



POWER DISTRIBUTION SOLUTIONS

Ingeteam

INGETEAM

POWER DISTRIBUTION SOLUTIONS



Ingeteam has been offering a **wide range of products and solutions** with the latest technology for the automation of electrical distribution grids for **more than 25 years**, within the context of the development of **Smart Grids**, in sectors such as the **transmission and distribution** of energy or the generation of **renewables**.

Ingeteam makes available to our clients a **network of professionals**, covering **4 continents** to offer both service and assistance during each phase of their projects, from the initial project definition phase to the end of the useful life of the devices.

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DISTRIBUTION AUTOMATION

The automation of the secondary distribution network is a key factor in the construction of **smart grids**, optimizing the **operation** and **reliability** of the power supply provided by electricity companies.

The secondary distribution network is comprised of both **aerial and underground lines**, which link up the distribution substations with the electric power transformer stations that carry power supply to the end user.

Automating the distribution network enables all elements and parameters of the secondary network to be **monitored in real time**. This supervision allows processes that reduce and eliminate power outage times to be automatically executed and provides the necessary information and tools to minimize maintenance tasks.

Ingeteam has **long-standing experience** in designing devices, applications and systems for electric distribution automation.

This experience, together with the rollout of new telecommunications technologies has helped us to develop a **range of flexible solutions** that can operate autonomously or be integrated into **DMS systems**.

The solutions developed by Ingeteam **adapt to any scenario**, from urban areas with underground distribution to rural areas with aerial distribution, regardless of the type of distribution grid (ring, radial, mesh, etc.).



Benefits

- Rapidly and automatically minimizes the number of customers affected by a power outage.
- Increases the precision of fault location, which reduces the time it takes for maintenance teams to take the necessary corrective measures.
- Provides accurate information on the fault to help the post-fault analysis.
- Improves reliability of supply quality indicators (SAIDI, SAIFI, Caidi...), reducing possible penalties due to regulatory breaches.
- Reduces maintenance costs due to early detection of wear and tear in switches or overloading in transformers and, thereby, increases the useful life of the RMU.



FUNCTIONS



The **secondary distribution network** is responsible for the power supply reaching the end user and in recent years it has grown significantly due to the major rise in electricity demand. This has called for increasing **automation, control and remote supervision** in the management thereof.

Ingeteam has powerful solutions for **monitoring and automating** any protection and maneuvering element on this secondary network.

Measurement and monitoring

Supervising the status of the installations allows, on the one hand, the necessary **information** to be availed of in the **DMS** in order to view and **control the status** of the secondary network and, on the other hand, in the event of an incident, provides **all the necessary data** for the maintenance teams to take suitable action quickly and effectively.

Incorporating **digital devices** in combination with the **communication network** enables the substation status to be monitored while also **detecting** situations that could affect the integrity of the installation, such as fires, floods or the presence of unauthorized persons. They can also detect and report the parameters and status of the electric infrastructure itself, such as the status of the **transformer** or the **cells** it comprises.

Automation

The monitored data gathered by the devices and solutions designed by Ingeteam enables actions to be **programmed** and executed **automatically**, which **minimizes or avoids interruptions** in the power supply to the end user.

These include **automatic transfer of supply**, which enables the **location and direction of the electrical fault to be detected** and a series of actions coordinated in the elements, facilitating an alternative electricity flow path so that the interruption can be minimized, both in terms of duration and number of users affected.



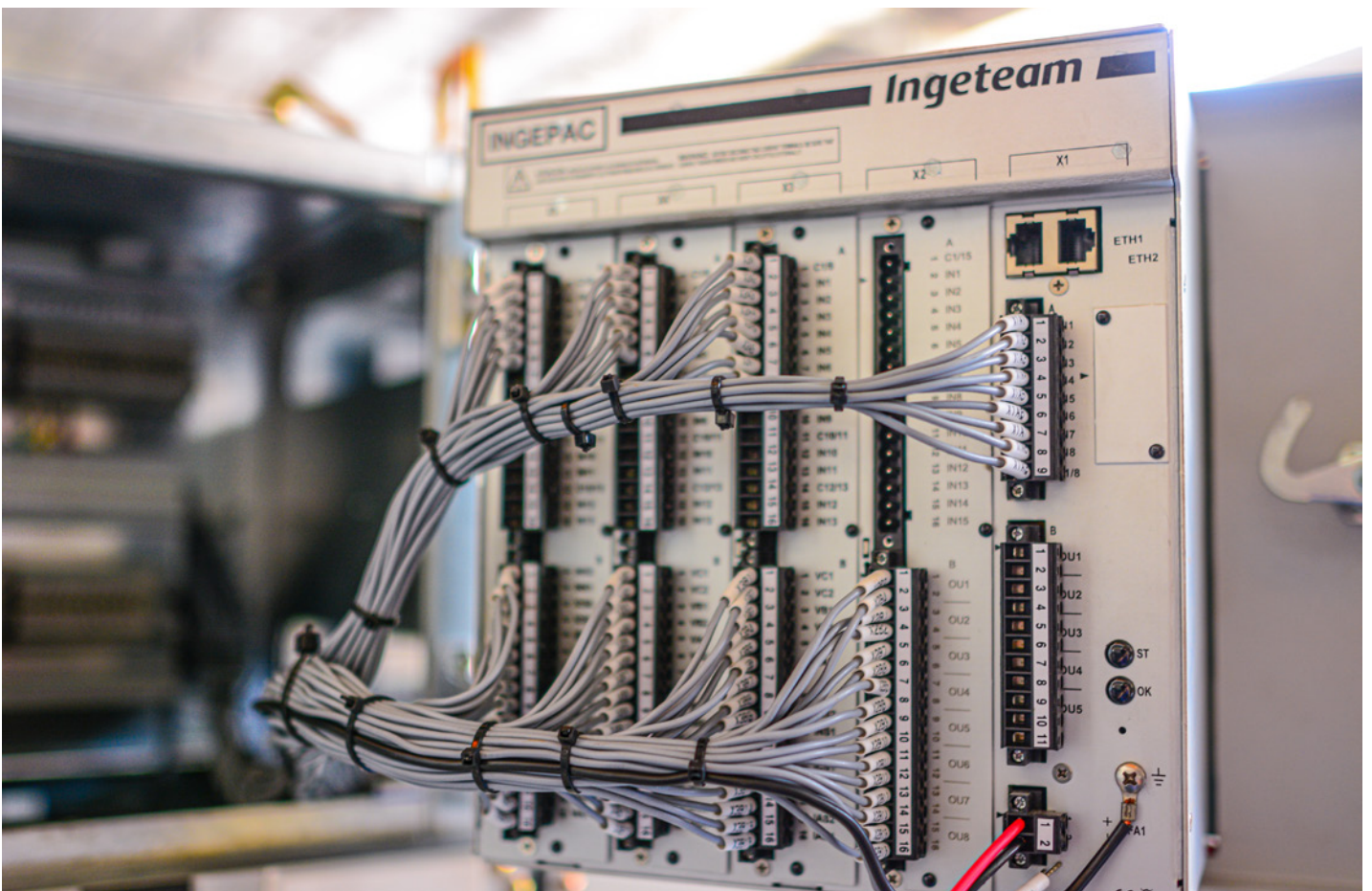
Protection

Ingeteam provides electric protection devices, which guarantee the **detection of parameters** outside normal operating limits, protecting the infrastructures of the network itself, as well as the users and their assets.

Communications

Ingeteam devices incorporate all the **communication protocols** generally used in the electricity sector, as well as the communication capacities for their use both **locally** and **remotely** (remote control offices, DMS, etc.)

The **RTU** function allows **information to be sent** on electrical parameters, status of elements or alarms and **orders can be sent** to operate elements remotely.

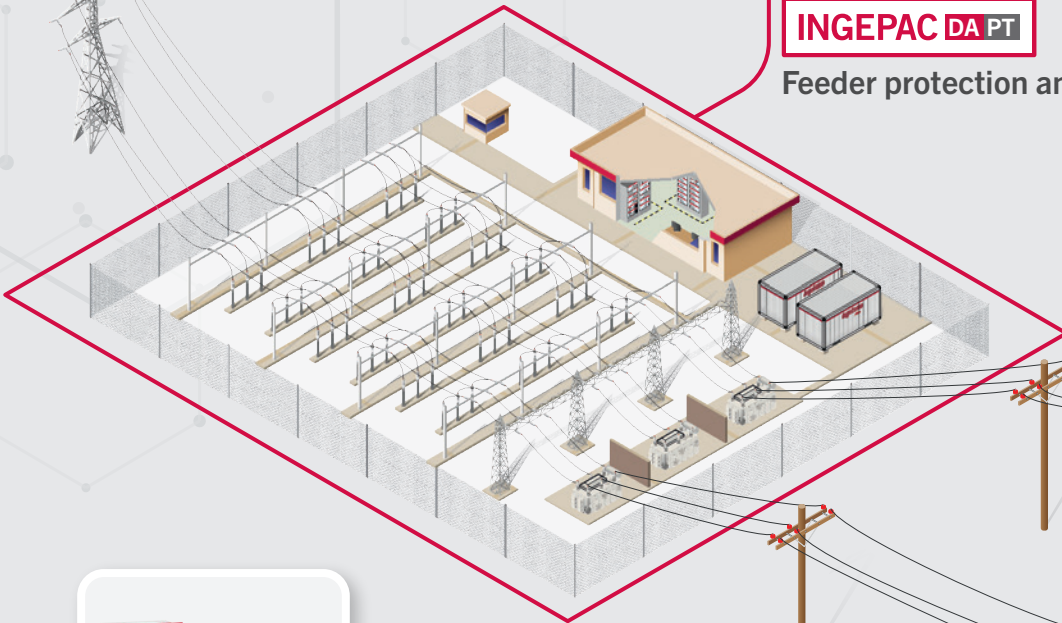


SECONDARY GRID NETWORK

PRIMARY DISTRIBUTION SUBSTATION

INGEPAC DA PT

Feeder protection and control



SECONDARY DISTRIBUTION SUBSTATION

INGEPAC DA

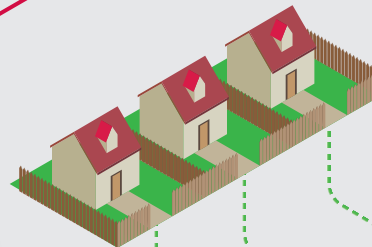
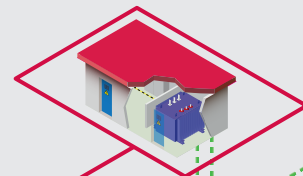
Substation automation and control

INGEPAC DA PT

Protection relay

INGEPAC LP

Low-power instrument transformers



underground line



RECLOSER

INGEPAC DAPT

Control, protection and automation

INGEPAC LP

Low-power instrument transformers

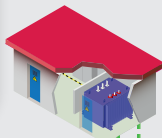
LOAD-BREAK SWITCH

INGEPAC DA

Control, monitoring and automation

INGEPAC LP

Low-power instrument transformers



RING MAIN UNIT

INGEPAC DA AU

Control, monitoring and automation

INGEPAC LP

Low-power instrument transformers



“

Ingeteam's product range includes control, protection, automation and sensor devices for the secondary distribution network.

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INGEPAC DA PT

The multifunction devices of the INGE PAC™ DA PT product range offer a compact design on a **native IEC 61850 platform** to control, monitor, protect and automate **aerial medium-voltage lines**.

The devices incorporate the main functions of protection, detection, isolation and location of faults, as well as automations such as sectionalizing and service restoration (loop automation), which makes them **comprehensive and reliable** solutions for aerial lines, with LBS or reclosers with voltage measurement on one or both ends of the switch.

INGEPAC™ DA PT offers a powerful **logical programming** capacity, voltage inputs from conventional transformers or voltage sensors, quality parameter measurement, including holes and overvoltages, as well as communication functions that enable **remote operation** through the main **remote control protocols** implemented by electricity companies.



The device has spontaneous sending of oscillations and fault reports via FTP/sFTP, as well as a simulation mode for analog inputs and I/O for testing.



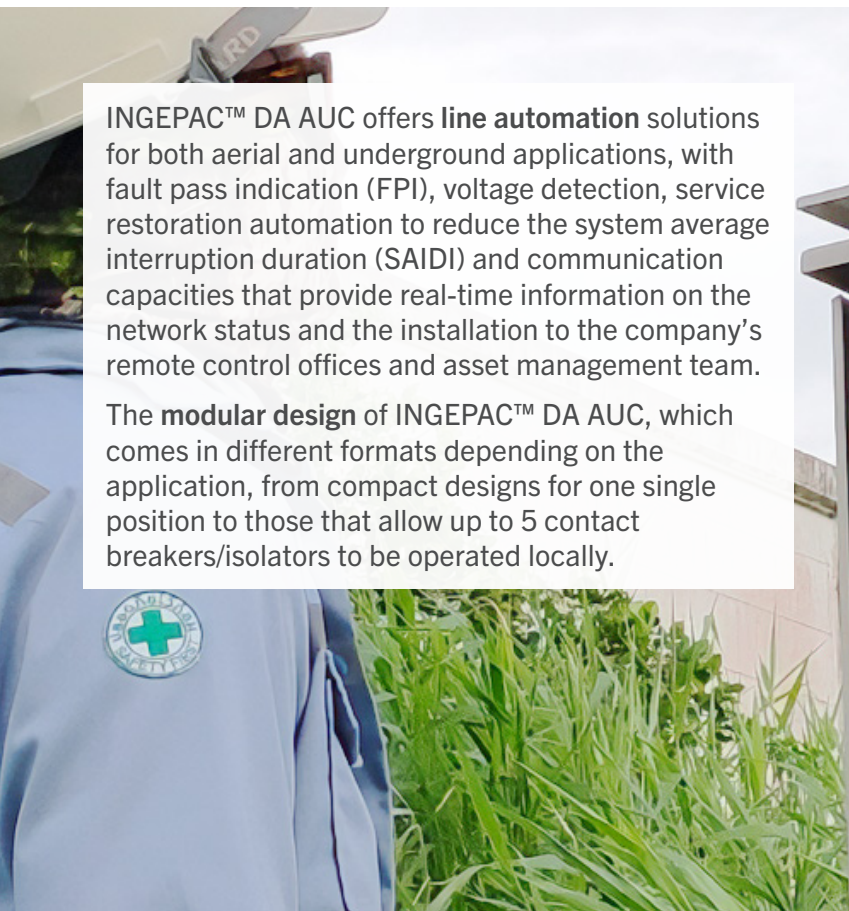
INGEPAC™ DA PT installed in a cabinet

Recloser control, monitoring, protection and automation

	DA PT4	DA PT5
Features	Recloser protection and control (3 voltages)	Recloser protection and control (6 voltages)
Protection functions	67, 67N, 67NS, 67NA/NC, 50/51, 50N/51N, 50NS/51NS, 67Q, 46FA, 49, 59, 27, 59N, 47, 81M/m, 81R, CLP, HCL, Hot Line Tag HLT, 68FF, 74TC/CC, 50BF, 32, 78, Fault locator	67, 67N, 67NS, 67NA/NC, 50/51, 50N/51N, 50NS/51NS, 49, 67Q, 46FA, SECC, 59, 27, 59N, 47, 81M/m, 81R, 59 (side B), 27 (side B), 32, 78, CLP, HCL, Hot Line Tag HLT, 68FF, 74TC/CC, 50BF, Fault locator
Automatism	79: the device allows up to 4 reclosures 25: synchronism Fault detection Sectionalizer (fault isolation)	79: the device allows up to 4 reclosures 25: synchronism Fault detection Sectionalizer (fault isolation) Loop automation / service restoration
Analog channels	4 voltages (sensor or VT) and 4 currents	6 voltages (sensor) and 4 currents
Enclosure	1/3 19" chassis with or without display (front or surface)	
Power supply	24, 48, 125, 220 Vdc	
Leds	24 programmable LEDs + 1 status	
Slot 1	Analog board: 4 V + 4 I + 13 DI / 4 V + 4 I + 4 DI + 5 DO *VT or sensor (LP VT) inputs *I neutral or I SEF * Optional: high speed outputs	1 analog board (A side): 4 V + 4 I + 13 DI / 4 V + 4 I + 4 DI + 5 DO * Voltage sensor (LP VT) inputs * I neutral or I SEF * Optional: high speed outputs
Slot 2	Optional: 15 DI and 8 DO / 24 DI and 16 DO / 8 AI DC (mA or V)	Analog Board (B side): 3 V + 13 DI * Voltage sensor (LP VT) inputs
Measures (class 0.2 for direct measurements)	Currents; voltages; frequency; active, reactive and apparent power; active and reactive energy counter; power factor; maximeters; harmonics	
Quality	Sags and swells, CBEMA curve, THD overexcitation, individual measurements of voltage and current harmonics, interruptions	
Breaker information	KL2 sum, reclosure counter, breaker opening counter, last current opened	
Reliability index	SAIFI, SAIDI, MAIFI, CAIDI, ASAI; duration of all interruptions; total number of long and short interruptions	
Data acquisition	Events and faults recording in non-volatile memory, COMTRADE files	
Communication ports	Front: RJ45 + USB / Rear: 2 Ethernet + 1 serial RS232/485	
Redundancy (IEC 62439-3)	PRP / HSR	
Synchronization	SNTP / IEEE 1588 v2 (PTP) / IRIG-B	
MMS and GOOSE messages	Yes, under IEC 61850-8-1	
Cybersecurity	Firewall, HTTPS, sFTP, logs, RBAC, LDAP	
Protocols	IEC 61850, DNP3, IEC 60870-5-101, IEC 60870-5-103, IEC 60870-5-104, Modbus	

INGEPAC™ DA AUC offers **line automation** solutions for both aerial and underground applications, with fault pass indication (FPI), voltage detection, service restoration automation to reduce the system average interruption duration (SAIDI) and communication capacities that provide real-time information on the network status and the installation to the company's remote control offices and asset management team.

The **modular design** of INGEPA™ DA AUC, which comes in different formats depending on the application, from compact designs for one single position to those that allow up to 5 contact breakers/isolators to be operated locally.



RMU automation

Feeder control, measurement and automation

Functions	<ul style="list-style-type: none"> Control, supervision and measurement of up to 5 medium voltage feeders
Automatisms	<ul style="list-style-type: none"> Voltage presence Directional pass fault detection Fault isolation
Protection functions	<ul style="list-style-type: none"> 67, 67N, 67NS
Enclosure	<ul style="list-style-type: none"> 1/3 or 2/3 19" chassis (front or surface) Compact (front or DIN rail)
Power supply	<ul style="list-style-type: none"> 12, 24, 48, 125, 220 Vdc
Pushbuttons (optional)	<ul style="list-style-type: none"> For front panel mounting: L/R and Open/Close/Automatism for every supervised feeder
LEDs	<ul style="list-style-type: none"> Depend on the number of I/O
1, 2 or 4 slots for I/Os	<ul style="list-style-type: none"> ED/SD (several options) 4 V + 4 I (from sensors or VT) 8 I 8 EA (mA and/or V) (several options)
Measures for each monitored feeder (class 0.2 for direct measures)	<ul style="list-style-type: none"> Currents Voltages Frequency Active, reactive and apparent power Active and reactive energy counter Power factor
Breaker supervisions (for each monitored feeder)	<ul style="list-style-type: none"> Breaker opening counter (trips or commands) Faults counter
Data acquisition	<ul style="list-style-type: none"> Events and faults recording in non-volatile memory, COMTRADE files
Communication ports	<ul style="list-style-type: none"> Front: RJ45 + USB / Rear: 2 Ethernet + 1 serial RS232/485
Synchronization	<ul style="list-style-type: none"> SNTP / IRIG-B
MMS and GOOSE messages under IEC 61850-8-1	<ul style="list-style-type: none"> Yes
Web page	<ul style="list-style-type: none"> HTML5 and CSS3
Protocols	<ul style="list-style-type: none"> IEC 61850, DNP3, IEC 60870-5-101, IEC 60870-5-103, IEC 60870-5-104, Modbus

INGEPAC DA PT

INGEPAC DA PTC

The multifunction devices of the INGE PAC™ DA PT product range offer a compact design on a **native IEC 61850 platform** to control and protect medium-voltage lines and positions.

INGEPAC™ DA PTC is a remote position unit with a modular design and different hardware options, which allows different **digital input and output modules** to be incorporated for full position control, as well as analog card modules to capture the key electrical figures.

INGEPAC™ DA PT1 facilitates **control, measurement and protection** functions in a single device, providing all functionalities required for an MV feeder.

Both product ranges have a powerful logical programming capability based on the **IEC 61131** standard and incorporate the main communication protocols to communicate with the installation control system.



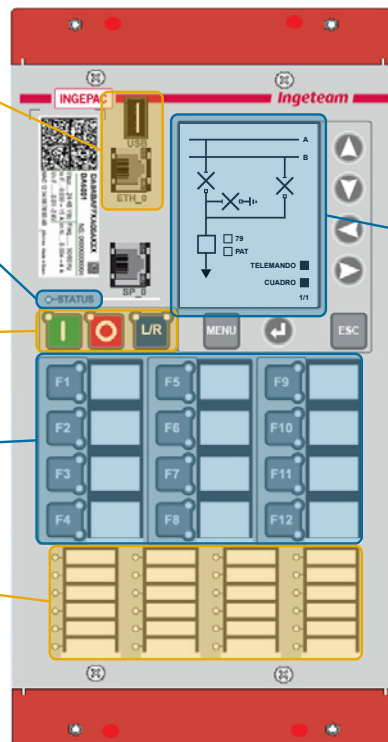
Front ports:
USB and RJ45

1 HW status bicolor LED

Local command: Open/Close/L/R

12 programmable function
keys with labels

24 general purpose LEDs
with interchangeable labels



3.5" programmable LCD display:

- Up to 9 graphic pages
- I/O signal display
- Events screen
- Alarms screen (160)
- Protection settings
- Missing report

8 analog channels
32 samples/cycle
0.2 measurement class

Bay control

	DA PT1	DA PTC
Features	Bay protection and control	Bay control
Protection functions	67, 67N, 67NS, 67NA/NC, 50/51, 50N/51N, 50NS/51NS, 67Q, 46FA, 49, 59, 27, 59N, 47, 81M/m, 81R, CLP, HCL, Hot Line Tag HLT, 68FF, 79, 25, 74TC/CC, 50BF, 32, 78, Fault locator	N/A
Automatism	79: up to 4 reclosures 25: synchrocheck	Programmable logic
Logics	IEC 61131	
Analog channels	4 voltages and 4 currents	Optional (4 voltages and 4 currents)
Enclosure	1/3 19" chassis	1/3 or 2/3 19" chassis (front or surface)
Power supply	24, 48, 125, 220 Vdc	
LEDs	24 programmable LEDs + 1 status	LEDs number depends on the enclosure
I/O slots	1 slot for I/O selectable: 15 DI and 8 DO; 24 DI and 16 DO; 8 AI DC (mA or V)	2 or 4 slots for I/O selectable: 15 DI and 8 DO; 24 DI and 16 DO; 13 DI; 8 AI DC (mA or V)
AI inputs resolution	15 bits + 1 sign	
Measures (class 0.2 for direct measurements)	Currents; voltages; frequency; active, reactive and apparent power; active and reactive energy counter; power factor; maximeters; harmonics	Currents; voltages; frequency; active, reactive and apparent power; active and reactive energy counter; power factor; maximeters; harmonics (only for models with analog board)
Quality	Sags and swells, CBEMA curve, THD overexcitation, individual measurements of voltage and current harmonics, interruptions	N/A
Breaker information	KL2 sum, reclosure counter, breaker opening counter, last current opened	Breaker status supervision
Data acquisition	Events and faults recording in non-volatile memory, COMTRADE files	Events recording in non-volatile memory,
Communication ports	Front: RJ45 + USB / Rear: 2 Ethernet + 1 serial RS232/485	
Redundancy (IEC 62439-3)	PRP / HSR	
Synchronization	SNTP / IEEE 1588 v2 (PTP) / IRIG-B	
MMS and GOOSE messages under IEC 61850-8-1	Yes	
Cybersecurity	Firewall, HTTPs, sFTP, Logs	
Protocols	IEC 61850, DNP3, IEC 60870-5-101, IEC 60870-5-103, IEC 60870-5-104, Modbus	

INGEPAC™ LP CT and INGEPACTM LP VT sensors offer an alternative solution to conventional instrument transformers in a reduced space and at a more competitive cost, being a very complete solution for medium voltage environments.

INGEPAC™ LP sensors comply with the requirements defined in the IEC 61869-10 and IEC 61869-11 standards, thus guaranteeing a measurement accuracy of 0.2 S for currents and 0.5 P for voltages.



Benefits

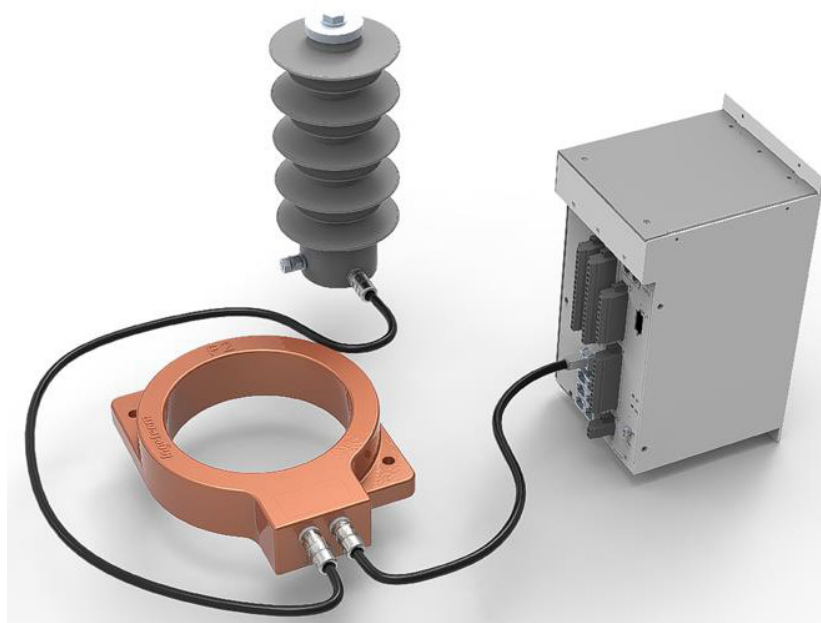
- Measurement and protection accuracy
- Smaller size and weight
- Good accuracy
- Very safe
- Extensive dynamic range
- Lower cost
- Ease of installation
- More sustainable (less amount of raw material needed)



All devices are individually tested to guarantee precision

Voltage and current sensors

Features	INGEPAC™ LP VT 24A	INGEPAC™ LP CT 150
Primary	11 kV / 13.2 kV / 15 kV / 20 kV	500 A
Transformation ratio	20000/ $\sqrt{3}$: 3.25/ $\sqrt{3}$	500 A / 225 mV
Accuracy	Class 0.5 P	Class 0.2 S / 5P20
Module accuracy	0.5	0.2
Argument accuracy	20'	10'
Application	Air or outdoor	Air or outdoor
Frequency	50/60 Hz	50/60 Hz
Burden	<3 W	NA
Temperature	-25°C up to 40°C	-25°C up to 40°C
Protection grade	IP65	
Length	248 ± 1 mm	195 (external diameter)
Weight	1480 ± 30 g	2145 kg
Material	Silicone	Epoxy



LP VT-24-A + LP CT-150 500A combined solution

Voltage sensors are based on resistive power splitter technology and offer an **accurate solution** in a small space and at a highly competitive price, with a very comprehensive solution for medium-voltage settings.

INGEPAC™ SR sensors offer a class 1 voltage measurement in line with standards **IEC 61869-1** and **IEC 61869-3**, undergoing the same precision and overvoltage testing as conventional voltage transformers.

Benefits

- They don't saturate, linear operation
- Smaller size and weight
- Good accuracy
- Very safe
- Extensive dynamic range
- Lower cost
- Ease of installation
- More sustainable (less amount of raw material needed)



All devices are individually tested to guarantee precision

Voltage sensors and PLC couplers

Features	INGEPAC™ SR GR24	INGEPAC™ SR AR24	INGEPAC™ SR PG24	INGEPAC™ SR GR36
Primary voltage	11, 13.2, 15 and 20 kV (maximum voltage: 24 kV)			Between 11 kV and 36 kV
Transformation ratio	20.000/√3: 2/√3	10,000:1	20.000/√3: 2/√3	30000/√3: 2/√3 or 30000/√3: 3.25/√3
Accuracy	Class 1			
Application	SF6 gas insulated	Air or outdoor	SF6 gas insulated	SF6 gas insulated
Frequency	50 Hz	50/60 Hz	50 Hz	50/60 Hz
Burden	< 3 W			
Frequency range	N/A		1-32 MHz	N/A
Temperature	-10°C up to 60°C			
Primary area protection grade	IP65			
Length	147±2 mm	250±1 mm	147±2 mm	159±1 mm
Weight	900±20 g	1480±30 g	900±20 g	1050±50 g
Low voltage connector	BNC	BNC (inside) TNC (outside)	BNC	BNC
Primary area material	Resin		Silicone	Resin



INGEPAC™ SR GR
in cabinet

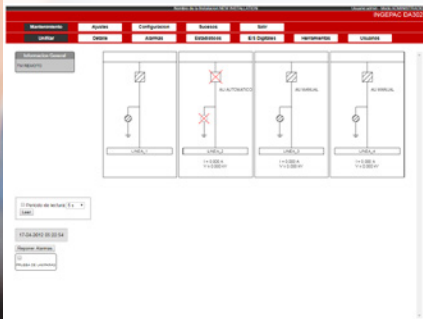


INGEPAC™ SR GR
installed in cells

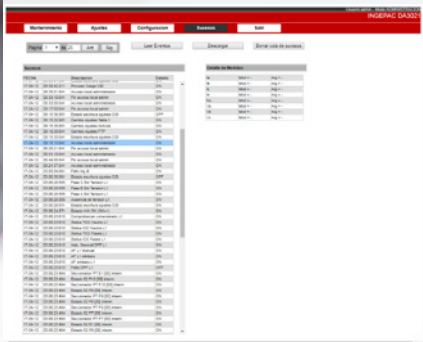
WEB ACCESS



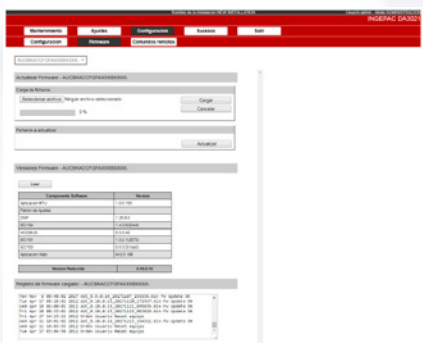
General configuration



Monitored positions status



Event list



Firmware update

Additionally, Ingeteam devices have a powerful **embedded web server** compatible with PCs, smartphones and tablets, which allows access to the device without any software installed on the device.

Access can be made from anywhere with an Internet connection after **user authentication and password**.

Depending on the **permission** that the user profile has, it will be allowed to **view** or also **manage** the complete configuration of the device and the information stored in it.

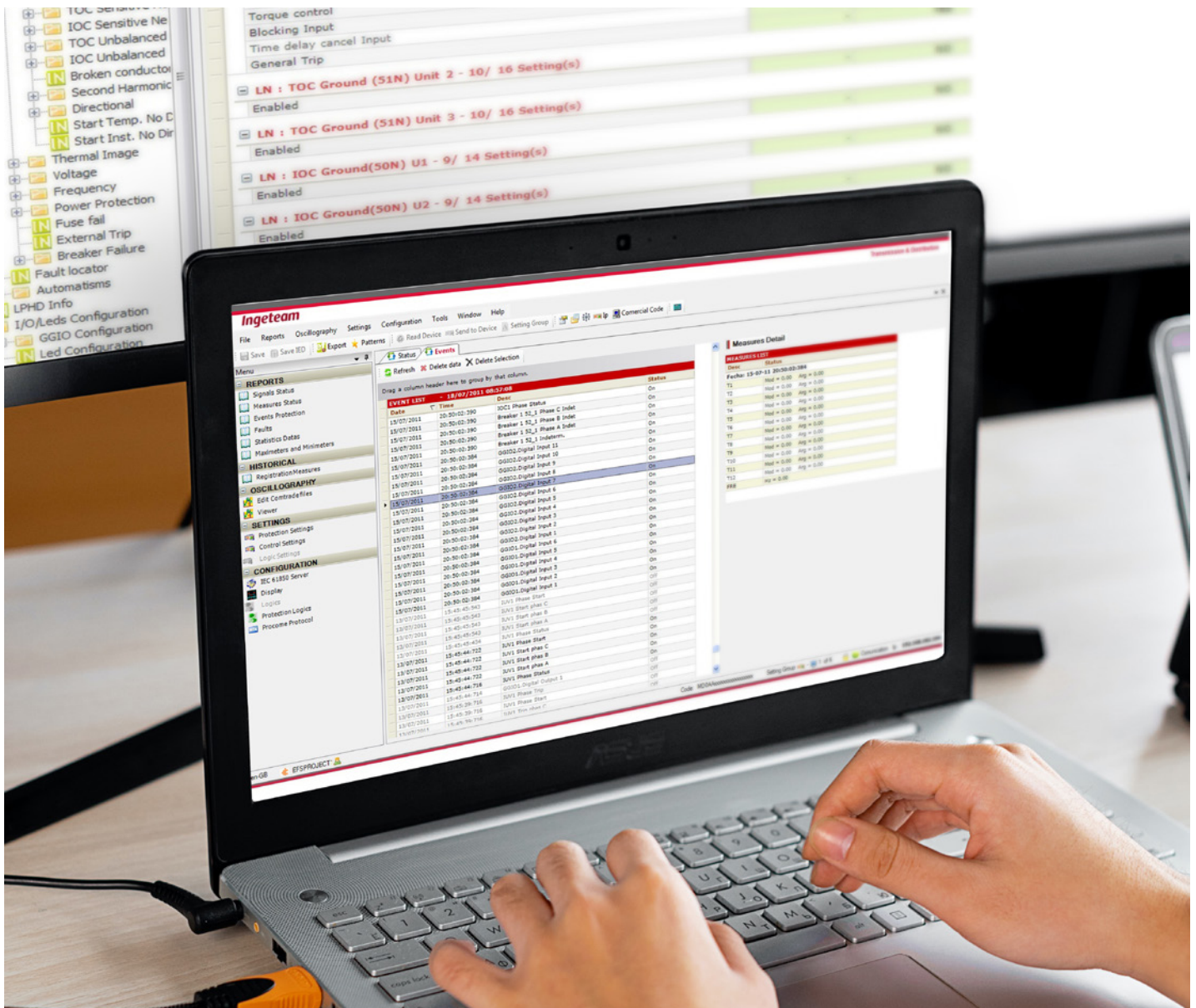


DEVICE ACCESS AND CONFIGURATION TOOLS

All Ingeteam devices are configurable using the free **INGESYS™ eFS pacFactory** software tool, which is a powerful tool for device configuration and management through a highly intuitive interface.

The tool enables among other functionalities:

- Auto-detection of IEDs connected to the network
- Configuration settings and parameters
- Logic programming under IEC 61131 standard
- Management and export of measurement files, events and alarms
- Protocol configuration



STANDARDS AND CERTIFICATION



Design

As part of its commitment to quality and customer satisfaction, Ingeteam applies these processes and conducts comprehensive tests on all the devices it manufactures to ensure compliance with the highest quality standards and regulations.

Ingeteam devices are certified by **independent external laboratories** in compliance with **international standards** for electric, climatic and mechanical testing, thereby ensuring optimal performance.

The INGE PAC™ DA product range meets the following directives and standards:

- Low Voltage Directive 2006/95/EC
- EMC Directive 2004/108/EC
- IEC 60255-1
- IEC 60255-26
- IEC 60255-27

The INGE PAC™ SR product range complies with the following directives:

- IEC 61869-1
- IEC 61869-3



Quality

Ingeteam Power Technology, S. A. holds the **ISO 9001** certification, which guarantees that it meets applicable legal and regulatory requirements and implements **continuous improvement** processes.

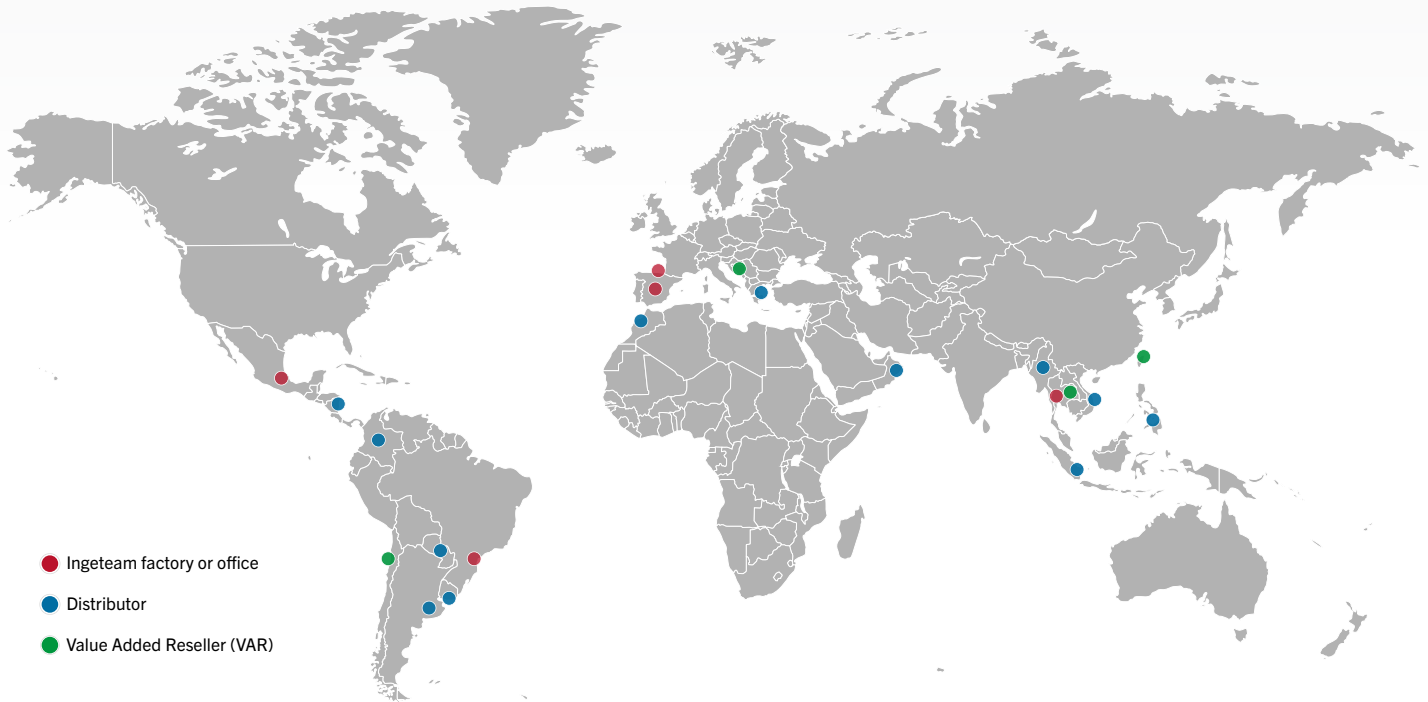
It also holds the **ISO 14001** certification, which specifies **environmental management** requirements and attests to Ingeteam's commitment to protection of the environment.

Ingeteam has the **ISO 27001** certification on information security and privacy, which guarantees the **assurance, confidentiality and integrity** of all the data managed by the company.



INTERNATIONAL PRESENCE

Ingeteam has a network of **offices, factories, distributors** and **VARs** to serve the customer closely



CENTRAL OFFICE

INGETEAM POWER TECHNOLOGY, S. A.
Parque Tecnológico de Bizkaia, Edificio 110
48170 Zamudio, Bizkaia - Spain
Tlf.: (+34) 944 039 600

BRAZIL OFFICE

INGETEAM LTDA.
Rua Tenente Francisco Ferreira de Souza, 2145,
Boqueirão, Curitiba, Paraná - Brasil
CEP 81070-010
Tlf.: (+55) 41 3276-9841 / 9193-2042

MEXICO OFFICE

INGETEAM POWER TECHNOLOGY MÉXICO
S. DE R. L. DE C. V.
Av. Ejército Nacional Mexicano, 351 - Piso 6,
Chapultepec Morales, Granada, Miguel Hidalgo,
11520 Ciudad de México, CDMX
Tlf.: (+52) 55 6586 9930

THAILAND OFFICE

100/67 Vongvanij bldg. B, 22nd floor Rama IX Rd
Huaykwang
10320 Bangkok - Thailand
Tlf.: (+66) 224 61798

powergridautomation@ingeteam.com



Ingeteam

www.ingetteam.com