the energy performance of buildings.

Carlo Gavazzi, with its global offer of products, solutions and competences, evolves its product portfolio from energy efficiency monitoring solutions to active control through building automation.

**Often, existing infrastructure like wiring and panels can be up kept and upgraded with newer and more advanced technology saving huge money for retrofit projects.**

### ■ The performance of a car park

In a place, nearby a business activity, where there is a high concentration of parked cars, like in shopping malls, airports and in large railway stations, an indoor car-park or multi-storey garage is another point of attention. It is not only aimed to implement energy saving actions but also solutions to be more service effective.

The attention moves from the energy efficiency of the facility to the occupants of the car-park. This means the drivers, providing them automated information about where to drive and park the car, reducing their stress, thus increasing car flow efficiency and reducing fuel emissions.

## The topics

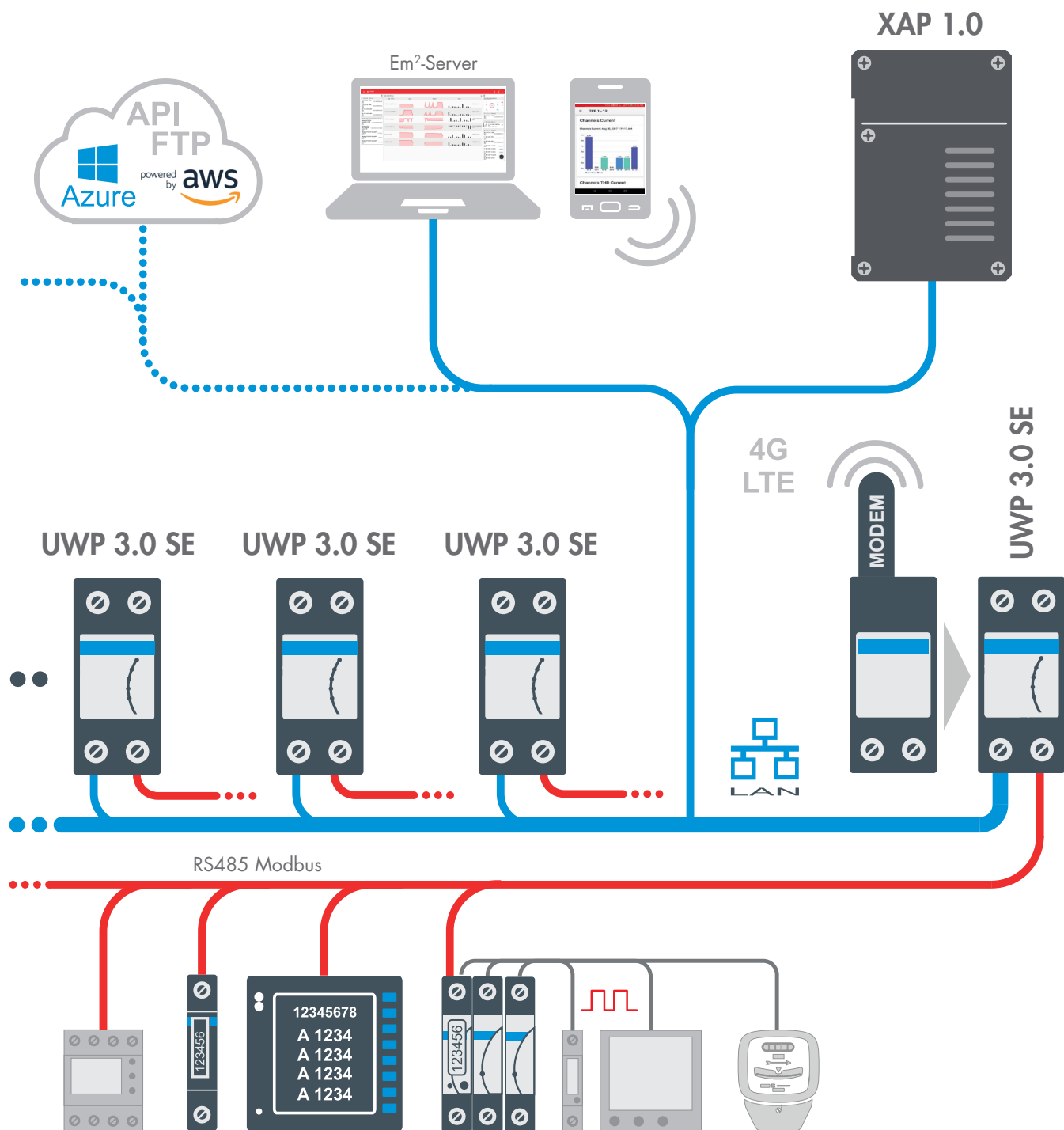
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<b>C</b> Car parking indoor guidance systems	52-54
<b>D</b> Fire damper control solution	51

# Active control

## One platform, many solutions

The UWP 3.0 SE platform evolves from energy monitoring to active control, adding: I/Os, functions and specific bus integration modules...

■ up to a full integration into a BMS

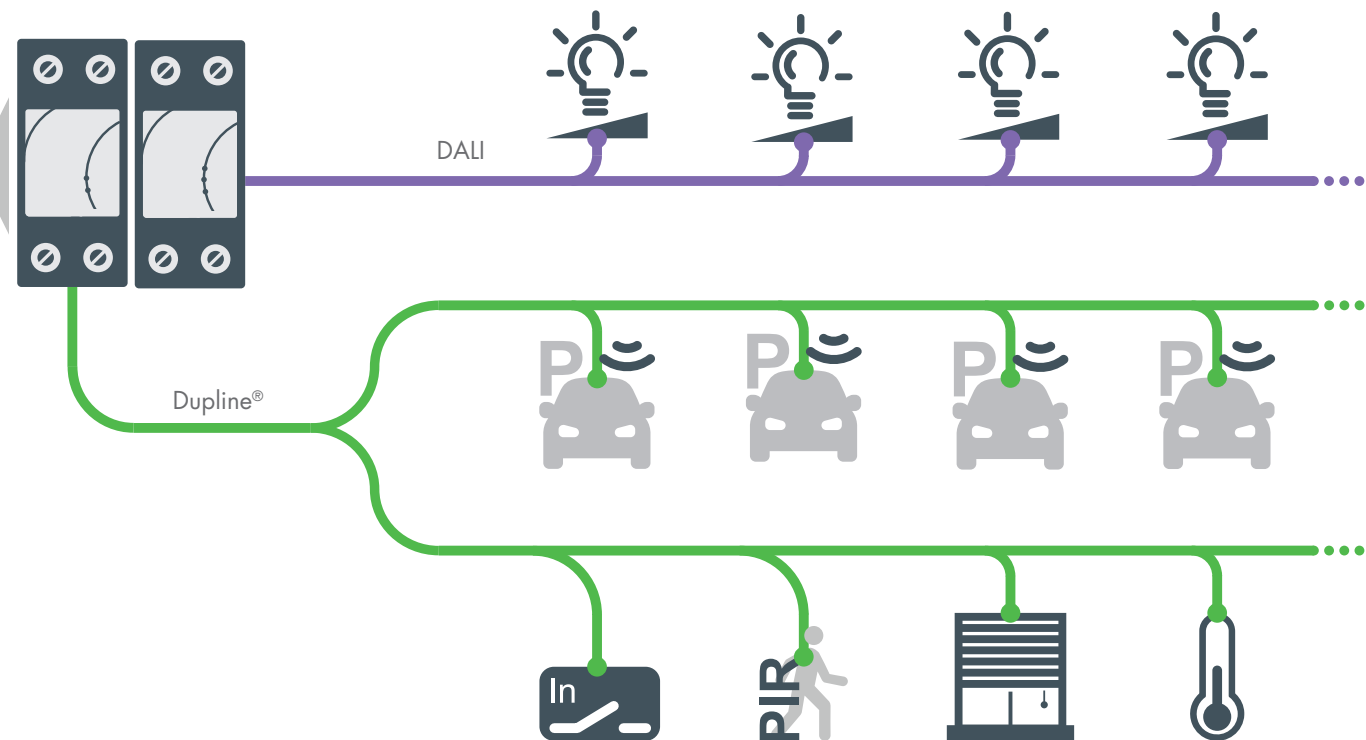


### ■ The architecture completion

Simplicity, short commissioning time, cost reductions, error proof configuration, expandability and scalability are the key characteristics of UWP 3.0 SE, that make this platform a powerful solution to achieve the Energy Efficiency goals. Ultimately, the platform evolves from the pure monitoring introduced in the first part of the presentation, to the active control. To achieve energy savings it is simply not enough to collect data from the meters and the application of active control drives the total solution. Energy efficiency aimed to minimize the energy costs is the synergy of two major actions: monitoring and active load control.

### ■ The active control

The active control performed by UWP 3.0 SE is the capability of this platform to act, at a first level, directly and automatically on the loads but also at a second level to integrate into other management systems. As a first example, in an industrial plant we can have several buildings like a production facility with services, offices, and a warehouse, with different needs in terms of load control and integration. In the production facility, there are energy intensive loads like large machines, electric heaters, chillers and air-compressors. All of them have to be monitored and optimized. There is also the need to allocate the energy costs by produced item (see our extensive meter offer).



# Active control

## The architecture technologies

### One solution from Field devices up to Management

Efficiency is not only electric or on the transformation process, it is also human.

#### ■ Energy savings and human efficiency

In the offices there is the need to maximize energy efficiency in relation to the external environmental conditions and people occupancy, while providing the highest levels of comfort, safety and quality. Lighting is one of the major areas to focus on, so to reduce electricity costs. A proper controller module based on DALI bus provides a wide range of control strategies to achieve both energy savings and comfort level. Efficiency is important not only for energy resources, but also for human resources. A modern company knows that people engagement, mood, and commitment can be easily enhanced taking care of the work space in terms of CO<sub>2</sub> level (ventilation), temperature (heating and cooling), and illumination (DALI).

#### ■ Control and integration

Last but not least, in the warehouse the main energy users are lighting, heating, and ventilation. A proper management of those loads and the communication by means of BACnet, will integrate the UWP 3.0 SE platform into a BMS so to complete the offer to achieve the energy efficiency goals.

#### ■ From energy efficiency to flow efficiency

As an additional example, moving from an industrial installation to a shopping mall or an airport, there is the need to different extents, in addition to what already explained beside, to implement energy efficiency strategies also in an indoor car-park or multi-storey garage. In this case, as for the people using the offices, efficiency is important not only to control lighting and ventilation (making sure they are disabled in unoccupied zones), but also for drivers, providing them automated information about where to drive and park the car, reducing their stress, thus increasing car flow efficiency and reducing fuel emissions.

#### Beyond communication networks, the BACnet communication integration

Learn more



LoRaWAN® certified products for Mexican market only

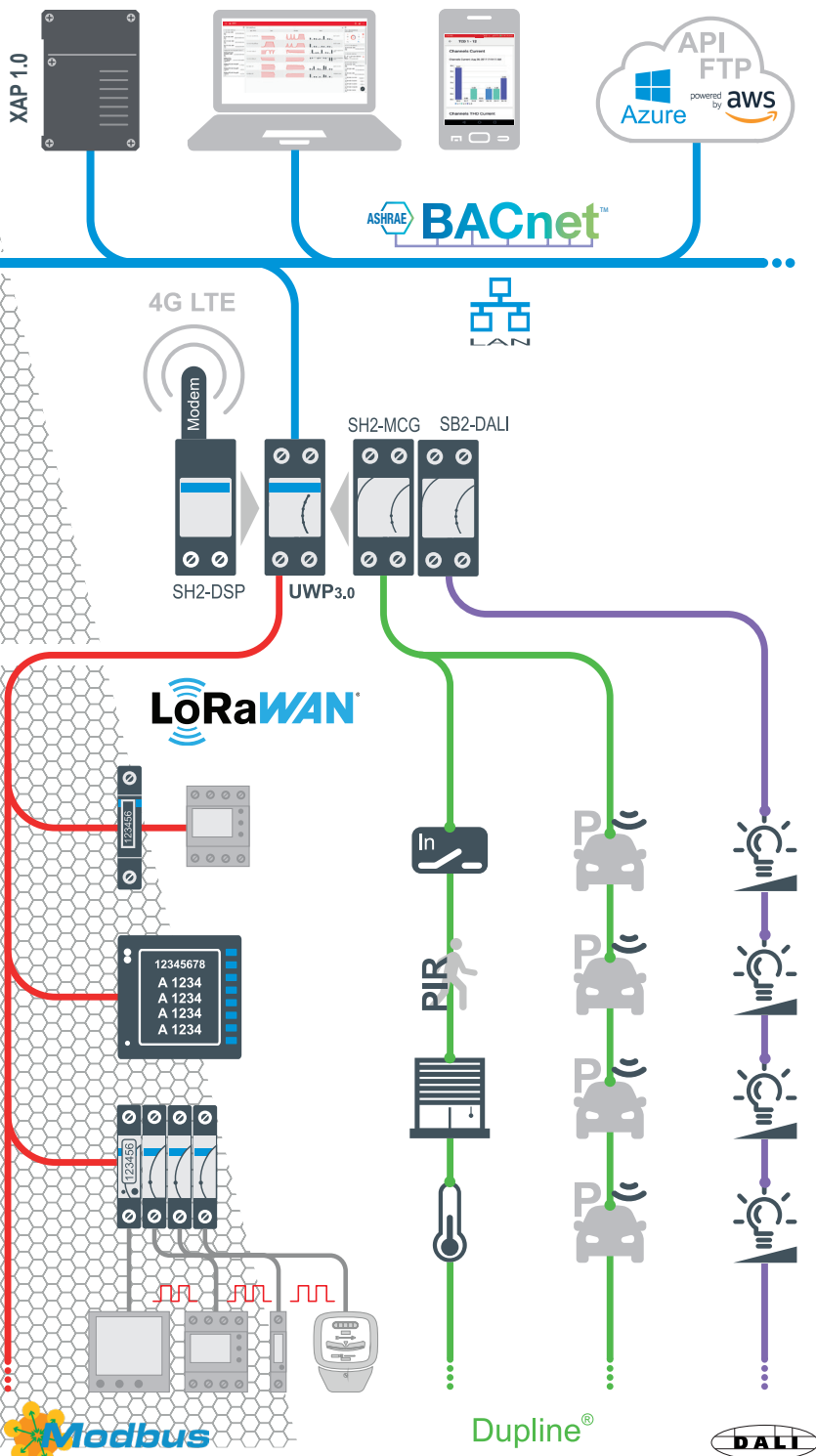
Management

Automation

Field

# The BACnet communication integration and more

BACnet means a specific data communication architecture and protocol designed to ...



... provide mechanisms for computerized building automation devices to exchange information, regardless of the particular building service they perform.

■ This means a data exchange and management of heating, ventilation, and air-conditioning control. But also lighting control, access control, and fire detection systems and their associated equipment to achieve the energy efficiency and saving goals. While communication networks are used extensively in Building Automation systems at the automation and management levels, they are less used at the device level, especially within HVAC control systems. In most cases, each data point needs its own wire(s) back to the DDC (Direct Digital Control), which complicates the installation in case of widely distributed data points, meaning, cost issues and device level complexity.

■ While on one hand UWP 3.0 SE significantly simplifies the field level of HVAC and lighting wiring without increasing material costs, on the other hand it reduces both commissioning and BACnet integration time.

■ UWP 3.0 SE is a multi protocol unit which means, in a BACnet world, the central unit of the system. It interfaces to XAP 1.0 the DDC's (Direct Digital Controls) and the BMS (Building Management System) through BACnet/IP, managing up to 7 Dupline® bus generators. The Dupline® fieldbus links together all the sensors, actuators and indicators needed for the HVAC and lighting systems in a free topology network.

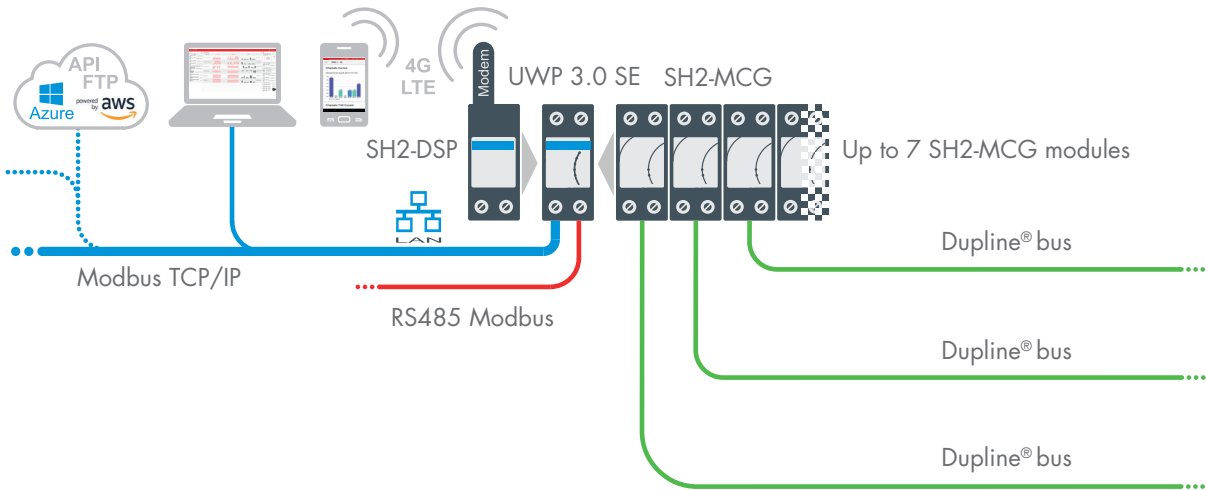
Carlo Gavazzi is part of the BACnet Manufacturers Association (BMA), is listed as an official vendor, and provides BTL certified products.

# Active control

## The smart field bus wiring

### The Dupline® bus

Dupline® is the smart fieldbus to exchange information between smart field sensors and the UWP 3.0 SE core unit and platform.



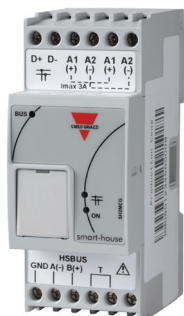
#### ■ Why the Dupline® proprietary smart bus?

Because among all the platform compatible standard field buses, Dupline® is the best solution in its application context, since it brings numerous benefits, such as:

- eliminating expensive shielded cable, saving money just because it uses a twisted pair (2 wires);
- being extremely noise immune, can run next to power cables;
- carrying the power supply to power the connected sensors;
- simplifying the field level wiring (based on free topology) without increasing the material costs (e.g. using existing cables);
- running the bus signal up to 1.24 mi (2 km) without any repeater;
- being robust with a proven technology with over 150,000 installations worldwide including not only energy efficiency solutions but also mining, oil drilling, railroads and many others;
- being modular and scalable, the system can be progressively extended with new modules (up to 7) according to the application needs.

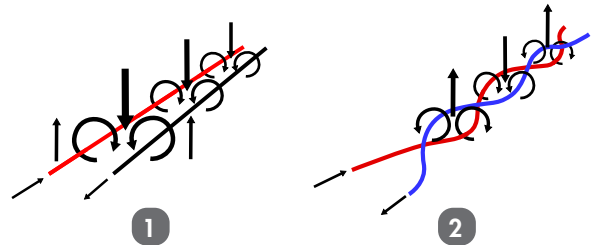
#### ■ SH2-MCG

- Connection to UWP 3.0 SE via internal bus or terminals via the high speed bus
- Up to 7 SH2-MCGs can be connected on the same network, considering the sum of SH2-MCGs and SH2-WBUs
- 2-DIN modules housing
- 24 V dc power supply



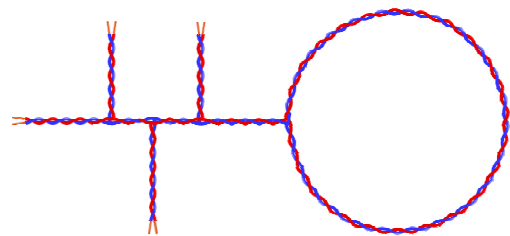
#### ■ The noise and crosstalk immunity of Dupline®

- 1) Inductive coupling effect in parallel wires.
- 2) Minimizing the inductive coupling effect in Dupline® twisted Cables.



#### ■ The free topology of the Dupline® network

Ease of installation and wiring.



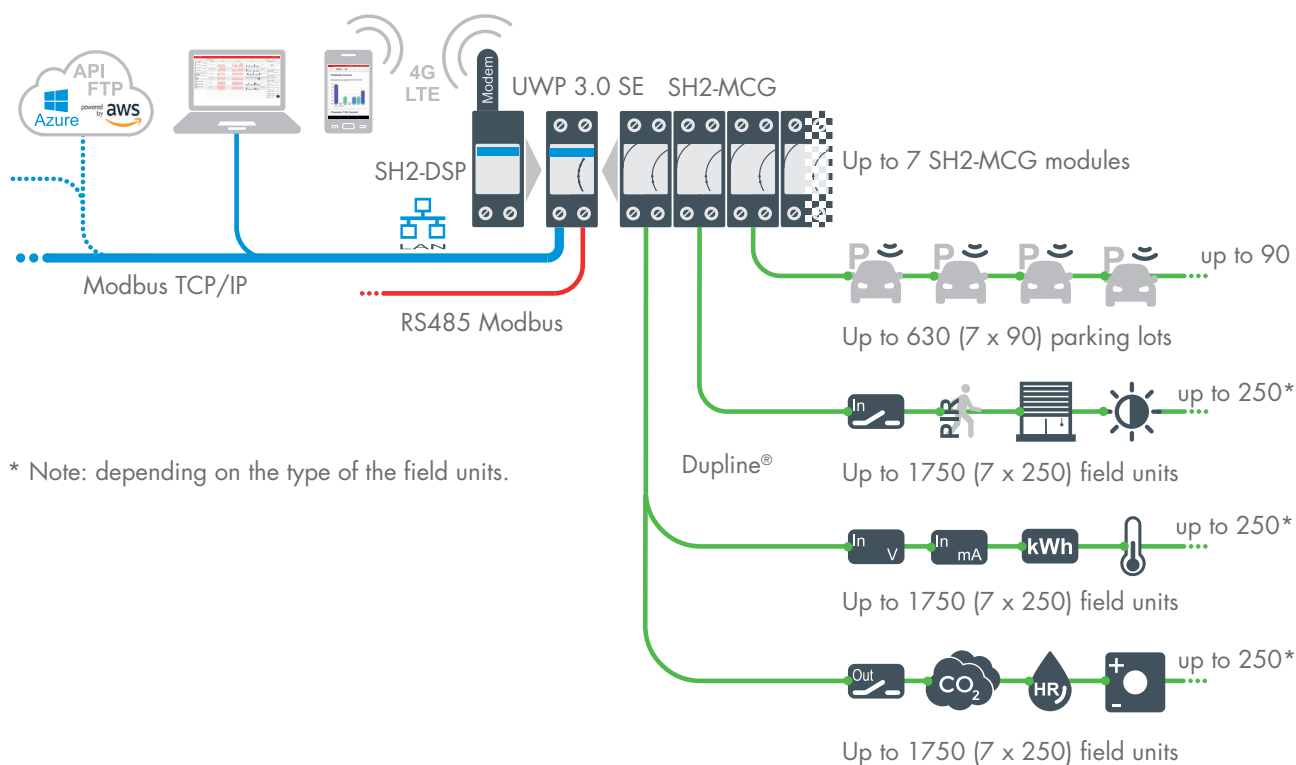
#### ■ Only 2 wires to perform a reliable communication

Many wires vs. two wires, this is the Dupline® smart field bus!



## Specialised sensors for a changing world

Being able, in an existing installation, to keep the same wiring or to simplify it, upgrading the technology, adding new functions, is beneficial to achieve the planned energy efficiency savings.



\* Note: depending on the type of the field units.

This means, within the UWP 3.0 SE platform, the availability of Dupline® smart field components suitable to:

- measure environmental parameters, such as temperature, humidity and CO<sub>2</sub>;
- measure luminous flux per unit area (LUX);
- measure standard signals, such as volts and milliamps from various transmitters;
- measure the energy consumption of single-phase loads;
- detect movement and presence within a room;
- sense status signals, such as light and load switches and alarms;
- activate outputs by means of relays;
- generate 10 V dc analog signal outputs;
- display and locally adjust temperatures.



### ■ Sensors and I/Os as part of the Ecosystem to achieve energy saving goals

Different combined and streamlined sensing and actuating components, specifically designed to meet space constraints and cost savings.

A complete set of units capable to measure ambient parameters and to manage input and output signals aimed to provide all the necessary information to the platform through the UWP 3.0 SE core unit. This becomes the ecosystem which with proper algorithm boosts the energy savings.

# Active control

## XAP 1.0 the eXtended Automation Platform

### ■ Flexibility, scalability and integration capability!

In a medium to big industrial site or building, the need is to collect a massive amount of data generated by field devices like meters and sensors. This data has to be brought where they need to be processed and managed to implement an effective Energy Efficiency plan, thus saving natural resources and consequently also preserving the environment. In this respect, it is important to have a flexible system suitable to the different local needs. Being a production facility something that changes very often due to process reviews, scalability is a must. Moreover, to be able to meet an Energy Efficiency plan, there is the need to interact with users, to exchange data with new or already existing systems using different communication protocols, but also with Cloud-based systems. In a system, this means being able to manage an efficient and effective integration.

### ■ Why is it fundamental to manage data in an efficient and effective way?

Nowadays, data management is fundamental to achieve the saving goals, but this is very often a hassle for the system integrator. There are two orders of problems:

- the first one is related to the way data is exchanged, therefore the protocols used, and as a consequence the potential lack of know-how;
- the second one is the data interaction and the logic to be implemented to achieve the energy saving goals.

Both problems are costs which will be paid by the end users, but will also limit the competitiveness of the companies providing the solution and services. How to solve those problems? From the point of view of the system integrator, by making the architecture lean by using as few devices as possible in the data exchange, and from the point of view of the Energy service Companies, by easily implementing proper control logics.

### ■ One step further!

When architecture complexity increases, to be able to meet additional integration needs and to automate the management system, UWP 3.0 SE is only a part of the solution. To complete the architecture there is the need to add a further powerful device which goes beyond the UWP 3.0 SE features. It is XAP 1.0, the ultimate compact controller and gateway with embedded IIoT (Industrial Internet of Things) for seamless connection of multiple and various devices and sub-systems. Using the standard IEC61131 CODESYS, XAP 1.0, it supports network stacks and local I/O expandability. It provides easy programming, while the configurable web interface makes it an outstanding web HMI, with easily programmable graphic pages, functions, and protocols. The two Ethernet ports offer network segregation for WAN/LAN. XAP 1.0 is simple to connect to other devices as it offers multiple embedded standards, such as CODESYS, OPC UA, KNX IP, and BACnet, as well as data distribution via MQTT. The Linux-based operating system is designed to be interference resistant, while HTTPS provides secure web server access. By providing internet and web-server capability, XAP 1.0 together with UWP 3.0 SE, are the supervision and control solution to ensure optimisation of lighting, HVAC and in general building automation functions which can dramatically decrease energy usage and in turn the energy bill!



FTP



powered by **aws**

  
**Azure**

**XAP 1.0**

**UWP<sub>3.0 SE</sub>**

**UWP<sub>3.0 SE</sub>**



**Automation functions**

**Edge units**

**Field devices**

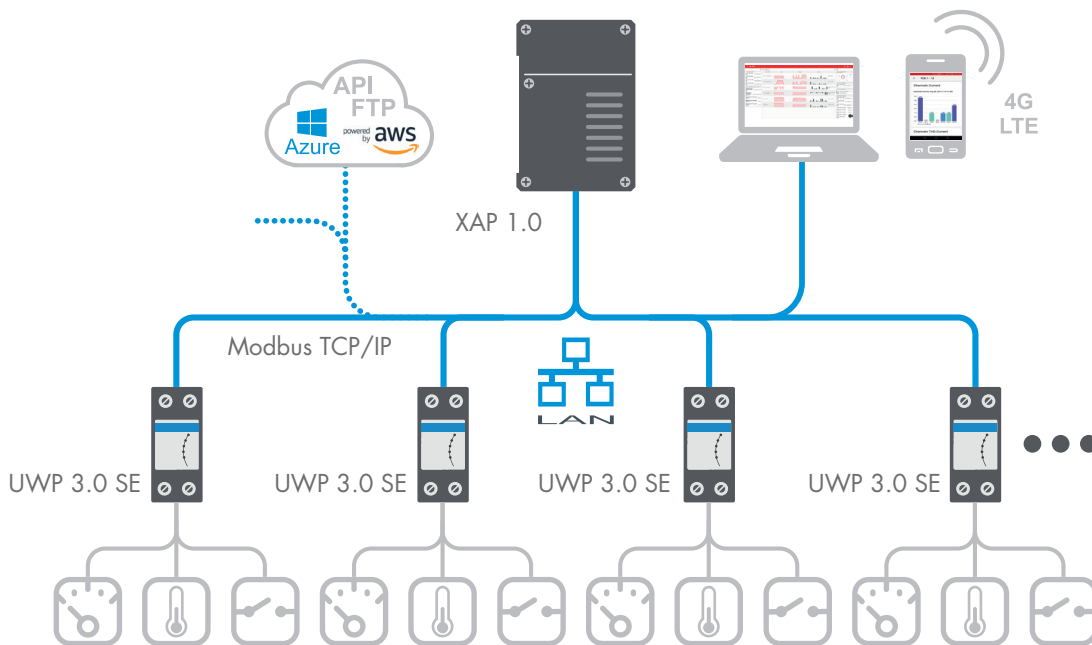
# Active control

## XAP 1.0 the eXtended Automation Platform

### Flexibility, scalability and integration capability!

**XAP 1.0, a compact, IIoT-ready controller and gateway for seamless connection of multiple and diverse devices and sub-systems.**

XAP 1.0 is aimed to deliver a complete solution for both industrial and building automation, from BMS down to field devices being XAP 1.0 the management level, UWP 3.0 SE the edge automation level, and the Dupline® and Modbus devices the field level. XAP 1.0 integrates the Codesys V3 development environment based on a solid Soft-PLC engine for programming controller applications according to the international industrial standard IEC61131-3. In order to be able to interact with industrial processes, XAP 1.0 integrates OPC UA client and server capabilities thus connecting databases, analytic tools, ERP, and other systems with real-world data from low-end devices. As modern processes involve cloud technology and services, the Node-RED connector has been embedded to connect hardware devices and online services (MQTT, FTP, SMTP) as part of the IoT world. XAP 1.0 among many available tools and functionalities is powered by a configurable web interface which makes it an outstanding web HMI, which can be easily programmed with graphic pages, functions and protocols, thus contributing significantly to system optimisation, ensuring total and integrated control.



#### XAP 1.0

- Controller and gateway, web HMI, PLC for building automation functions
- Data communication: OPC UA
- Cloud connectivity: Node-RED (Optional)
- Operating system: Linux
- Secure web server access: HTTPS
- Protocols: Modbus RTU/TCP-IP master and slave, BACnet client, KNX IP, KNX TP using an expansion module
- Compatible with CODESYS V3: it supports network stacks and local I/O expandability
- 2 Ethernet ports for network segregation from WAN/LAN
- Customisable web interface, with different access types according to the type of user
- Connectible to UWP 3.0 SE via BACnet or Modbus/TCP
- 24 V dc power supply



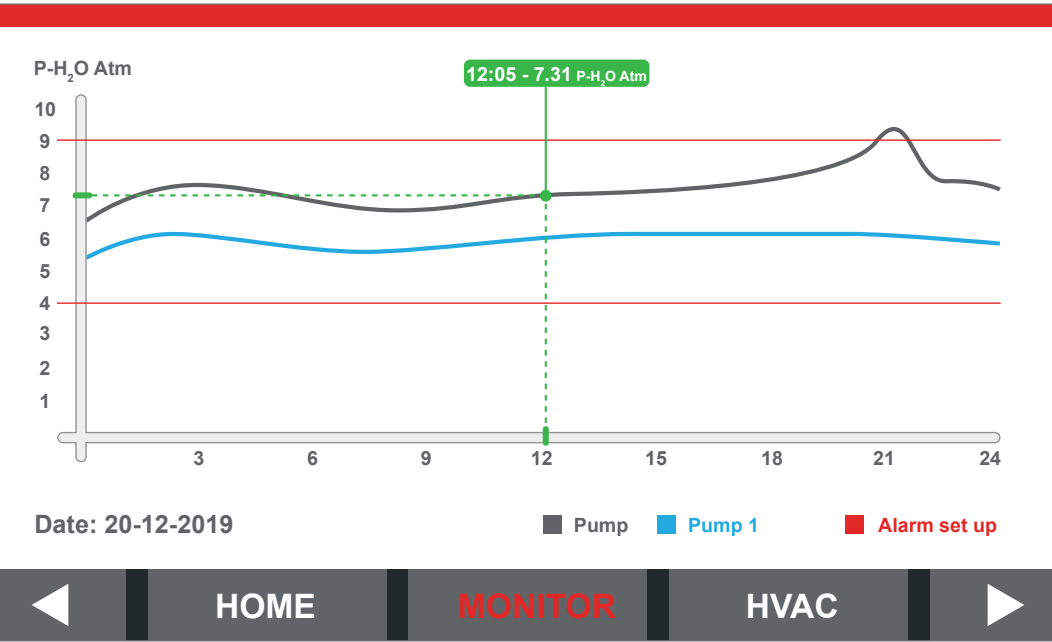
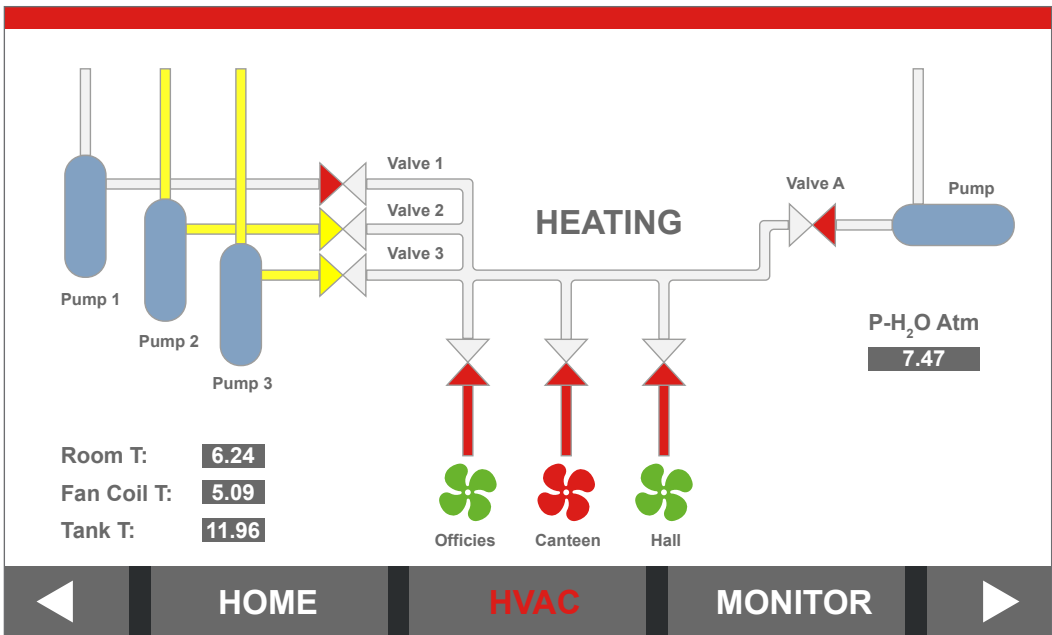
Learn more



# A combination of tools in one solution

**In a medium to large industrial site or building, the need is to collect a massive amount of data generated by field devices like meters and sensors to implement an Energy Efficiency plan.**

In such applications, architecture complexity is a rising problem, together with additional integration needs and a high level of data exchange. In addition, to be able to achieve the saving goals, also data interaction and logic complexity have to be managed properly. XAP 1.0 is the solution to those problems, being one core device with easy protocols management, able to manage a high level of data exchange and interactions with proper logic tools. In an ordinary architecture, the configuration of the whole system may impact the TCO (Total Cost of Ownership), that's why XAP 1.0, as an advanced system, uses an advanced user interface so to be more effective, and SCADA functions or web pages can be created for any type of application.



# Active control

## Beyond communication networks

### From DALI control to tunable white

The UWP 3.0 SE platform can be enhanced, if needed, adding to the BACnet/IP communication bus also the DALI worldwide standard bus.

Helping the application to maximize energy efficiency in relation to the external environmental conditions and occupancy of the building, while providing the highest levels of comfort, safety and quality. Lighting in buildings, is one of the major areas to focus on in order to reduce electricity costs, so the ability to control and monitor is a key feature that can easily be achieved by means of both flexibility and scalability of the UWP 3.0 SE platform. The provided main control strategies are:

- daylight harvesting, which provides automatic dimming to compensate for the amount of natural light;
- automatic sunrise and sunset calculation;
- real-time clock and schedulers to switch ON/OFF, dim or change scenario;
- light level control according to people presence and timers;
- zone control.

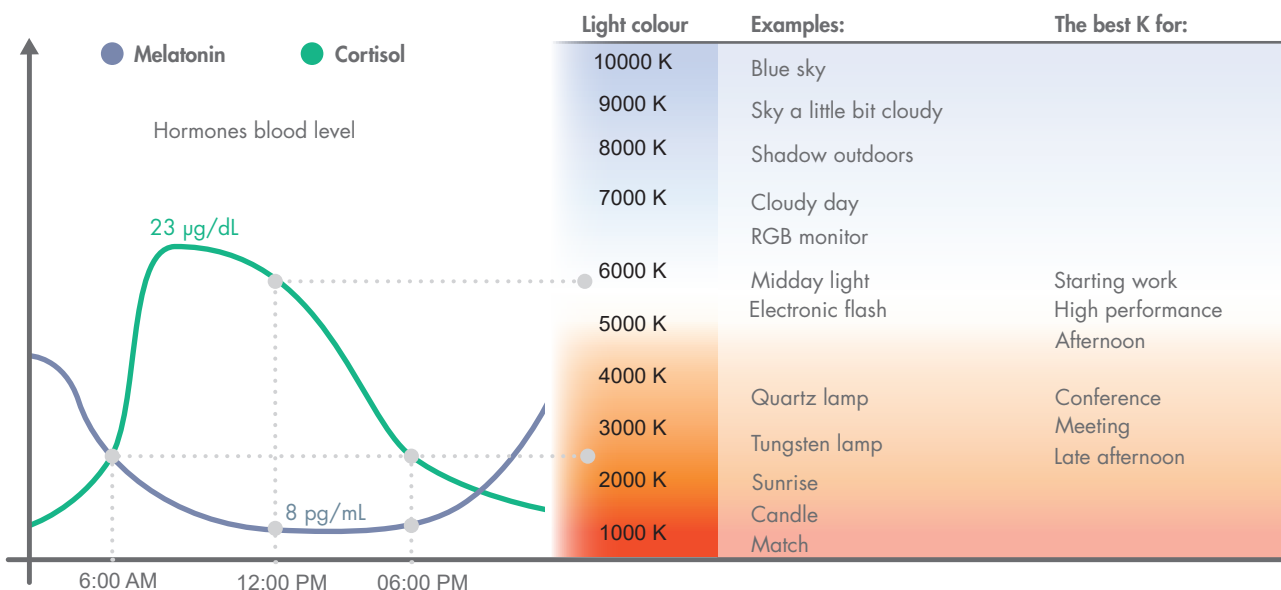
#### Lighting strategies are connected to building occupants

These advanced functions are not enough to meet the more demanding lighting needs, which nowadays are not limited to the energy savings only. The Carlo Gavazzi platform implements, through specific DALI master units also the DALI (Digital Addressable Lighting Interface) bus. This means a unique and wide range of control strategies which can be adapted at any time according to the changing needs of the building occupants. The remarkable success of DALI is also due to its very easy installation (just two non-polarized wires with free topology), its low commissioning costs (no certified wires or fees are required) and last but not least, its scalability and flexibility.

Nowadays people are the most important resource a Company must take care of: people engagement, mood, and commitment can easily be enhanced taking care of the work space in terms of CO<sub>2</sub> level, temperature and illumination, which means people performance and efficiency. This means, in different words, that people's biological clock is regulated by light and darkness as shown in the graph below.

#### The temperature of white light influences people's performances

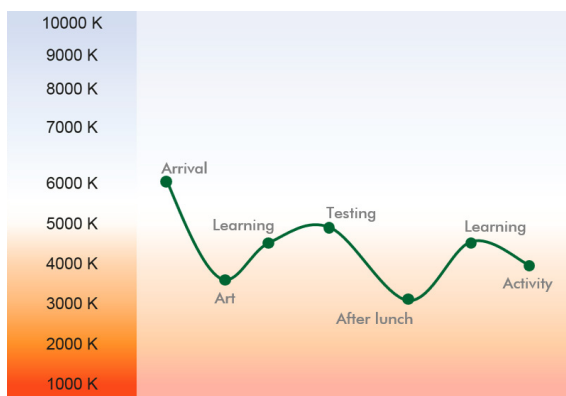
The graph shows how our hormones change during the day according to the color temperature: cortisol is our waking hormone, whilst melatonin controls our sleeping rhythm. A warmer temperature is more relaxing, while a cooler temperature creates a motivating environment. As a consequence, the white colour of lamps influences people's performance and efficiency. Thanks to an ever-improving LED technology, all the mainstream LED lighting companies are moving to offer products which can change the white of the light from warm (2500K) to cold (6000K) to follow the behaviour of natural white. This feature is called "Tunable white" or Kelvin colour temperature change or CCT (Correlated Color Temperature) and is the capability of changing the temperature (K) of the color of the light.



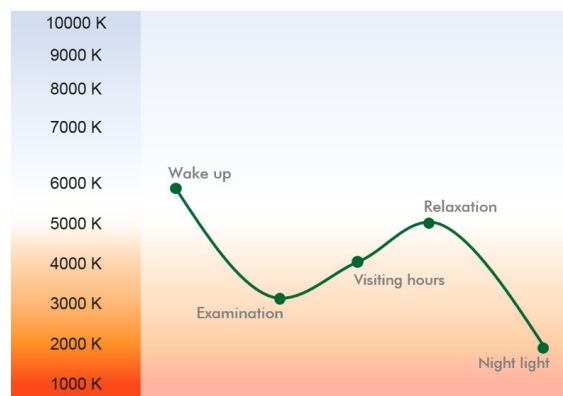
# Lighting exposure has an impact on the mood

**In offices where people have little access to the beneficial properties of daylight, static lighting conditions might disrupt the biological rhythm.**

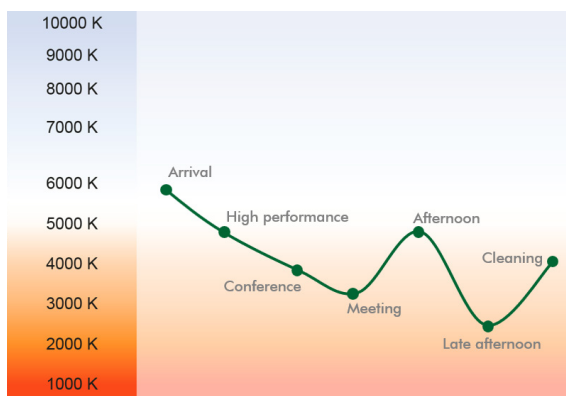
Thanks to the SB2-DALI specific module and the embedded "Tunable White" features, independently from the external environmental conditions, it can provide the perfect atmosphere for each activity during a working day. Cooler temperatures to support concentration and focus or to compensate for an afternoon dip in energy levels, warmer temperatures during activities which require creativity and cooperation.



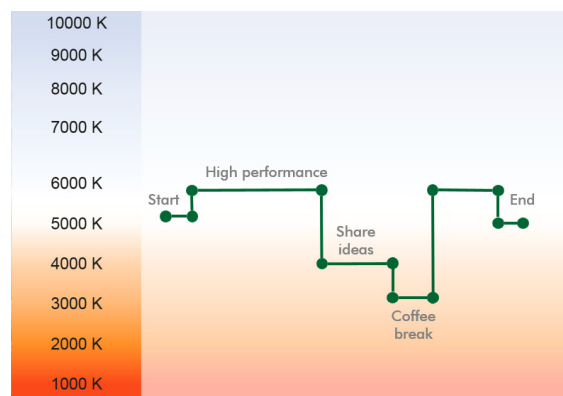
Light temperature vs. daily activity in a school.



Light temperature vs. daily activity in a hospital.



Light temperature vs. daily activity in an office.



Light temperature steps vs. daily activity in an office.

## Lighting system and humans health

Additionally, studies have shown that light exposure has an impact on the mood and reduces symptoms of depression in individuals. Exposure to light has also been directly linked with health and can affect how we recover and heal. Rooms with large, sun-facing windows reduce recovery time for patients suffering from severe depression and those recuperating after heart attacks, compared to similarly afflicted patients in rooms with windows facing buildings or other obstructions. Reduced exposure to daylight has been linked to the onset of depression and impairment of cognitive function in individuals. Studies show strong links between better views, brighter light and better performance in office environments.

The lighting environments where humans spend their time impact their visual, circadian and mental health. Currently, lighting conditions in most spaces are designed to meet the visual needs of individuals but do not take into account circadian and mental health. This presents an opportunity for projects to provide lighting conditions required by humans for optimal health and well-being.

WELL aims to provide a lighting environment that reduces circadian phase disruption, improves sleep quality and positively impacts mood and productivity.



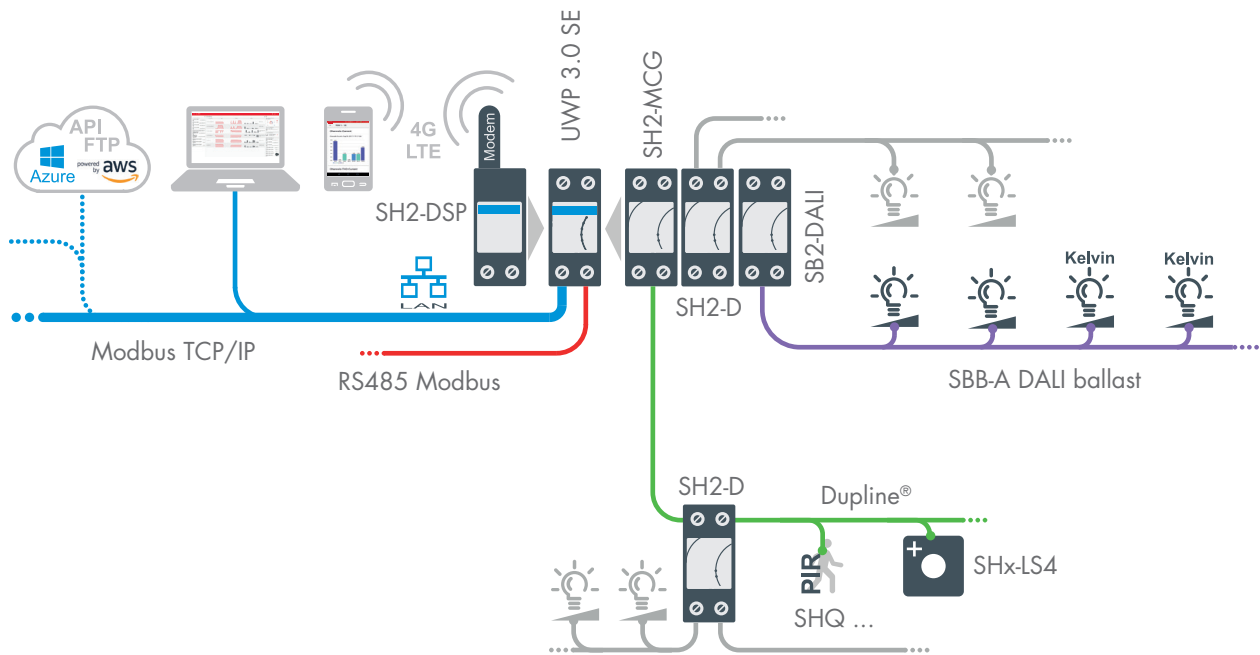
# Active control

## Precise control for a green building

### The evolution of the lighting

**If most energy waste is due to inefficient room temperature management, misuse of lighting is largely underestimated.**

It doesn't matter if the building is for industrial, commercial or public use, the common problem is how to make lighting part of the energy efficiency plan, but also, how to make people more efficient. As proper ON/OFF light switches are an obvious part of this offer, passive infrared (PIR) movement detectors with programmable sensitivity and embedded lighting measurement together with light dimmers are the offer completion to carry out an effective control by automatically switching off the lights when either people are not occupying the room or there is enough day light in the room.



#### SB2-DALI and SBB-A

##### SB2-DALI

- Dupline® bus interface to DALI controller with embedded power supply unit capable to manage up to 64 DALI ballasts
- Up to 7 SB2-DALI can be connected to one Dupline® bus, depending on the configuration of the DALI groups
- 2-DIN module housing
- 230 V ac power supply

##### SBB-A

- 2 constant current output channels, total output power up to 50 W
- Output current level selectable from 250 mA - 1500 mA
- Built-in DALI interface, DALI DT6 and DT8 ballast. DALI approval
- Colour temperature adjustment: device Type 8, colour Type Tc

#### SHQ, SBQ, SHx-P90

##### SHQ

- Passive infrared detector (PIR)
- Detects movement and presence
- Indoor and outdoor applications
- Dupline® bus powered
- Lighting measuring range: 0 – 20 K lux
- Walk test: LED indication
- Programmable sensitivity

##### SHQ/SBQ

- Operating angle: 360°

##### SHx-P90

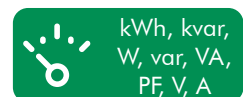
- Operating angle: 90°
- 4 individually programmable push buttons

#### SHx-LS4

- 4 individually programmable push buttons
- Integrated temperature and humidity sensor
- Temperature range: -40 – 60 °C
- Humidity range: 5 – 95 %
- Dupline® bus powered
- SHA4: designed to fit into wall sockets and frames from Fuga, NIKO, and BTicino
- SHE5: designed to fit into wall sockets and frames from Elko, Gira, and Jung

#### SH2-D

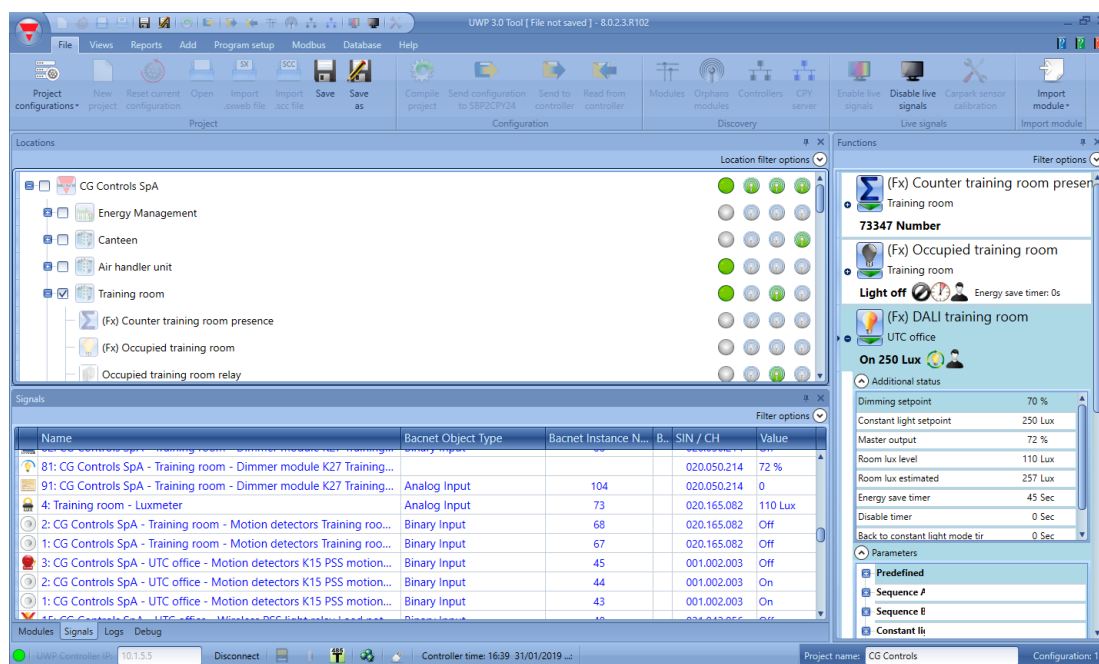
- Universal dimmer switch for R, L, C loads up to 500 W and LEDs loads
- Two models available: with and without embedded energy analyzer
- Automatic load type detection: R, L, C
- LED-indications for power supply, bus and output status
- Push button for local ON/OFF switching
- 2-DIN module housing
- 115/230 V ac power supply



## A software to configure quickly and easily your system

**Programming is half of the cost of an installation, but thanks to the UWP Tool configuration software, this activity is extremely shortened.**

The master unit UWP 3.0 SE is programmed by means of the configuration software UWP Tool, freely downloadable from the Carlo Gavazzi website. UWP Tool has been developed to make commissioning fast, easy and error free. It guides the user step by step in the creation of the map of the installation and of the automation functions. Furthermore, it is an essential tool for the diagnostics of the installation: the bus and any connected device can be easily monitored.



### Fast commissioning

As soon as the software is connected to a master unit UWP 3.0 SE, it scans the network and finds all the connected modules. Thanks to this feature, the installer doesn't have to worry about any addressing of the modules, since it is done automatically.

### Report

Anything which is happening in the system is monitored in order to issue a warning if something goes wrong. All this information is logged in a file so that the installer can check it any time.

### Diagnostics

Should any trouble occur, the system provides powerful diagnostic functions in order to make fault finding much easier. The bus is always monitored, providing information about short-circuits, bus voltage and bus load, noise level, and quality of the bus signals.

### Clear view

When commissioning a project, it is very important to have a clear overview of the installation to place modules and quickly create logics. Afterwards, a well-structured location tree will help in reminding what has been done or troubleshoot.

### Save time

The icon and picture based wizard guides the installer/integrator in a straightforward and error free programming, since everything is very immediate and no memory efforts are required.

### Easy testing

Thanks to the live signals function, it is very easy and straightforward to test the logics. Everything can be done in front of the PC: enabling and disabling the functions, changing the parameters to reach the perfect settings, or trouble shooting.

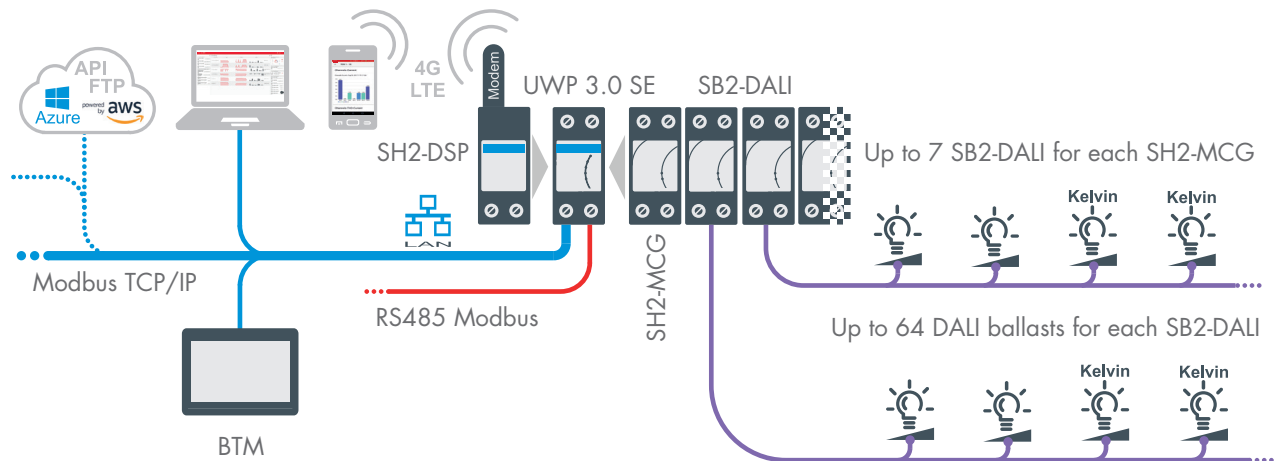
# Active control

## Not only lighting efficiency

## Energy efficiency and people efficiency

**DALI technology makes a working ambient more energy efficient but also more people efficient.**

The DALI technology which Carlo Gavazzi has embedded into the SB2-DALI unit is a step beyond an energy efficiency program, since it provides, through the available LED-based lighting systems, functions like "Tunable white" and "lighting scenarios" to influence people's working performance.



### ■ People efficiency can make a company more competitive

Understanding business energy costs, energy management, and people efficiency can make a company more competitive. This depends not only on energy efficiency and energy management, but also on the working environment for the workers. The latter can be addressed and improved by the control of CO<sub>2</sub> level, temperature and illumination which means people performance and efficiency. Being able to change the working environment according to specific needs is the key to the success of the solution. That's why Carlo Gavazzi provides a dedicated end-user app to turn a smartphone into a powerful remote controller. It also provides a family of HMI panels with 7", 10" and 15.6" display footprint including also BTM Studio suite that includes a powerful integrated development environment to design and manage a wide range of applications so to meet all the energy saving strategies.

#### ■ BTM-T7, BTM-T10

##### BTM-T7

- 7", 800 x 480 pixel
- Dimensions 187\*147\*34 mm

##### BTM-T10

- 10", 1024 x 600 pixel
- Dimensions 282\*197\*34 mm

##### BTM-T7 and BTM-T10

- TFT resistive touchscreen, 64 k colours
- 1 Ethernet port, 1 USB port, Multistandard serial port
- Linux operating system
- Fully programmable by IDE software
- IIoT data distribution via MQTT and OPC UA
- BACnet, Modbus communication protocols
- Data logging
- 24 V dc power supply

#### ■ BTM-T15

- 15.6", 1366 x 768 pixel HD
- Dimensions 422\*267\*64 mm
- TFT capacitive multitouchscreen
- 16 M colours
- 3 Ethernet ports, 2 USB ports, SD card slot, multi-standard serial port
- Linux operating system
- Fully programmable by the IDE software
- IIoT data distribution via MQTT and OPC UA
- BACnet, Modbus, KNX communication protocols
- Data logging
- 24 V dc power supply

#### ■ BTM Studio suite

This Windows suite is made by three licenses:

##### BTM-PC-IDE software

- large embedded widgets library to design and manage HMI projects
- Wide range of communication protocols to meet all different application requirements
- OPC UA server / client for Industry 4.0 applications to exchange data among HMI, PLC and devices
- MQTT service for IIoT messaging compatible with any MQTT broker
- Unified programming approach for native and web HMI applications with HTML5 and Javascript support
- Easy integration into the UWP 3.0 SE ecosystem through plug and play import of Modbus maps and EDE BACnet files

BTM-PC-RUNTIME: A powerful PC Runtime application turns any Microsoft® Windows® computer into a HMI panel

BTM-PC-CLIENT: is a viewer

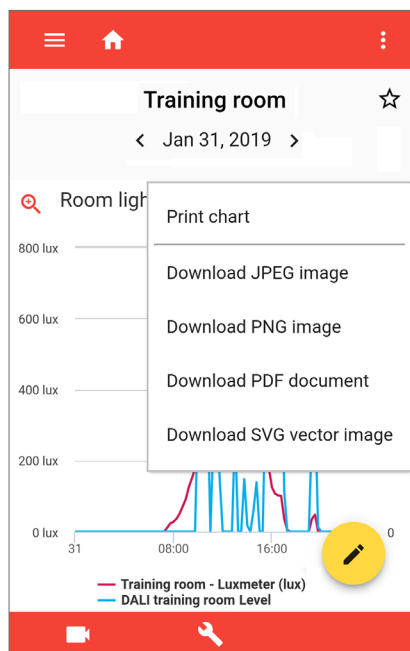
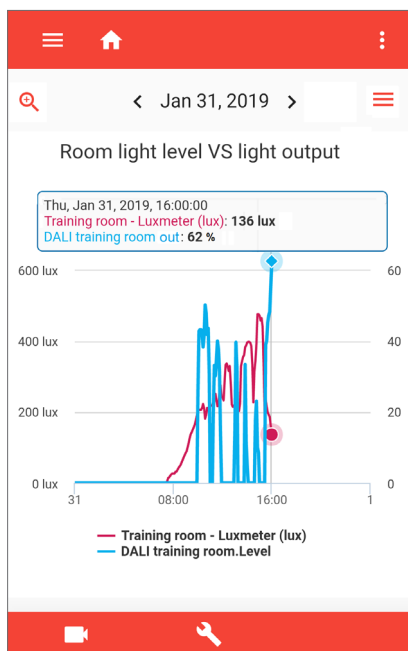
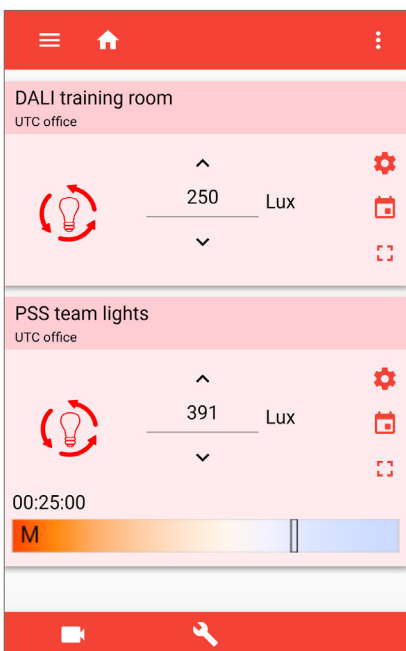
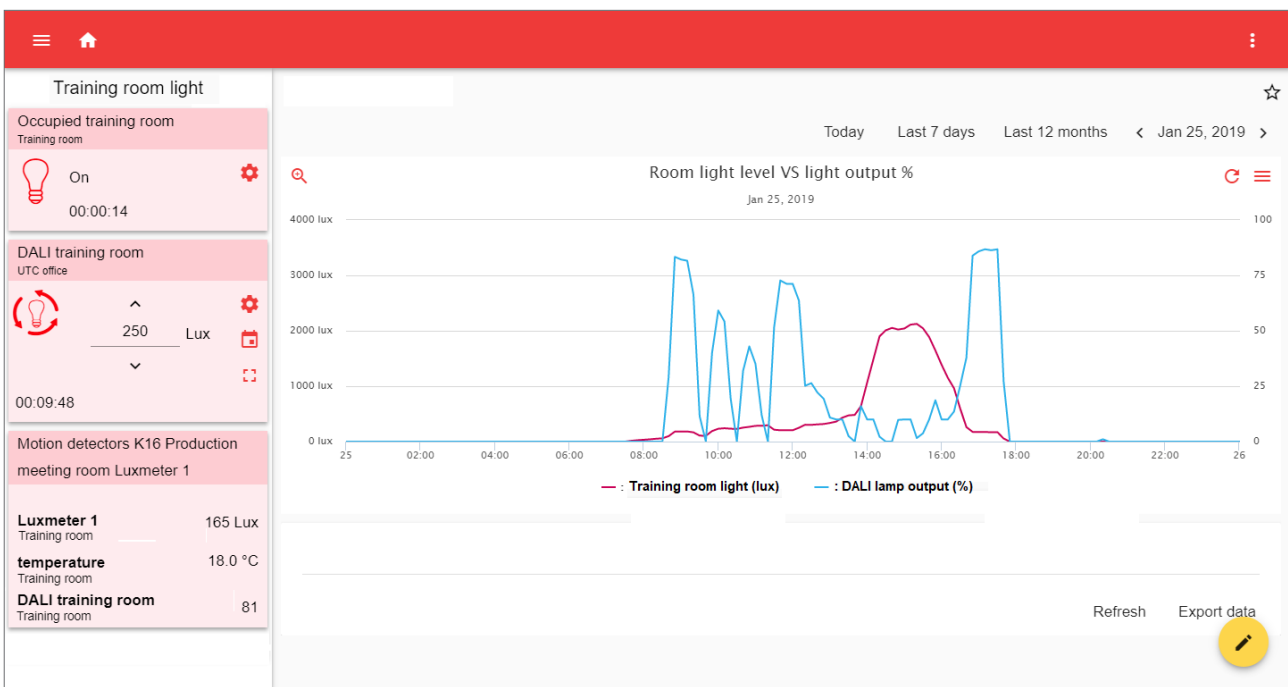




# Right at your fingertips

**In today's world, apps are essential tools for our everyday life: so why don't you control your building via an Android or iOS device?**

Any mobile device can be turned into a remote controller thanks to the integrated web app and the ownControl app, available both for Android and iOS phones/tablets. The pages of the App can easily be customised with graphs to monitor the consumptions, the temperature of a room or the level of a light. Many widgets are available to switch and dim lights, to change temperatures, to set the curtains position and in general to remotely control any function of the system. Furthermore, webcams can be easily integrated into the App to have a 360° supervision of the building.



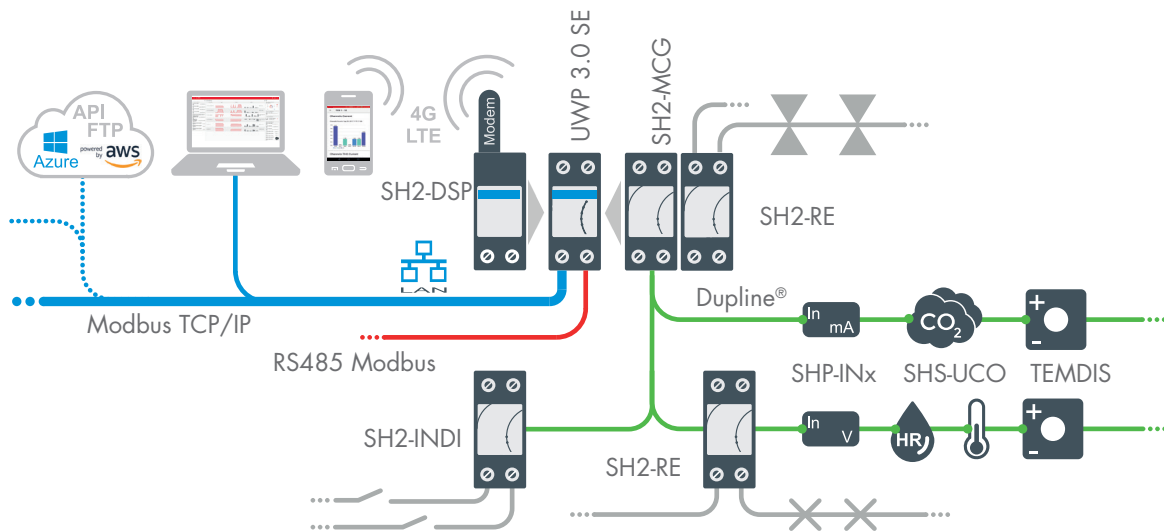
# Active control

## From environment to actions

### From wired environmental probes to I/Os

Sensors are essential components of every metering and control system.

In Industrial, commercial, and public buildings, the combination of temperature, humidity, CO<sub>2</sub>, and other non-electric and electric variables is essential to the management of the proper energy vectors. This means that air heating, cooling and ventilation, but also air quality information must be collected and managed to implement a proper energy efficiency plan. The UWP 3.0 SE platform, equipped with bus powered smart field devices, is the most effective answer, featuring specific field units, such as analog inputs to measure signals from various temperature sensors, but also standard process signals (10V/20mA); single and combined wall mount sensor units with onboard display, digital inputs to detect alarms and ON/OFF switches, smart relay outputs to activate valves/actuators with signal feedback (by means of embedded energy analyzers) for real-time diagnostics, and last but not least, remote controllers with embedded display. To be able to meet the different installation needs, most of the devices have specific configurable functions.



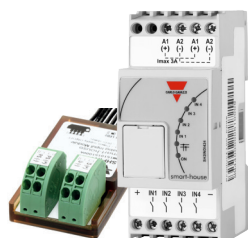
#### SHSU

- Room sensors for CO<sub>2</sub>, temperature and humidity measurement
- Available with/ without display, or RGB LED
- Temperature range: -20 – +50 °C
- Humidity range: 0 – 100 %RH
- CO<sub>2</sub> range: 0 – 2000 ppm
- Easily mountable
- Dupline® bus powered
- Low energy consumption



#### SHP-INx, SH2-INDI

- SHP-INV3: 3\*0 – 10 V adjustable inputs
- SHP-INA2: 2\*0/4-20 mA adjustable inputs
- SHP-INV2T1P1: 2\*0-10 V dc + 10K3 thermistor + 1-11 kΩ inputs, 24 V dc powered
- SHP INT: Pt1000, Ni1000, 10K3 thermistor, 1-11 kΩ potentiometer inputs, Bus-powered
- SHP IN: 4 contact ON/OFF/counter inputs. Count reset via Dupline® (optional)
- SH2-INDI: 4 PNP/NPN/contact inputs also with counter function, Bus-powered in 2-DIN modules



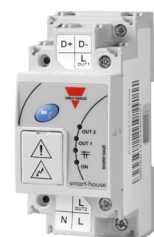
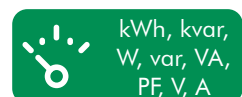
#### SHx-TEMDIS

- Temperature controller with display
- Shows current room, outdoor, and auxiliary temperature
- Turns ON/OFF heating and cooling
- Energy Save through 3 different setpoints: comfort, activity, economy
- Dupline® bus powered
- SHA4: designed to fit into wall socket from Fuga, Niko, and BTicino
- SHE5: designed to fit into wall socket from Elko, Gira, Schneider, Siemens, and Jung



#### SH2-RE

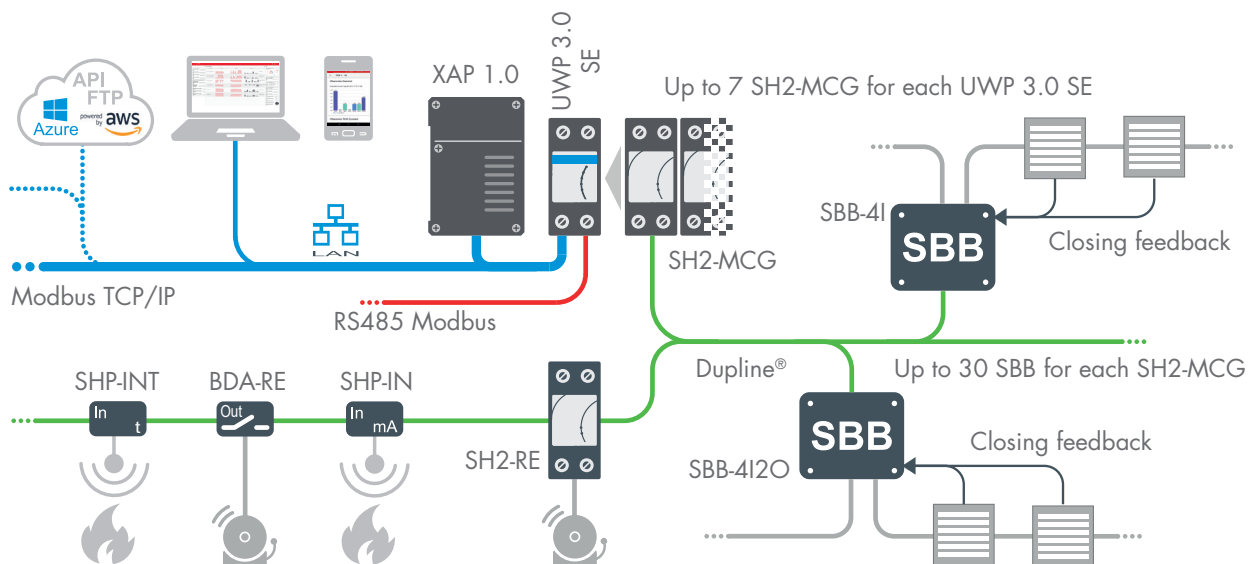
- 2 or 4 relay outputs with embedded energy analyzer
- LED-indications for power supply, bus and outputs status
- Push button for local ON/OFF switching
- 2-DIN module housing
- 230 V ac power supply, Dupline® bus powered, 24 V dc
- Connection to other cabinet modules via local bus



# Fire Damper control solution

## How to prevent the spread of fire inside the ductwork in buildings with fire-resistance rated walls and floors?

Fire dampers are passive fire protection products largely used in industry, public buildings, shopping malls, airports, and indoor car-parks or multi-storey garages. In those places, fire dampers are used to prevent the spread of fire inside heating, ventilation, and air conditioning (HVAC) ducts. When a rise in temperature occurs in standard installations, the fire damper closes, activated by a thermal element which melts at temperatures higher than room temperature but low enough to indicate the presence of a fire, allowing springs to close the damper blades. In more advanced solutions, fire dampers closure is initiated by an electrical signal from a fire alarm system, utilising remote detectors, indicating the sensing of heat in the building occupied spaces or in the HVAC duct system. Carlo Gavazzi, among the different product solutions for energy efficiency and building automation, provides a ready-to-use junction box for fast and easy decentralized installation, capable to monitor and control up to two fire damper actuators. This junction-box, being based on the Dupline® bus technology, is part of the UWP 3.0 SE platform and XAP 1.0 BMS system. UWP 3.0 SE can manage, for every Dupline® generator (SH2-MCG), up to 60 fire dampers.



### BDA-RE

- Small sized single relay output
- Load: 16 A/ 250 V ac
- Withstands 130 A inrush current
- Dupline® bus powered

### SH2-RE

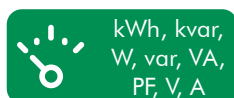
- 2 or 4 relay outputs with embedded energy analyzer
- LED-indications for power supply, bus and outputs status
- Push button for local ON/OFF switching
- 2-DIN module housing
- 120/240 V ac power supply, Dupline® bus powered, 24 V dc
- Connection to other SBB units via Dupline® bus

### SBB-4I

- Robust module for decentralized installation near or directly on fire dampers
- Designed to monitor two fire dampers
- 4 contact inputs (voltage-free)
- Easy wiring of the system
- Cost-effective design
- Dupline® bus-powered

### SBB-4I2O

- Robust I/O-module for decentralized installation near or directly on fire dampers
- Designed to control two fire dampers
- 4 contact inputs (voltage-free)
- 2 relay outputs (230 V ac/ 3 A)
- Easy wiring of the system
- Cost-effective design
- 120/240 V ac, 24 V ac/dc power supply



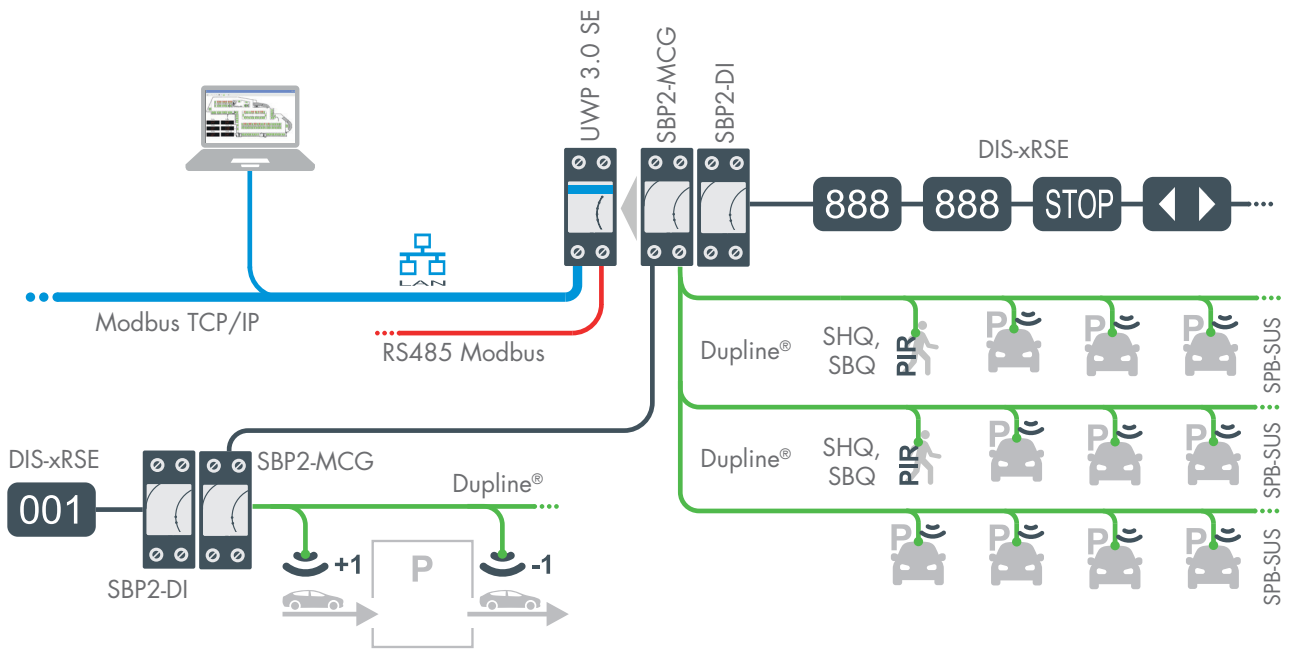
# Active control

## Indoor car parking guidance system

### A profitable and fully integrated solution

**A modern indoor car-park or multi-storey garage needs to be both energy and service efficient.**

In a car park or a multi-storey garage, lighting and ventilation are the big energy consumers, and in many cases they are ON all the time. In this case, being energy efficient, means intelligent demand-based control where lighting levels are based on the presence of people and cars, and the speed of ventilation fans is based on actual measured CO<sub>2</sub> levels. Being fire protected means to manage a proper fire protection system based on fire dampers. Car parks or multi-storey garages sell services based on car occupancy and, being part of a wider system (like an airport or a shopping mall) they are integrated in a global service system. Providing a quality service and having an adequate profitability is a mandatory condition! Carpark 3 with its web-server-based management software is the answer to manage the car park efficiently. The car park operator will be able to monitor the real-time status of the entire car park through a graphical user interface taking actions in case of alarms or high occupancy rates. Spaces for specific purposes can be reserved manually by selecting a specific colour for the LED indicators, or using a calendar-based scheduler. All parking events are logged into the database, so as to build up a powerful analysis tool aimed to improve the car park service performance.



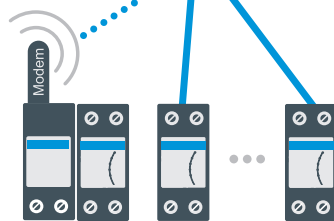
Up to 90 combined SBP-SUS, SHQ, SBQ sensors for each SBP2-MCG. Up to 7 SBP2-MCG for each UWP 3.0 SE

#### Carpark server SBP2-CPY

- Carpark server which links together up to 10 UWP 3.0 SE controllers
- Manages the parking guidance system
- Built-in web server with parking management software
- Data export to Excel® format
- One Ethernet port
- 12 – 28 V dc power supply
- DIN-rail mounting



TCP/IP



Up to 10 UWP 3.0 SE

#### DIS-xRSE

- Bright RGB LED matrix
- Selectable symbols
- Visible at a distance of more than 50 m
- Brightness control
- Settings are configurable from the embedded webserver
- Indoor and outdoor use - IP55
- Extended temperature range, up to -30°C
- Up to 4 digits, 2 symbols and running text
- 24 V dc power supply



#### SBP2-DI

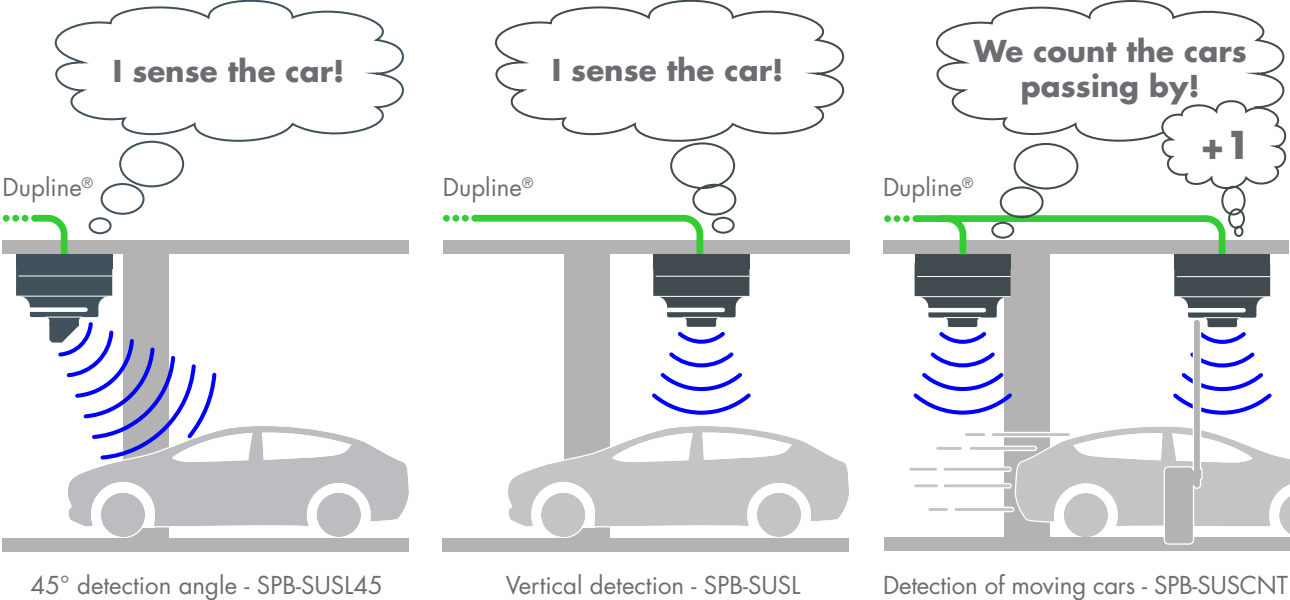
- Gateway to connect the displays DIS-xRSE to the Dupline® network
- 2-DIN module housing
- Can be mounted up to 300 m away from the display



# Better utilisation - higher revenue

**Reduce stress and frustration of users, enhancing your car park with a guidance system.**

The first thing users will notice when entering the carpark is how great it looks. Bright indicator lights in different colours, beautiful direction displays, and aesthetically designed sensors all together create an impressive scenario that will attract attention. The next thing users will enjoy is the easily comprehensible guidance function. By following the direction displays with dynamic green arrows, they will be led to the nearest driveway with vacant spaces. Once there, the drivers just have to look for the bright green LED lights indicating vacant spaces. In this manner the service will be improved, but there is more to it than that. You will achieve a better utilisation of the carpark, an improved efficiency through powerful supervision and analytics software tools, and a significant potential for energy savings.



- SBP-SUSL45**
- Ultrasonic sensor with a 45° detection angle for mounting outside the parking bay
  - Power and communication via the Dupline® 3-wire bus
  - Clearly visible LED indication in a 360° visual angle
  - 8 selectable LED colours to use for status indication
  - Protected against dust and moisture

- SBP-SUSL**
- Ultrasonic sensor with a vertical detection angle for mounting directly above the car
  - Power and communication via the Dupline® 3-wire bus
  - Clearly visible LED indication in a 360° visual angle
  - 8 selectable LED colours to use for status indication
  - Protected against dust and moisture

- SBP-ILED**
- Additional LED indicator to be used in conjunction with the sensor SBP-SUSL
  - Power and communication via the Dupline® 3-wire bus
  - Clearly visible LED indication in a 360° visual angle
  - 8 selectable LED colours to use for status indication
  - Protected against dust and moisture

- SBP-SUSCNT**
- Vertical sensor to be mounted directly above the driving lane
  - Designed for detection of moving cars in a count system
  - Detection of cars running at speeds up to 20 Km/h
  - Power and communication via the Dupline® 3-wire bus
  - 8 selectable LED colours to use for status indication
  - Protected against dust and moisture



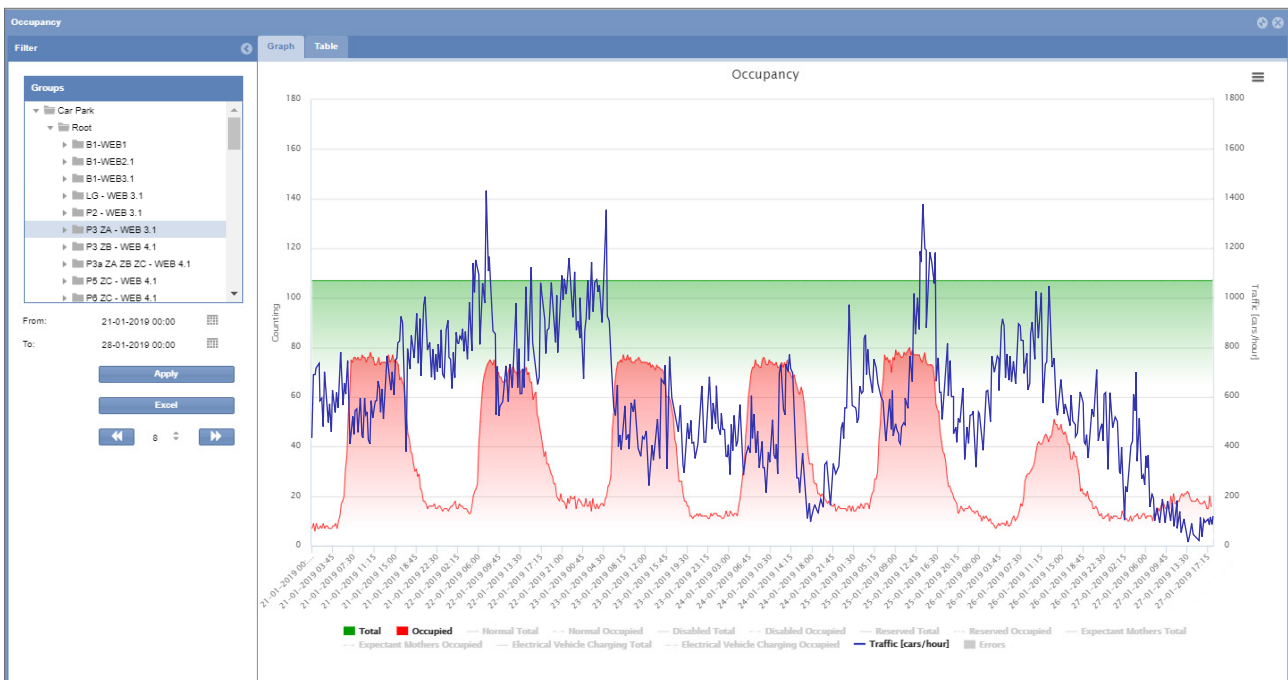
# Active control

## Indoor car parking guidance system

### Effective management through the built-in webserver

Immediate overview about the parking bays status helps you manage in an efficient and cost-effective way your parking installation.

UWP 3.0 SE provides a graphical user interface and management tool via the built-in web server, which can be accessed from any PC. This software provides a complete overview of the status of the carpark in real-time: each bay and its display can be monitored, occupancy rates and statistics for the different types of spaces and areas of the carpark can be viewed as bar graphs. Alarms about occupancy time or rate pop up on the screen and are recorded in the alarm log, allowing the operator to take immediate action if needed.



## Notes

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## OUR COMPETENCE CENTRES AND PRODUCTION SITES

### DENMARK

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Hadsten

### MALTA

Carlo Gavazzi Ltd  
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### ITALY

Carlo Gavazzi Controls SpA  
Belluno

### LITHUANIA

Uab Carlo Gavazzi Industri Kaunas  
Kaunas

### CHINA

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