

BRIDGING THE GAP  
BETWEEN PROCESS  
CONTROLLER AND  
POWER MANAGEMENT

# IEC 61850 Standard



Interoperability for Advanced Protection  
and Control Applications

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# INTEROPERABILITY FOR ADVANCED PROTECTION AND CONTROL APPLICATIONS

**IEC 61850** is the international standard for communication in substations. It enables integration of all protection, control, measurement and monitoring functions and additionally provides the means for high-speed substation protection applications.

## ■ Benefits

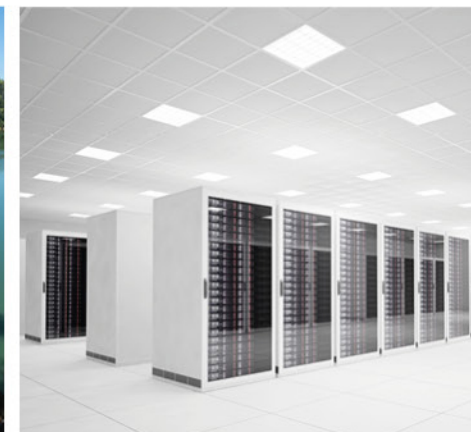
- Cost effective solution due to reduced inter-wiring
- Flexible programming allowing relays and new protection functions to be added without affecting physical wiring
- No external protocol converters are required and devices or systems can be easily upgraded to IEC 61850.

## ■ What is IEC 61850?

**IEC 61850** is an **Ethernet-based protocol** designed for electrical substations. It is a standardized method of communications, developed to support integrated systems composed of multi-vendor, self-describing **IEDs** (Intelligent Electronic Device) that are networked together to perform monitoring, metering, real-time protection and control.

**IEC 61850** provides a single system for integrating process and power in many industrial applications including the following:

- **Distributed energy resources**
- **Hydro power**
- **Oil and gas**
- **Mining, metals and minerals**
- **Other processes with a need to integrate power system data**







## ■ IEC 61850 - Introduction

In the technical area, communication can be much more than an exchange of data based on one of the various protocols available in the market. It can actually involve syntax and semantics to the extent that information becomes universally understandable. **IEC 61850** provides a standardized structure for integrating substation components, functional characteristics, the structure of the data in the devices, data designation conventions, establishing how the applications must interact and monitor the devices and lastly, conformance testing. Enabling the Control devices to communicate with power control systems using the **IEC 61850** compliant communications and implementing it across the unified system architecture provides maximum integration of process and power. With its standardized model of the **IED** and its data and communication services, **IEC 61850** ensures interoperability between electrical devices and is able to replace all the typical protocols found in the substation automation domain.

**IEC 61850 makes the application future-proof over entire system lifecycles.**

## ■ IEC 61850 - Concept and Structure

### The basic approach of IEC 61850

To ensure long-term interoperability, considering that the substation functions have different development time-frames and the need to keep pace with the changes in communication technology, the approach followed by **IEC 61850** is to separate the data and communication service models from the protocols.

Either way, the data models have been standardized by **IEC 61850** at various communication layers so as to assure interoperability.

The model classes are substantially related to one substation. Wind farm, hydroelectric power plant and distributed energy source object-oriented models were added later.

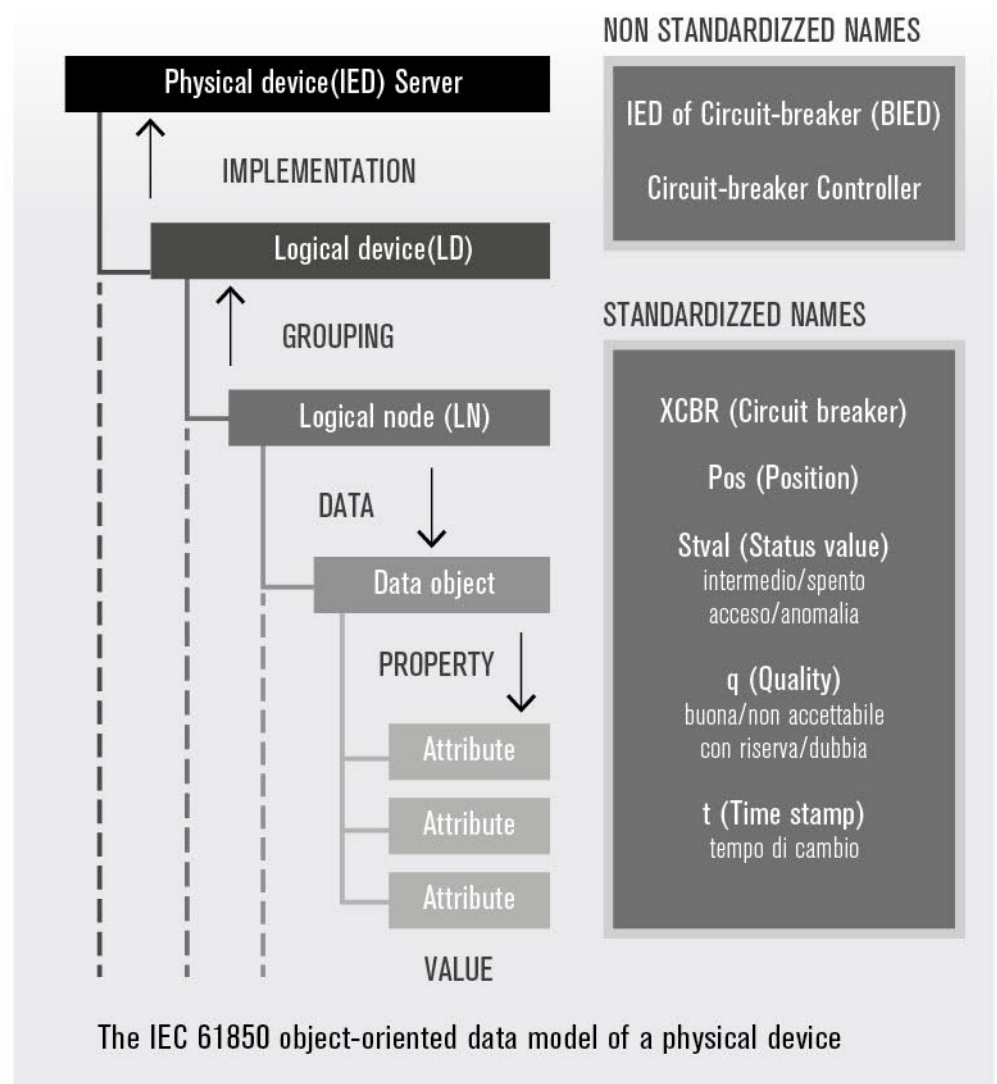
All the application functions, which include data interfaces towards primary apparatuses, are divided into the smallest possible parts that can communicate with each other and, more importantly, can be implemented separately in the various **IED**. Standard **IEC 61850** calls these basic objects Logical Nodes (**or LN**).

The name of a class to which an **LN** belongs refers to the function to which the data object belongs.

The data objects in an **LN** can be mandatory, optional or conditional.

In addition, the data objects contain attributes which can be considered as detailed properties or values of the data object.

*This hierarchical model is illustrated in the adjacent figure.*



## ■ Control products based on IEC 61850: **EMA-90N** network analyzers

Native development of IEC 61850 in Control monitoring devices IEC 61850 in combination with **EMA-90N network analyzers** or **EMM multifunctional meters** are opening doors to new and cost-effective solutions.

- Centralized data recording, including the plant-wide sequence of events
- A complete view of electrical measurement data, especially to process operators so they can make educated decisions.
- Real-time processing of collected data with advanced functions



## ■ Control products based on IEC 61850: **EMS-96** network analyzers

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## ■ Control products based on IEC 61850: **Compalarm E** alarm system device

Native development of IEC 61850 in Control monitoring devices IEC 61850 in combination with **Compalarm E** alarm system device allows unit to be make any alarm system size to suit the individual customer's requirements.

- Digital inputs status | • Logical inputs status
- Alarm inputs | • Acknowledge inputs
- Status alarm windows (off, on, slow flashing, fast flashing, irregular flashing)



## ■ Control products based on IEC 61850: **CTT**

Native development of IEC 61850 in Control monitoring devices IEC 61850 in combination with **CTT** temperature control devices allows to have the right substation climate: control and safety of power transformers.

- Instantaneous temperature display
- Maximum temperature display
- Probe diagnostics for anomalies or incorrect installation



## ■ Model implementation conformance statement.

The model implementation conformance statement is defined by IEC 61850-7-3 and IEC 61850-7-4, and provides the following specifications:

- Logical nodes, used to model substation devices and functions
- Common data classes and common data attribute classes used in the logical nodes

The IEC 61850 Control devices implements simple web server which allows user to access important information about current state of the device and control its functionality:

- Display status information
- Current network parameters (IP / MAC address)
- Status if connected IEC 61850 clients
- Modify device settings (IP address, Subnet mask, Gateway, Hostname)
- Download CID file
- Upload CID file
- Upgrade firmware



## ■ Ethernet and the station and processes buses

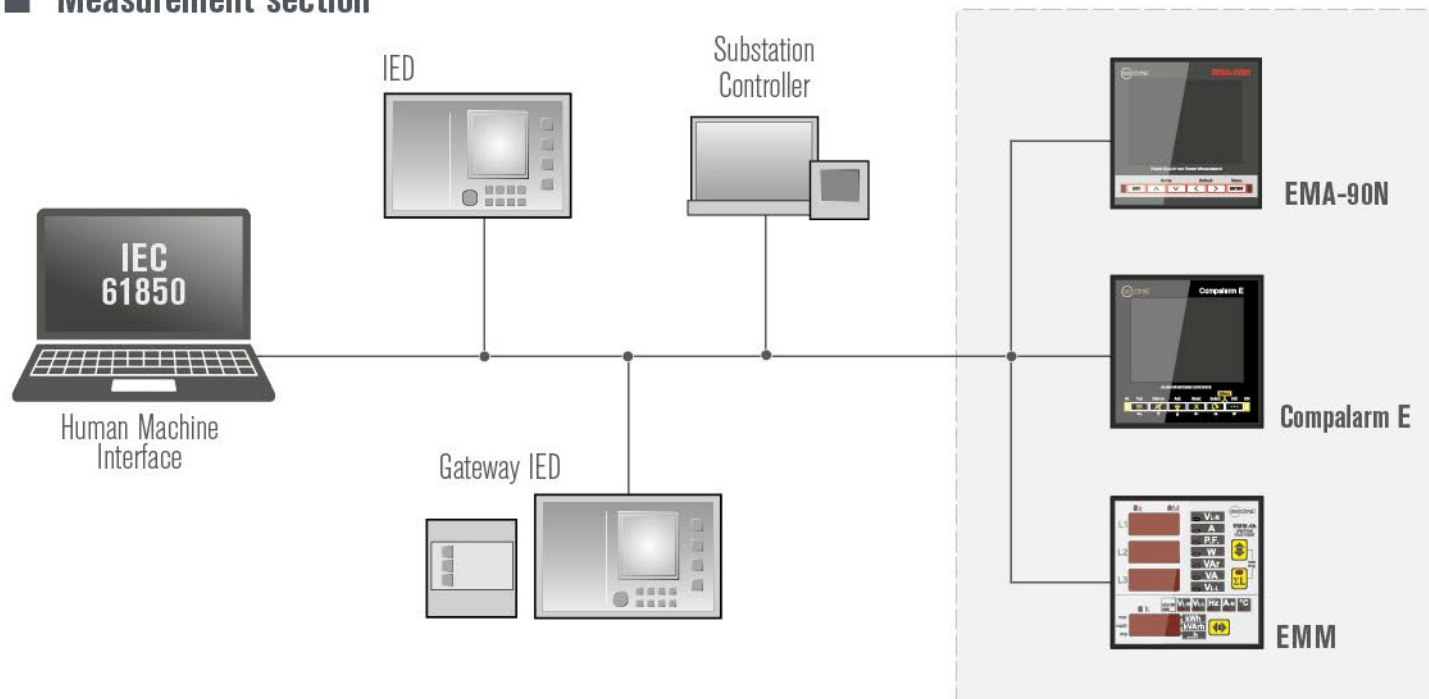


**Ethernet is the basic technology adopted by IEC 61850.**

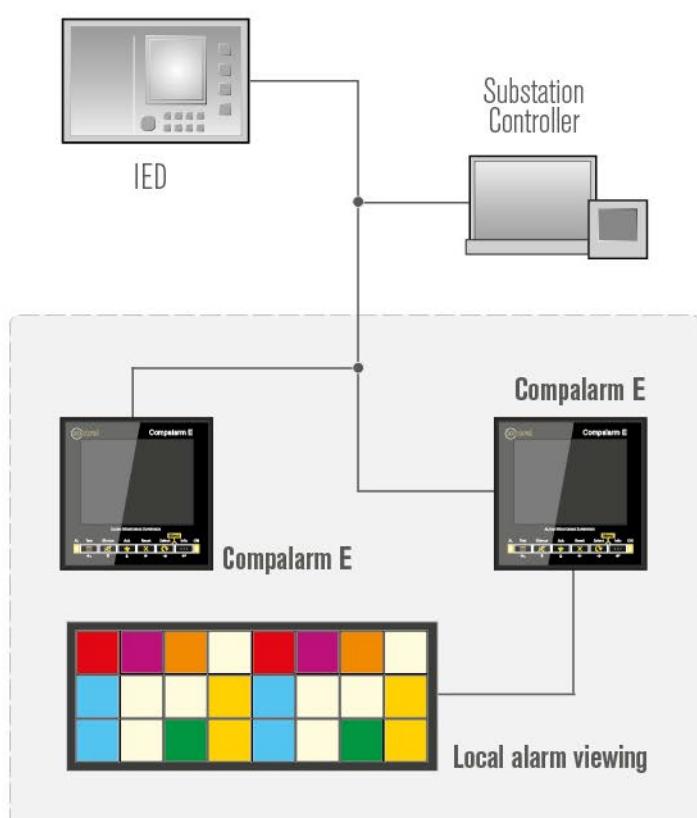
The Standard envisages two buses based on **Ethernet switch technology**.

The station bus connects the protection, control and monitoring **IED** of the bay units to the devices at station level, i.e. the central computers with relative **HMI** and the gateways towards the communication center (**NCC, Network Communication Center**) using all the services required by the applications.

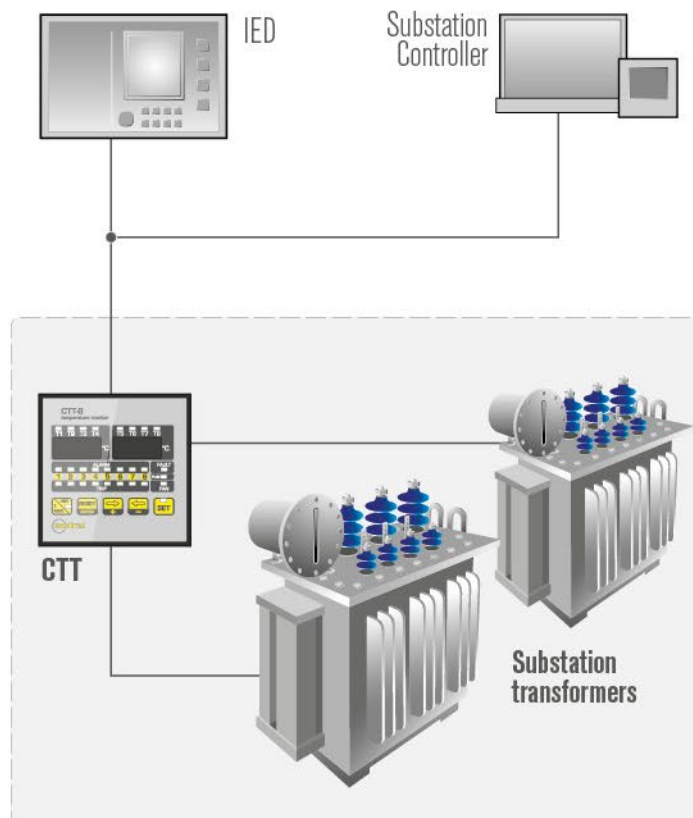
## ■ Measurement section



## ■ Alarm section



## ■ Transformers temperature monitor section



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