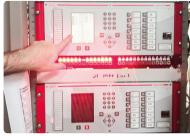
CASE STUDY

IEC 61850 communications laboratory Thailand









Applications

- Interoperability testing
- Control systems simulation
 Training

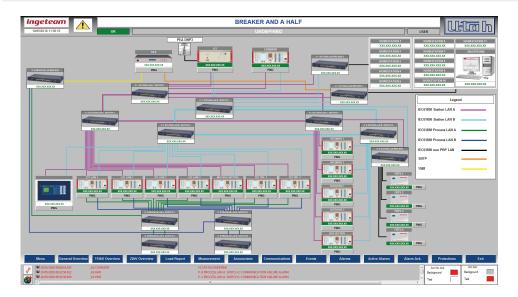
Fault and data analysis



The IEC 61850 **Communications Interoperability Laboratory** is a major project developed by our local VAR (Value Added Reseller) in **Thailand**, **Power Utah Group Co. Ltd.** This new laboratory belongs to PEA, the public electricity company in Thailand.

The laboratory will allow to **simulate** the behavior of control and protection systems with different topologies and schemes, such us: Breaker and a half, H Scheme, Double busbar, Double busbar with double breaker and Main and Transfer.

These new facilities will serve as a platform for the study, testing and validation of protection and control systems based on the IEC 61850 standard with different communications architectures and features.



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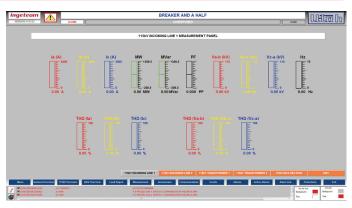
Digital substation

The evolution of the electrical grid in recent years and the advancement in the field of communications allow an ever greater **digitization of the network**. The smart grid needs information to draw from, and this **information** is obtained from the substations and the equipment installed in it. This concept of information exchange has been called a **digital substation**, and everything that surrounds it is what will allow it to be evaluated with the new laboratory

Digital substations introduce a series of improvements in the management of facilities: **centralization** and **ease of access** to all parameters and values in real time, which allows easier monitoring and analysis of data, **reduction of copper cabling** and related interference, the creation of **safer facilities**, the **reduction of installation times**, etc.

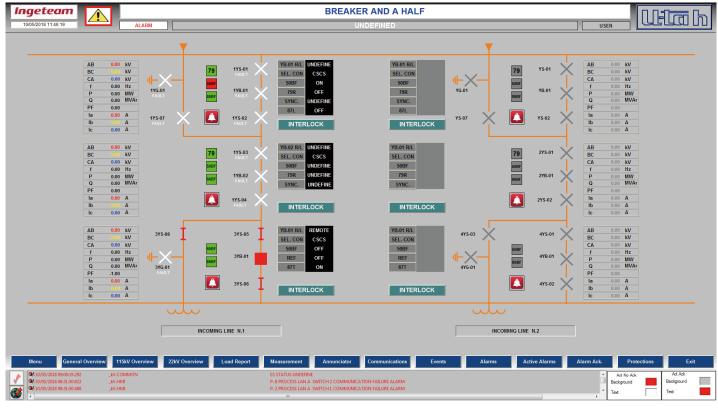
The new laboratory supports the configuration of systems with **different degrees of digitization**, from protection and control systems with traditional standards to the latest requirements based on the **IEC 61850-9-2 section**. This update to the IEC 61850 standard describes, among other things, the process bus and the transmission of Sampled Values.

Likewise, it also allows simulating different types of **architectures**: from the simplest to those with different types of **redundancy**, such as PRP or HSR technologies. On the other hand, there is the option of managing various types of **synchronization** methods, from the most traditional to the newest, such as **IEEE 1588**, which handle time accuracies below the millisecond.



Measurements



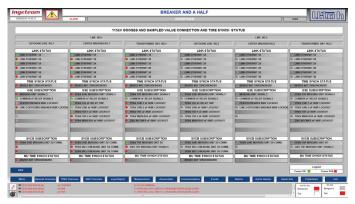


Single line diagram



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Advantages and features



Sampled Values, GOOSE messages and IEEE 1588 monitoring



The main advantage of the laboratory is that it does not require a large number of different equipment to be able to implement all the different possibilities that the digitization of substations offers. This is achieved thanks to the **INGEPAC™ EF product range** of equipment, which under the same hardware allows both to be used in **conventional substations**, directly measuring voltages and currents, and in those that have the **process bus** implemented, thanks to the capture of Sampled Values. and to the transmission/reception of **GOOSE messages**.

Also, with a simple setting, the same equipment can be used in **simple** or **redundant (PRP, HSR)** communication networks, or with one type of **synchronization** or another (**IEEE 1588, SNTP**).

Equipment is as important as having the tools to configure and analyze the data and information that is processed with them. For this, different **monitoring**, **operation**, **analysis** and **maintenance** workstations have been installed based on our **INGESYS™ IT** and **INGESYS™ eFS** software packages.

The INGESYS[™] control system has been installed with different modules and licenses on more than **10 workstations**, in order to enable **different users**, depending on their profile, to run, analyze and configure the system in parallel. This **parallel configuration** multiplies the **options for use and application** of the installed equipment.

The entire system has the necessary **cybersecurity** and **access control**, which, on the one hand, avoid possible external interference in the laboratory and, on the other hand, enable the testing and validation of the most appropriate configurations prior to their installation

Ingeteam		BREAKER AND A HAL	F		
10/05/2018 11:48:06		UNDEFINED		USER	
115kV INCOMING LINE 1 LOAD REPORT PANEL					
115kV INCOMING LINE 1	115kV INCOMING LINE 2	115kV TRANSFORMER 1	115kV TRANSFORMER 2	115kV MAIN BUS	
⊒ +× K ≪ ┡ X 3 @ @ @					
			MMXU1.A.phsC.I_Measure _115kV.LINE_01.LRP_ZT1.PROT.		
04/2018 11:35:34.000 0.000	0.000	0.000	0.000	0.000	
04/2018 11:35:44.000 0.000	0.000	0.000	0.000	0.000	
04/2018 11:35:54.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:36:04.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:36:14.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:36:24.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:36:34.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:36:44.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:36:54.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:37:04.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:37:14.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:37:24.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:37:34.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:37:44.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:37:54.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:38:04.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:38:14.000 0.000	0.000	0.000	0.000	0.000	
V04/2018 11:38:24.000 0.000	0.000	0.000	0.000	0.000	
V04/2018 11:38:34.000 0.000	0.000	0.000	0.000	0.000	
4/04/2018 11:38:44.000 0.000	0.000	0.000	0.000	0.000	
4/04/2018 11:38:54.000 0.000	0.000	0.000	0.000	0.000	
V04/2018 11:39:04.000 0.000	0.000	0.000	0.000	0.000	
V04/2018 11:39:14.000 0.000	0.000	0.000	0.000	0.000	
4/04/2018 11:39:24.000 0.000	0.000	0.000	0.000	0.000	
V04/2018 11:39:34.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:39:44.000 0.000	0.000	0.000	0.000	0.000	
V04/2018 11:39:54.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:40:04.000 0.000	0.000	0.000	0.000	0.000	
V04/2018 11:40:14.000 0.000	0.000	0.000	0.000	0.000	
V04/2018 11:40:24.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:40:34.000 0.000	0.000	0.000	0.000	0.000	
V04/2018 11:40:44.000 0.000	0.000	0.000	0.000	0.000	
V04/2018 11:40:54.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:41:04.000 0.000	0.000	0.000	0.000	0.000	
V04/2018 11:41:14.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:41:24.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:41:34.000 0.000	0.000	0.000	0.000	0.000	
/04/2018 11:41:44.000 0.000	0.000	0.000	0.000	0.000	
V04/2018 11:41:54.000 0.000	0.000	0.000	0.000	0.000	
V04/2018 11:42:04.000 0.000	0.000	0.000	0.000	0.000	
V04/2018 11:42:14.000 0.000	0.000	0.000	0.000	0.000	
V04/2018 11:42:24.000 0.000	0.000	0.000	0.000	0.000	
	m				
Menu General Overview 115kV Overview	22kV Overview Load Report Mea	surement Annunciator Communications	Events Alarms Active Alarms	Alarm Ack. Protections Exi	
W.10/05/2018 09:00:19:292 _kV.COMMON		ATUS UNDEFINE		Act No Ack Act Act	
\$\$\10/05/2018 08:31:50.822 _kV.HMI		ROCESS LAN A SWITCH 2 COMMUNICATION FAILURE ALARM		Background Background	
Avia 10/05/2018 08:31:50.480 kv.HMI		ROCESS LAN A SWITCH 1 COMMUNICATION FAILURE ALARM		Text Text	

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Overview

System control				
Substation gateway for SCADA/DMS (IEC 61850/DNP3)	INGESAS™ IC3			
GPS (IEEE 1588)	1093B			
Router / firewall	RX1500			
HMI with monitoring, engineering and manteinance software	12 x INGESYS™ IT - eFS			
Protection and control equipment (high voltage)				
Line primary protection (87L, 21) + BCU	2 x INGEPAC™ EF LD			
Line backup protection (21) + BCU	3 x INGEPAC™ EF ZT			
Busbar primary protection (87B)	487B			
Busbar backup protection (multifunction)	1 x INGEPAC™ EF MD			
Transformer protection (87T, REF) + BCU	2 x INGEPAC™ EF TD			
Process bus				
Merging unit and digital interface	7 x INGEPAC™ EF PB			
Protection and control equipment (medium voltage)				
Feeder protection + BCU	2 x INGEPAC™ EF MD			
Incoming protection + BCU	2 x INGEPAC™ EF MD			
Bus section protection + BCU	1 x INGEPAC™ EF MD			
Capacitor bank protection	P142			
Protocol converter	INGEPAC™ TCP			
Common signals				
Common signals BCU	1 x INGEPAC™ EF CD			
Feeder automation unit				
Feeder remote terminal Unit (FRTU)	4 x INGEPAC™ DA			
Communication switches				
Station bus switches	4 x MAR1040			
Process bus switches	6 x MAR1040			
Redbox	4 x RSP25			
Highlights				

· Simulation of control systems with different types of redundancy or synchronization: PRP/HSR, SNTP/IEEE 1588

IEC 61850 interoperability testing. IEC 61860 or serial equipment Integration tests

• Different architectures and protection schemes systems simulation: Breaker and a half, H Scheme, Double busbar, Double busbar with double breaker and Main and Transfer.



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