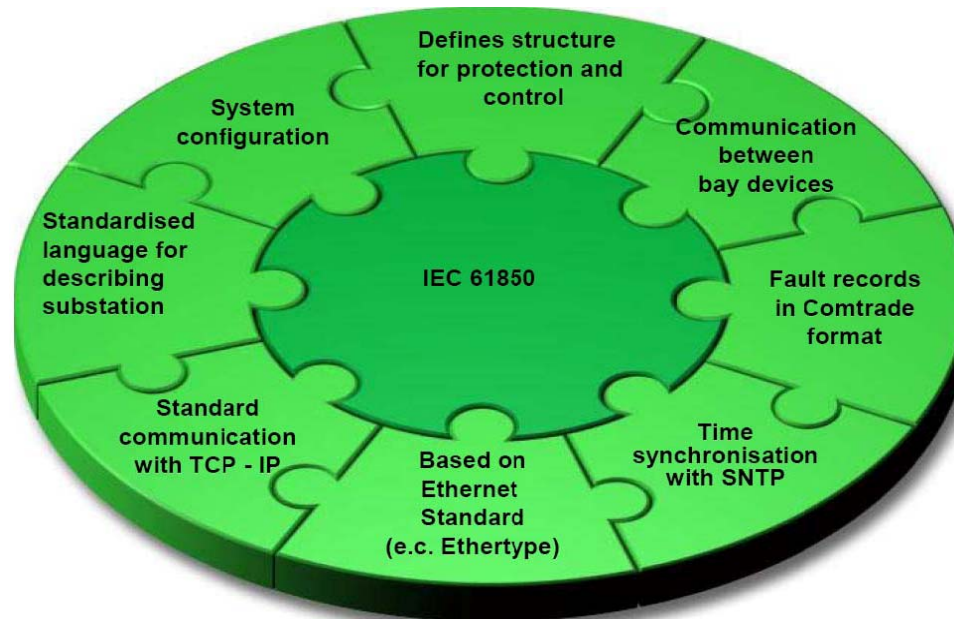


## IEC 61850-3 Standard

### Abstract

Applies to substation automation systems and more specifically defines the communication between intelligent electronic devices in the substation and the related system requirements.

### What is IEC 61850



The IEC (International Electrotechnical Commission) is the world's leading organization that prepares and publishes International Standards for all electrical, electronic and related technologies. IEC 61850 is an electrical substation standard by IEC.

Globally, IEC 61850 provides:

- standardized information models for things like circuit-breakers, transformers, and so forth;
- information exchange methods to access the data of the information models, report sequences-of-events (SoE), log historical data, control devices, sampled value distribution, fast peer-to-peer process data exchange, etc.;
- a unified system configuration language (XML based) and device online self-description.

It does this for the following applications:

- protection and control;
- integration of innovative sensor and switch technologies;

- metering, supervisory control and data acquisition (SCADA);
- remote monitoring and fault diagnosis;
- automated dispatch and control;
- asset management;
- condition monitoring and diagnosis.

**Benefit** from the standard in a similar manner because IEC 61850:

- is a global standard;
- uses mainstream technologies like Ethernet, TCP/IP, Object modelling, and XML;
- is highly flexible and scalable;
- reduces operation, engineering and maintenance costs;
- is a seamless solution for cross-application requirements;
- reduces the diversity of solutions to be supported;
- is applicable in various other application domains.

IEC 61850-3 is also referred to *IEC 61000-6-5: Generic Standard Immunity for Power Station and Substation Environments* for the dedicated requirements.

The details of these requirements and test procedures are given in the parts of the IEC 61000-4-x series. The figure below shows the relationship between IEC 61850-3, IEC 61000-6-5 the IEC 61000-4-x series and other referenced standards.

IEC 61850-3 EMI Immunity Type Tests:				
TEST	Description	Test Levels		Severity Levels
IEC 61000-4-2	ESD	Enclosure Contact	+/- 8kV	4
		Enclosure Air	+/- 15kV	4
IEC 61000-4-3	Radiated RFI	Enclosure ports	10 V/m	x
		Signal ports	+/- 4kV @ 2.5kHz	x
IEC 61000-4-4	Burst (Fast Transient)	D.C. Power ports	+/- 4kV	4
		A.C. Power ports	+/- 4kV	4
		Earth ground ports <sup>3</sup>	+/- 4kV	4
		Signal ports	+/- 4kV line-to-earth, +/- 2kV line-to-line	4
IEC 61000-4-5	Surge	D.C. Power ports	+/- 2kV line-to-earth, +/- 1kV line-to-line	3
		A.C. Power ports	+/- 4kV line-to-earth, +/- 2kV line-to-line	4
		Signal ports	10V	3
IEC 61000-4-6	Induced (Conducted) RFI	D.C Power ports	10V	3
		A.C. Power ports	10V	3
		Earth ground ports <sup>3</sup>	10V	3
		Enclosure ports	40 A/m continuous, 1000 A/m for 1 s	N/A
IEC 61000-4-29	Voltage Dips & Interrupts	D.C. Power ports	30% for 0.1s, 60% for 0.1s, 100% for 0.05s	N/A
		A.C. Power ports	30% for 1 period, 60% for 50 periods	N/A
IEC 61000-4-11			100% for 5 periods, 100% for 50 periods <sup>2</sup>	N/A
IEC 61000-4-12	Damped Oscillatory	Signal ports	2.5kV common, 1kV differential mode @ 1MHz	3
		D.C. Power ports	2.5kV common, 1kV differential mode @ 1MHz	3
		A.C. Power ports	2.5kV common, 1kV differential mode @ 1MHz	3
IEC 61000-4-16	Mains Frequency Voltage	Signal ports	30V Continuous, 300V for 1s	4
		D.C. Power ports	30V Continuous, 300V for 1s	4
IEC 61000-4-17	Ripple on D.C. Power Supply	D.C. Power ports	10%	3
IEC 60255-5	Dielectric Strength	Signal ports	2kVac (Fail-Safe Relay output)	N/A
		D.C. Power ports	2kVac	N/A
		A.C. Power ports	2kVac	N/A
IEC 60255-5	H.V. Impulse	Signal ports	5kV (Fail-Safe Relay output)	N/A
		D.C. Power ports	5kV	N/A
		A.C. Power ports	5kV	N/A

IEC 61000-6-5 defines port categories and the corresponding applicable standards. A 'port' is defined as a "particular interface of the specified equipments.

There are five port categories defined:

1. Enclosure Port
2. Signal Port
3. Low Voltage a.c. Input Power and Output Power Ports
4. Low Voltage d.c. Input Power and Output Power Ports
5. Functional Earth Port

Each port type has a corresponding list of IEC 61000-4-x EMI Immunity standards which must be met. Table 1 lists the required test standards and levels for each port type.

**Table 1: IEC 61000-6-5 EMI Test Levels**

Referenced Standards	IEC-61 000-6-5 LEVELS				
	Signal Port Types				
	Enclosure Ports	Signal Ports (In field)	a.c. Input Power Ports	d.c. Input Power Ports	Earth Port
IEC-61000-4-2 ESD	3 (8kV Air, 6kV Contact)				
IEC-61000-4-3 Radiated RFI	3 (10 V/m)				
IEC-61000-4-4 Fast Transients		4 (2kV/1kv)	4 (2kV/1kv)	4 (2kV/1kv)	4 (2kV/1kv)
IEC-61000-4-5 Surge		3 (2kV/1kv)	4 (4kV/2kv)	3 (2kV/1kv)	
IEC-61000-4-6 Induced RFI		3 (10 V)	3 (10 V)	3 (10 V)	3 (10 V)
IEC-61000-4-8 Magnetic Field	2 (3 A/m)				
IEC-61000-4-11 Voltage Dips a.c. Power			30% for 1 cycle		
IEC-61000-4-12 Damped Oscillatory		2 (1kv/0.5kv)	3 (2.5kv/1kv)	3 (2.5kv/1kv)	
IEC-61000-4-16 Mains Freq.		4 30V Cont. 300V for 1s		4 30V Cont. 300V for 1s	
IEC-61000-4-17 a.c. Ripple				10%	
IEC-61000-4-29 Voltage Dips d.c. Power				30% & 60% for 100ms	

## Environment & EMI Test

These environmental conditions are described in industrial standard specifications IEC 61850-3 and IEEE 1613 for networking devices. Similarly, equipment used for traffic control applications are required to withstand roadside vibration in addition to high/low heat and humidity.

	Tests	Industrial Standards	TC Communications - JumboSwitch Type Test and Levels	
			Power Supply Unit (PSU)	RJ-45 & Signal
Temperature/Humidity	Low Temperature Use	IEC 61850-3, IEEE 1613, NEMA TS-2	IEC 60068-2-1; Ae; -40°C; 16 hour	
	Low Temperature Storage	IEC 61850-3, IEEE 1613, NEMA TS-2		
	High Temperature Use	IEC 61850-3, IEEE 1613, NEMA TS-2	IEC 60068-2-2; Be; +80°C; 16 hour	
	High Temperature Storage	IEC 61850-3, IEEE 1613, NEMA TS-2	IEC 60068-2-2; Bd; +85°C; 16 hour	
	Damp Heat	IEC 61850-3, IEEE 1613, NEMA TS-2	IEC 60068-2-30; Db; +55°C; 95%; 96 hours	
Mechanical	Vibration	IEC 61850-3, IEEE 1613, NEMA TS-2	IEC 60068-2-6; Fc; 3 - 150 Hz; 7.5 mm; 2 g; 10 sweeps per axis	
	Shock	IEC 61850-3, IEEE 1613, NEMA TS-2	IEC 60068-2-27; Ea; 30g; 11ms	
ElectroMagnetic Compatibility	Electrostatic Discharge Immunity	IEEE 1613	IEC 61000-4-2; 8kV contact; 15 kV air	
	Radiated RF Immunity	IEC 61850-3, IEEE 1613	IEC 61000-4-3; 80 MHz - 1000 MHz; 20 V/m; AM 80% 1 kHz	
	EFT/Burst Immunity	IEC 61850-3, IEEE 1613	IEC 61000-4-4; 4 kV CM	IEC 61000-4-4; 4 kV CM
	Surge Immunity	IEC 61850-3	IEC 61000-4-5; 4 kV LG; 2 kV LL	IEC 61000-4-5; 4 kV LG; 2 kV LL
	Conducted RF immunity	IEC 61850-3	IEC 61000-4-6; 150 kHz - 80 MHz; 10 V; AM 80% 1 kHz	IEC 61000-4-6; 150 kHz - 80 MHz; 10 V; AM 80% 1 kHz
	Magnetic Field Immunity	IEC 61850-3	IEC 61000-4-8; 50 Hz; 100 A/m cont.; 1000 A/m 1 s	
	Damped Oscillatory Magnetic Field Immunity	IEC 61850-3	IEC 61000-4-10; 100 kHz; 30 A/m	
	Damped Oscillatory Magnetic Field Immunity	IEC 61850-3	IEC 61000-4-10; 1 MHz; 30 A/m	
Power Supply Unit (PSU) Variations	AC Voltage Dips	IEC 61850-3	IEC 61000-4-11; 30% & 100%, 0.5s	NA
	DC Voltage Dips	IEC 61850-3	IEC 61000-4-29; 40% & 70%, 0.1s	NA
	Damped Oscillatory Wave	IEC 61850-3	IEC 61000-4-12; 2.5 kV CM, 1.0 kV DM @1MHz	IEC 61000-4-12; 2.5 kV CM, 1.0 kV DM @ 1MHz
	Conducted PF CM Voltage	IEC 61850-3	IEC 61000-4-16; 50 Hz; 30 V cont.; 300 V 1s	IEC 61000-4-16; 50 Hz; 30 V cont.; 300 V 1s
	Conducted Emission	IEC 61850-3	CE/FCC/CISPR22 class A	CE/FCC/CISPR22 class A
	Conducted emission	IEC 61850-3	CE/FCC/CISPR22 class A	CE/FCC/CISPR22 class A
	Radiated emission	IEC 61850-3	CE/FCC/CISPR22 class A	
Dielectric	Dielectric 50 Hz Test	IEEE 1613	IEC 60255-5; 2 kV	IEC 60255-5; 0.5 kV
	Impulse Voltage Test	IEEE 1613	IEC60255-5; 5 kV	IEC 60255-5; 5 kV