Making the Smart Grid Real

LV Digital Grid

Applications & Benefits

ZIV Supervision Systems for:

- Quality of Service and Power Quality (PQ) Improvement
- System Energy Losses Reduction
- DT Monitoring
- DER / ESS / EV Integration

ZIV Automation

ZIV is a leader in Protection, Control, Communications & Metering technologies generating Smart Solutions for HV, MV & LV Power Systems

A unique company that innovates to support customers in achieving their new business objectives by offering a complete portfolio of solutions born from experience and a broad vision of the grid.

15 customer support centers located in: Spain, France, UK, Ireland, UAE, KSA, USA, Mexico, Brazil, Singapore, Indonesia

References in 85 countries.

Over 40 years of cumulative experience

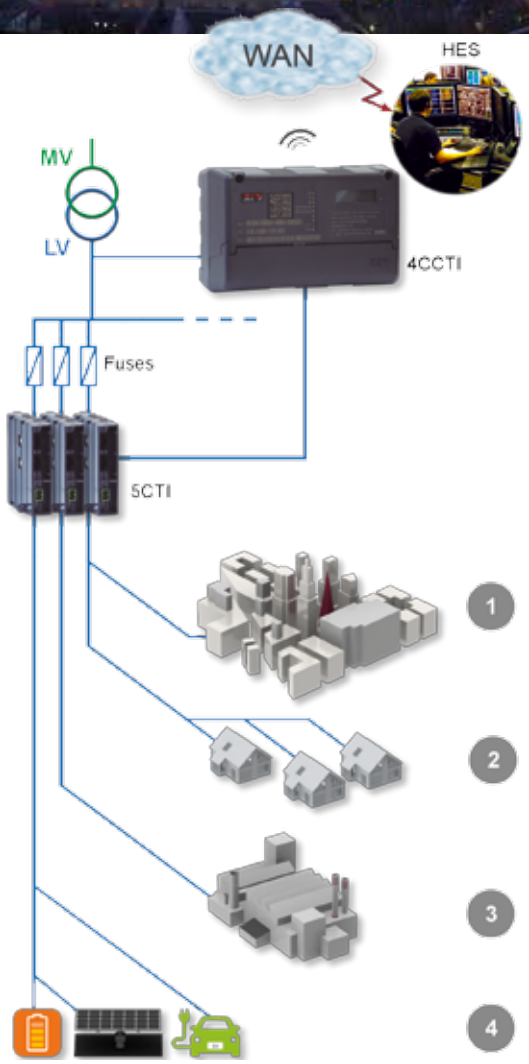
An active member of international technical fora and standardization committees

ZIV contributes to the development of sustainable networks offering fully digital solutions for:

Smart Metering
Advanced Metering Infrastructures +
EV Charging Solutions

Distribution Automation
LV Supervision Systems, MV
Supervision & Automation Solutions

Substation Automation & Telecommunication Systems
MV & HV
Protection, Control & Telecom Solutions



Low Voltage (LV) Supervision Systems

Continuously monitoring the supply enables **early detection of power outages** and power disturbances that may cause an impact on customers (Power Quality measurement). Status of blown fuses is reported to the operator as soon as they occur, **minimizing the interruption time**.

Loss and fraud detection by means of energy balancing in combination with Smart Meters and load balancing between feeders and phases are just an example of ways to optimize distribution grid efficiency.

Distribution Transformer monitoring → **Optimize Asset Management and Maintenance**

LV Supervision systems **facilitate DER / EV / Energy Storage Systems Integration**

Improved Quality of Service and Power Quality (PQ)

Continuity of supply is a must for DSO/DNOs, thus, reduction of the number (SAIFI) and duration (SAIDI) of power outages is the indicator of performance improvement for grid operators.

The use of loads (electronic devices and appliances, inverters…) sensitive to power disturbances connected to the grids is increasing too. Consequently, the measurement of power quality (PQ) parameters is becoming a need for network operators in order to minimize the impact of e.g. voltage sags, swells or harmonics on the clients.

ZIV Automation solution consists of two devices: the LV feeder supervisor and the LV controller.

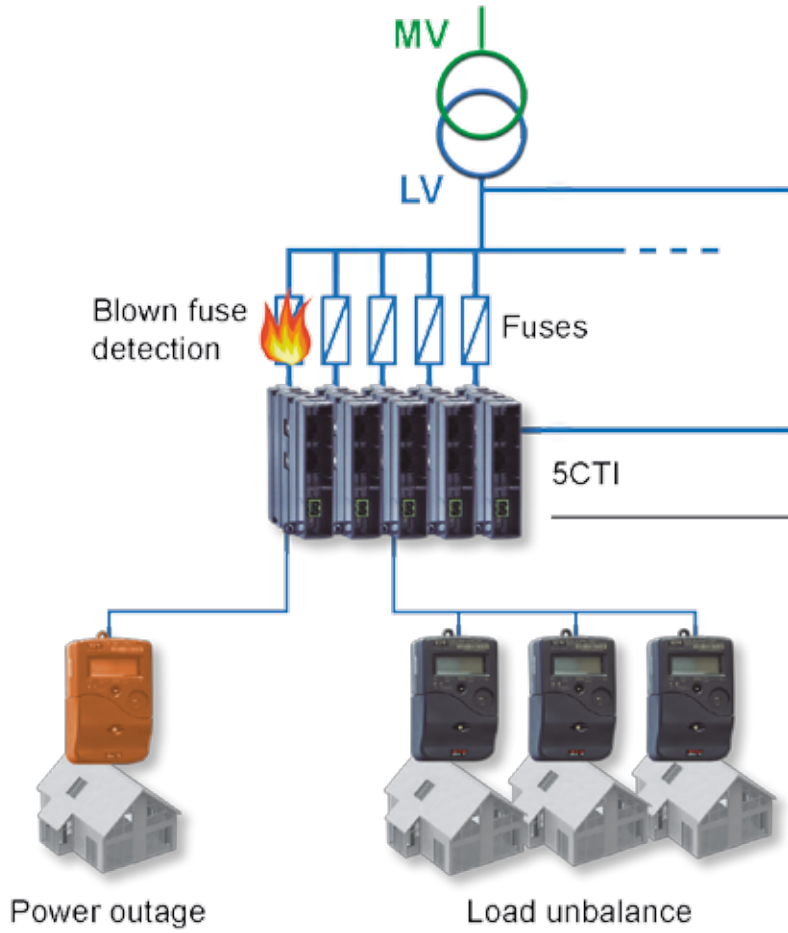
5CTI feeder supervisors allow to monitor every feeder output of the low voltage switchboard on the secondary of the distribution transformer.

- Three-phase voltage and current measurement.
- Blown fuse detection.
- Overcurrent and overload
- Loss of neutral

5CTIs are connected to a LV controller (4CCTI or USP 20) via a RS485 bus that provides valuable information:

- Three-phase voltage measurement.
- Power Quality measurement (voltage sags and swells, voltage variations, harmonics…) according to IEC61000-4-30 Class S
- Earth fault detection

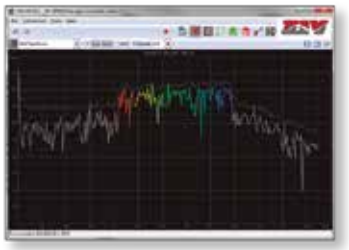
The measurement data is sent to a Head End System providing the operator with accurate and real time information that in combination with the SCADA facilitates the detection and location of faults in LV networks. As a result power outage time is significantly reduced.



Key Benefits

- ***Reduction of outage duration***
- ***Early detection of blown fuses***
- ***Minimize impact of loss of neutral***
- ***Online Power Quality monitoring***
- ***Improvement in grid operation capability/ Grid operator assistance and automated network operation***
- ***Great potential for further operation improvement in combination with other existing information systems (GIS, energy consumption historian, weather forecast).***

4CCTI



PQ measurement

Meter Code	Secondary Subst.	Event Description	Event Date
ZIV0037499641	Bay Avenue	Loos of neutral	11/11/2015 18:26
ZIV0037499641	Bay Avenue	Loos of neutral	11/11/2015 18:35
ZIV0037499641	Bay Avenue	Loos of neutral	11/11/2015 18:38
ZIV0037499641	Bay Avenue	Loos of neutral	11/11/2015 18:38
ZIV0037499643	Bay Avenue	Loos of neutral	11/11/2015 18:26
ZIV0037499643	Bay Avenue	Loos of neutral	11/11/2015 18:35
ZIV0037499643	Bay Avenue	Loos of neutral	11/11/2015 18:38
ZIV0037499643	Bay Avenue	Loos of neutral	11/11/2015 18:38
ZIV0037499648	Bay Avenue	Loos of neutral	11/11/2015 18:26
ZIV0037499648	Bay Avenue	Loos of neutral	11/11/2015 18:35
ZIV0037499648	Bay Avenue	Loos of neutral	11/11/2015 18:38

Loss of neutral

4CCTI - Advanced low voltage supervision and smart metering concentrator

- Head of the feeder LV supervisory meters (5CTIs) connected by RS485 communication bus.
- Earth fault detection
- Fault recording and oscillography
- Low voltage distribution transformer supervision function performed by an internal three-phase energy meter. Data concentrator of the measurements coming from the smart meters connected to it.
- Feeder detection algorithm which gives an updated LV circuit topology, mapping each end customer meter to the LV feeder and phase to which it is connected.

An Accurate Data Retrieval solution that provides key system information to improve the quality of service & PQ

The need: *Timely detection and reporting of network incidences to the DMS/OMS in order to restore service or correct undesired network conditions*

The solution: *Combine information from meters, feeder monitoring and transformer substation monitoring systems together with network operator actions to determine severity and extension of the incident.*

Reduction of System Energy Losses

Measurement of energy supplied from the transformer to the end users is crucial to detect system power losses due to essentially two factors:

- Efficiency of network components also known as technical power losses
- Fraud or so called non-technical or commercial energy losses

By comparing the total energy supplied by the transformer with the aggregation of the energy readings of the consumer meters, i.e. energy balancing, energy losses are detected.

5CTI feeder supervisors provide information that is combined with the data collected from the meters to obtain the mapping of meters to feeders (i.e. feeder mapping), often missing or not accurate enough.

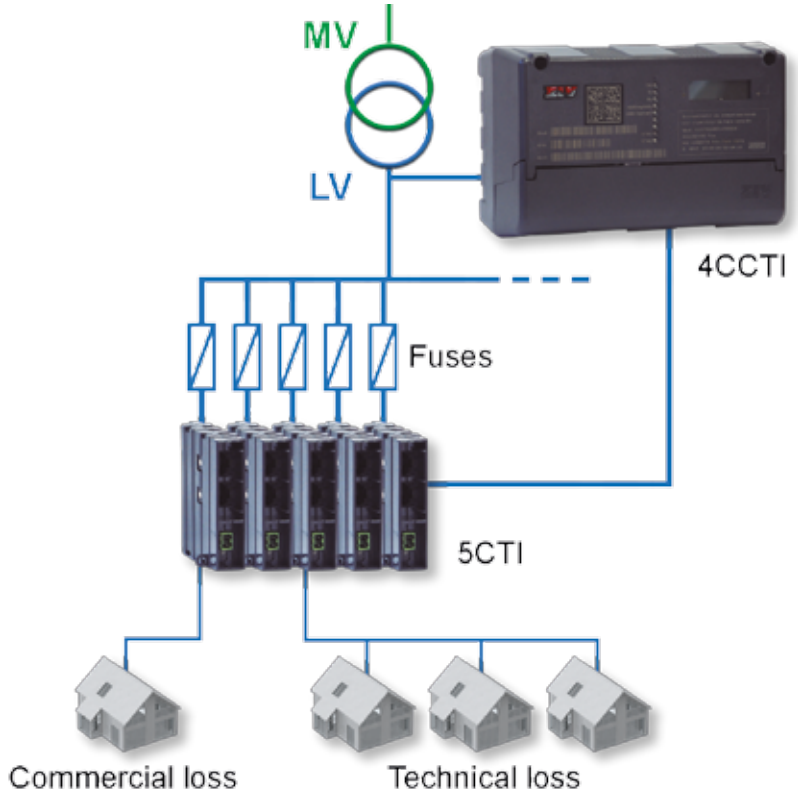
Differences between the transformer and feeder outputs and the energy consumption readings in meters show the total energy losses in the LV grid.

Data analytics is then required to discriminate between technical and non-technical losses.

As an additional benefit of the system capabilities, it helps to keep updated the location of meters data in the GIS (Geographic Information System).

Key Benefits

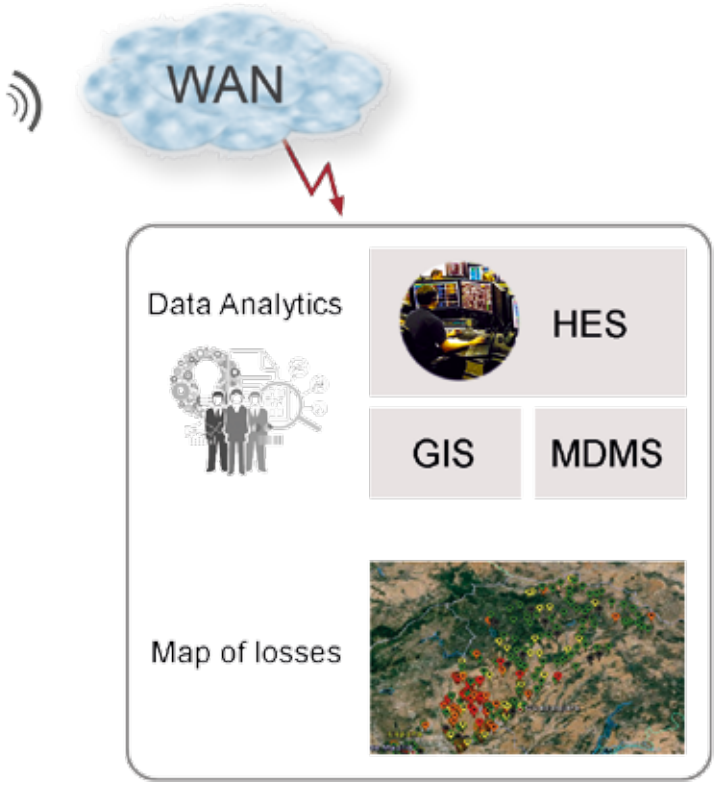
- ***Quantification of technical losses***
- ***Detection and location of commercial losses***
- ***Feeder and phase load unbalance detection and correction***
- ***Updated LV network topology***



Two ways of determining the LV feeder to which each meter is connected

5CTI - LV Feeder Supervisor

- Direct three phase voltage measurement.
- Indirect (CT required) current measurement.
- Average voltage per phase, average current per phase, average apparent power and average neutral current (calculated).
- Maximum (measurement in a cycle) voltage per phase, maximum current per phase, maximum apparent power and maximum neutral current (calculated).
- Energy recording. 6 energy values (imported and exported active energy and reactive in the 4 quadrants).



Based on **load variation matching** (requires adapted meters)

Based on **received PLC signal strength monitoring** (G3 PLC, PRIME…)
(it does not require adapted meters)

- Power Quality recording. Voltage variations outside the established thresholds, short and long voltage interruptions.
- Blown fuse detection.
- Overcurrent an overload detection
- Event recording.
- Smart meter feeder identification
- Communications protocol: DLMS/COSEM.
- Modular and expandable

Fraud Detection

Calculate energy losses in a transformer and LV feeder and compare with average network losses to detect deviations indicating irregular network performance. These particular locations are investigated to determine whether the inefficiency is due to fraudulent connection of consumers or poor performance of network components

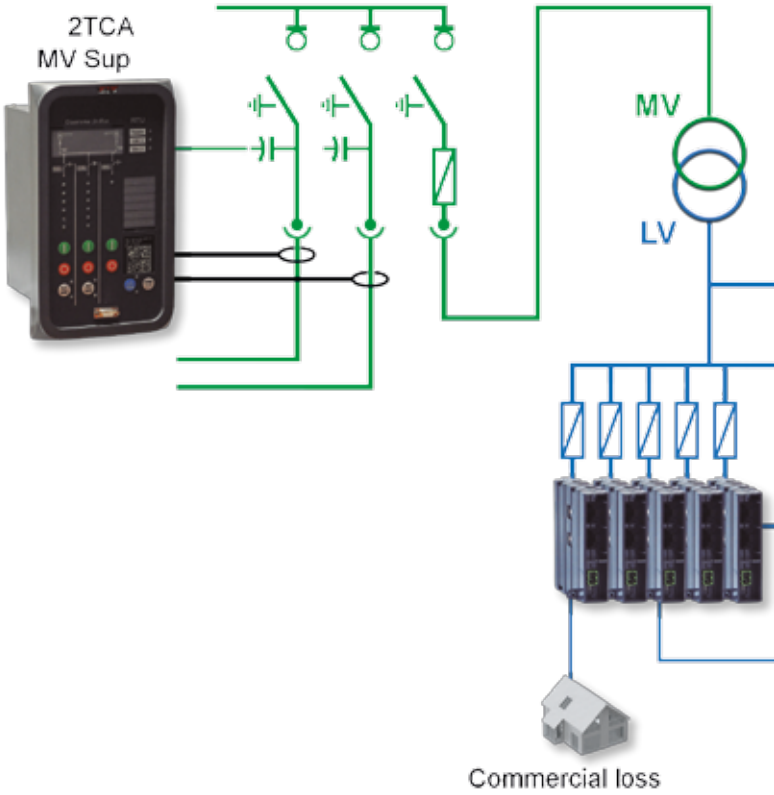
Distribution Transformer Monitoring

In combination with MV monitoring systems, the functionality of the LV supervision reaches out to every asset in a secondary substation. This includes the MV switchgear, LV switchboard and the distribution transformer.

For the latter, data coming from both systems must be combined in order to get accurate information about the state of health of the transformer.

Monitoring the performance of the transformer requires comparing the measurements on the primary (MV) and secondary (LV) sides. Together with environmental data, and other additional inputs, DSO/DNOs can make decisions on replacing a transformer or extending its life based on:

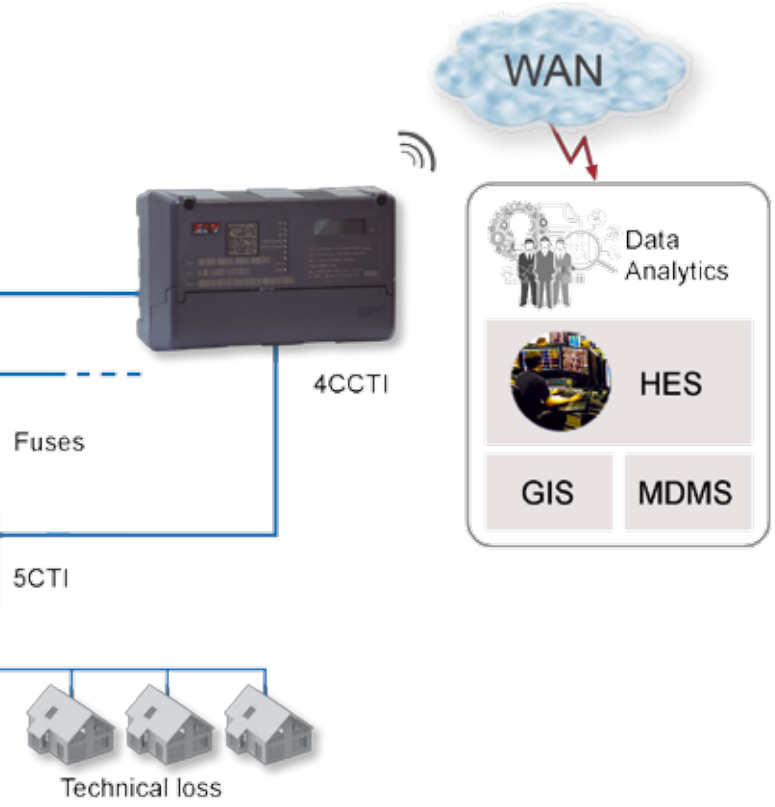
- Overload
- Losses
- Load unbalance
- Utilization factor



Information provided by the LV supervision systems helps in optimizing the management of the network assets and the economic return of the investment

Key Benefits

- ***Reduction of losses.***
- ***Switching load between transformers***
- ***Optimize secondary substation asset maintenance***



MV Supervision & Automation

TCA controllers implement MV supervision and automation functions for secondary substations switchgears in underground power grids, as well as for disconnection devices and reclosers in overhead power lines

MV supervision RTU with fault pass detector - 2TCA for RMU

- Telecontrol and fault pass detection for up to 3Lxp RMU.
- MV feeder current, voltage, active and reactive power measurement
- Local and remote operation
- Standard communication protocols: IEC60870-5-104 and DNP3.0.
- Advanced protection functions
- Cybersecure communications

LV Supervision systems facilitate DER / EV / Energy Storage Systems Integration

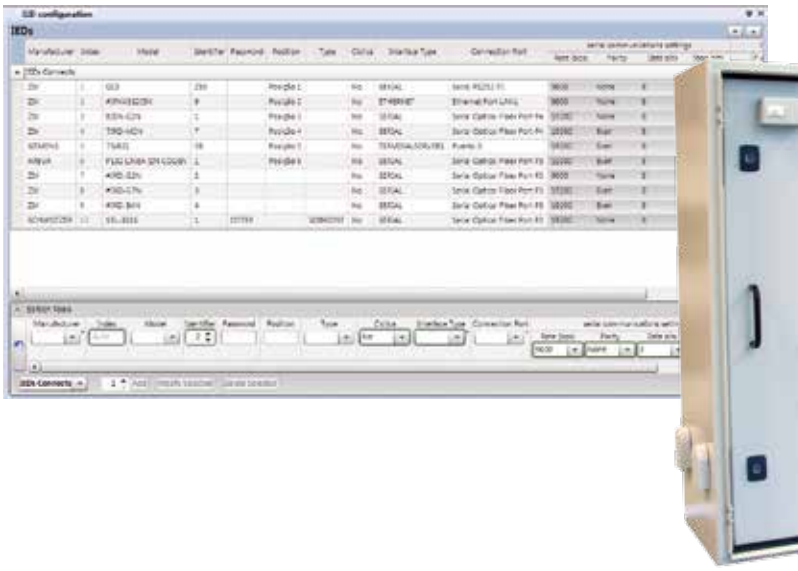
The exponential increase in the adoption of Distributed Energy Generation such as Photovoltaic (PV) and Wind has introduced significant challenges for DNOs when it comes to the control of network voltages and power flows at all voltage levels on their network. At times and when network conditions dictate, Generators are constrained. This results in inefficiencies in operation as well as lost generation.

ZIV Automation develops products and systems in response to industry demand for the intelligent management and control of Distributed Generation.

Genesis Controllers provide localized independent control of Distributed Generators in response to real time changes both at a local site level and to the network. The Generation controller provides a greater degree of control over both the constraint level and constraint type applied to a particular generator. It also allows for the Distributed Generator to operate in a number of alternative modes assisting the DNO to optimize the management of their network.

Genesis Generation Management Controllers allow the DNO to help optimize their network usage whilst assisting Distributed Generators to Maximize their Generation Capacity.

The Controllers can be totally standalone or easily integrated into an Active Network Management System. The Genesis Family of Controllers are modular compact Controllers providing a very cost effective solution for localized control of Distributed Generators.



Key Benefits

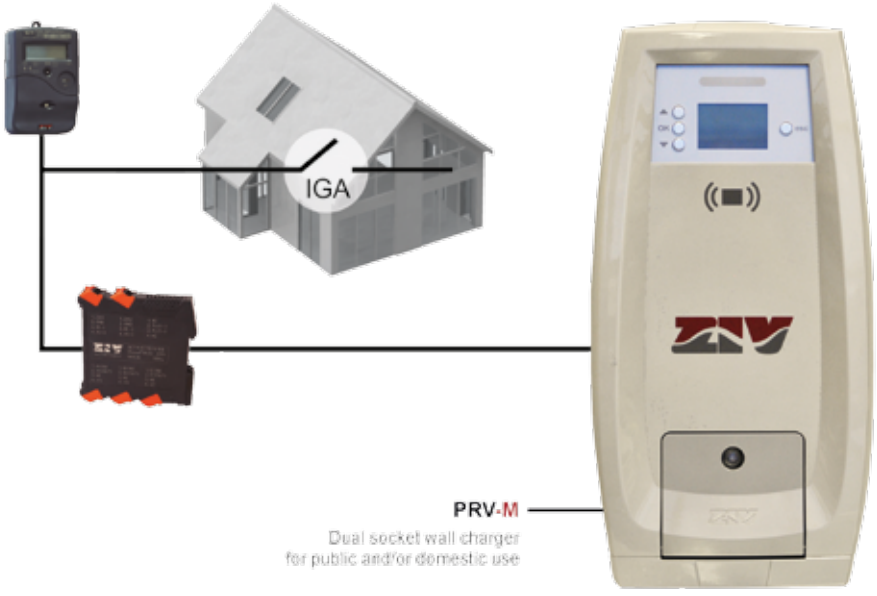
- ***Optimal energy management***
- ***Bi-directional power flow management***
- ***Line voltage profile control***
- ***Online network modelling***
- ***Local Volt/VAr control***

ANM & ANC controller

USP 20

USP-20 - Telecontrol, FPD, MV and LV supervision in a modular device

- MV monitoring
- LV supervision integration by connecting to 5CTI supervisors through its RS485 isolated port
- Protocol Gateway function (IEC 101/104, DNP3.0, Modbus)
- Modular chassis. 5 and 8 slots models
- Serial and Ethernet ports



VE Electric Vehicle re-connector

- Power consumption control to avoid grid overloads
- Demand management by implementation of V2G (Vehicle to Grid)
- Integration with utility's DMS/SCADA

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ZIV Automation

Headquarters

Parque Tecnológico, 210
48170 Zamudio, Bizkaia, Spain
T: +34 94 452 20 03
F: +34 94 452 21 40

www.zivautomation.com

7 Manufacturing facilities & 15 Customer support centers

Chicago (USA)
Mexico (MEX)
Niteroi (BRA)

Dublin (IRL)
Newcastle (GBR)

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