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SDO OCT.
OPTICAL CURRENT TRANSFORMER.

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INTRODUCTION

The SDO OCT is a highly accurate optical current transformer for high voltage systems, based on a fully passive optical transducer (The SDO ICT). The SDO OCT provides a digital measurement solution for metering and protection applications in the next generation of high voltage digital substations.

The operation of the SDO ICT is based on the Faraday Effect. The polarization state of a linearly polarized optical signal is rotated as it travels through a magnetic field. For an optical signal which travels along a closed path, the angle of rotation is proportional to the current enclosed by the path.

The rotation of the polarization state of the light is measured interferometrically as the phase difference between circularly polarized optical signals which travel in opposite directions around a coil of fibre that encloses the primary.

ARTECHE SDO uses the most advanced fiber sensing technology based on a patented technique that allows construction of passive interferometric transducers.

The SDO OCT is composed of three elements:

- SDO ICT sensor head.
- Post-type solid and dry polymer insulator with an embedded fiber optic.
- SDO MU merging unit.

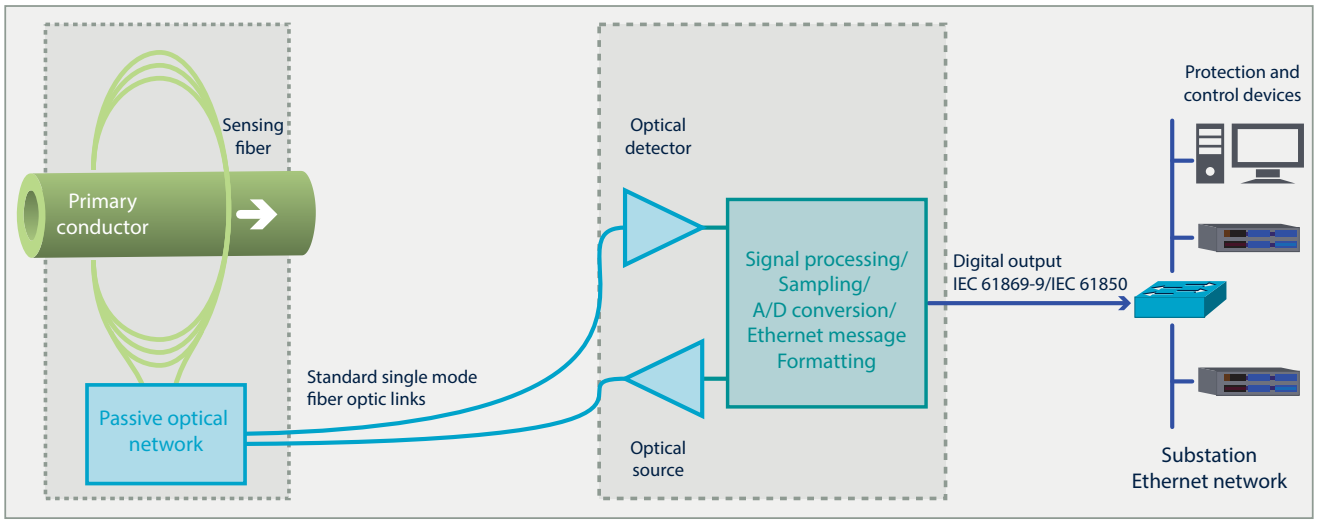
SDO ICT. Sensor Head.

Measure AC or DC current with an optical transducer.

SDO MU. Merging Unit.

Provide full digital measurement data for metering and protection IEC 61850-9-2 LE compatible and IEC 61869-9 ready.

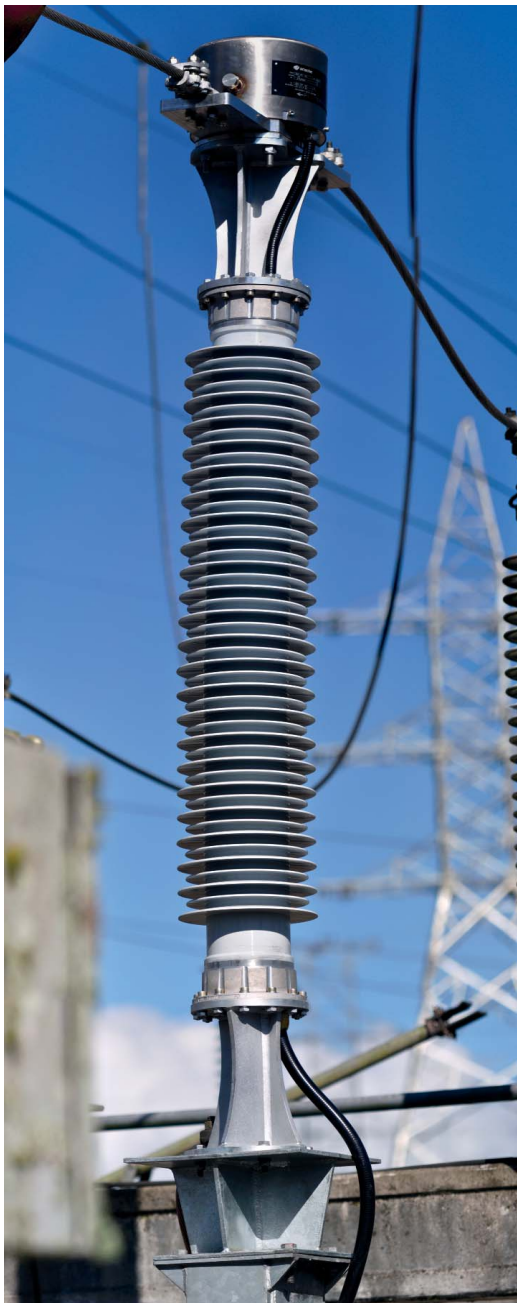
› Simplified block diagram of SDO OCT optical current transformer.



APPLICATIONS

SDO OCT is ideally suited for:

- Digital measurement for metering & protection based on the IEC 61850 process bus protocol.
- Custom, LEA output. Can also be provided for other applications, such as:
  - HVDC.
  - FACTS.



› SDO ICT head and insulator

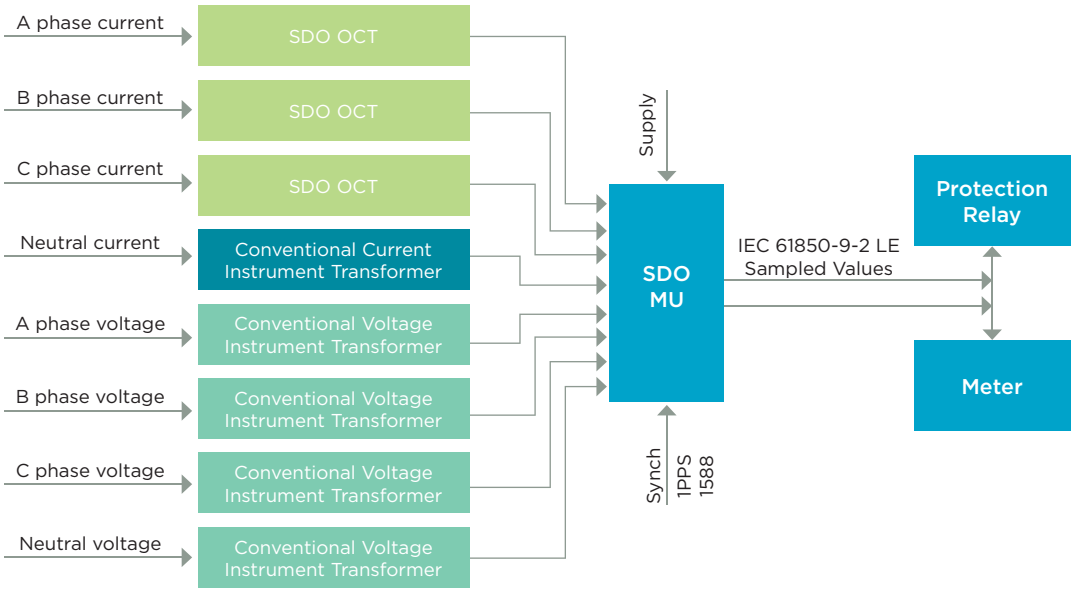
SYSTEM ARCHITECTURE

The SDO ICT is connected to the primary conductor in the switchyard. Typically it will be mounted on the insulator column however, other mounting options are possible for example by using suspension type HV links or by integrating the sensor into other apparatus such as circuit breakers or disconnecting switches.

The SDO MU is an integral part of the optical current transformer. It sends and receives the optical signal to and from the sensor controlling up to three SDO ICT current sensors. In addition to that, it can interface with conventional CT's and VTs.

The SDO MU performs all the necessary signal processing and analogue to digital conversion. It samples the measured values according to frequencies specified in IEC 61850-9-2LE and IEC 61869 standards.

Then it synchronizes and merges the current and voltage channels before encoding the output signal to the digital format of Sampled Values (SV) and streams it via two redundant Ethernet ports to the Process Bus network.



› Interfaces of SDO MU merging unit.

COMPONENT DESCRIPTION

SDO ICT SENSOR HEAD

- Fully passive current transducer based on optical fiber. No power supply required in the switchyard.
- Full galvanic insulation.
- No risk of open secondary's.
- Maintenance free.
- Reduced dimensions for an optimized substation footprint and easy retrofit integration.
- IEC Class 0.2 accuracy and full linearity over an unlimited dynamic range.
- Single transducer both for metering and for protection applications.
- The current transducer is independent from the voltage level.
- It can be designed for DC measurement.
- Redundancy is optional: The sensor head can house up to 2 sensing coils.

INSULATOR

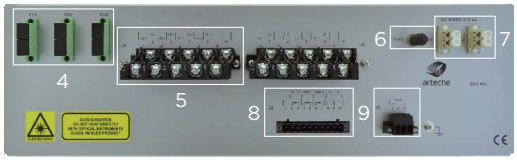
- Dry solid insulation. No oil or SF_6.
- Standard voltage levels: 145 kV, 245 kV, 420 kV and 550 kV. Additional voltage levels available on request.
- Connectorized fiber link inside allows easy interchangeability of insulator/sensor head.
- Custom options available using flexible, suspension type insulators mounted on the rigid bus.

SDO MU MERGING UNIT

- 19" 3U Rack mounted electronic signal processing device installed in the protection and control panel.
- Input interface:
  - 3x SDO ICT.
  - 4x Conventional VT.
  - 4x Conventional CT.
- Time Synchronization: 1PPS / 1588.
- Digital output via dual Ethernet port. Compliant with IEC 61850-9-2LE and IEC 61869-9 ready.
- For HVDC applications as custom analogue LEA output can be provided.

FRONT AND REAR VIEW

1. 4x20 LCD display.
2. 8 LEDs for status indications & alarms.
3. Configuration port. Web based interface.
4. Optical links to SDO ICTs.
5. Analog VT inputs.
6. 1PPS input.
7. 2xEthernet 100FX Port Duplex LC connector.
8. Relay contact outputs.
9. Power supply 88-270 Vac/Vdc.

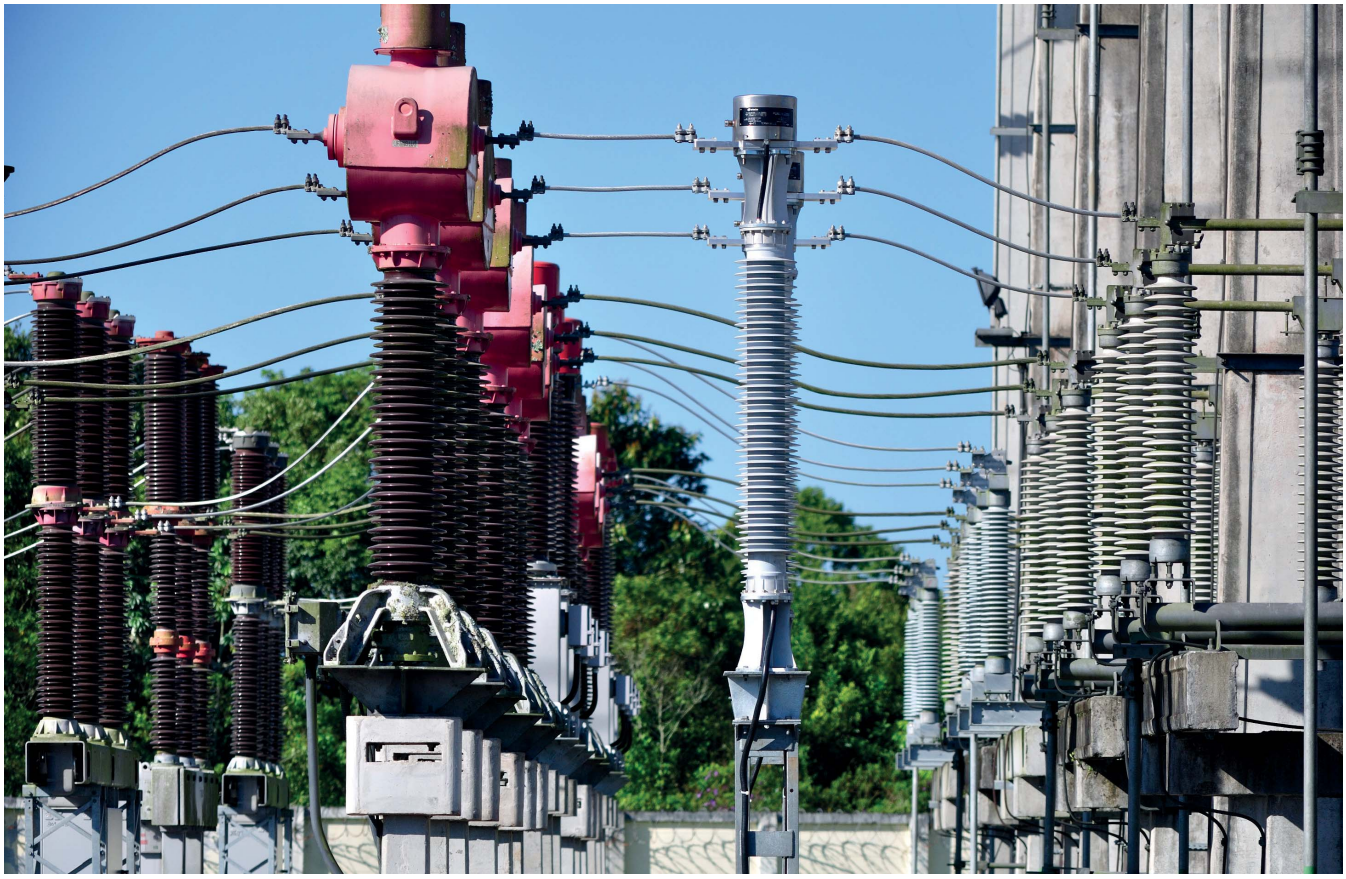


› Routine tested in ARTECHE's laboratory.

TECHNICAL SPECIFICATIONS

SDO ICT SENSOR HEAD	
Nominal current	User specified for up to 2,500 A (Higher current ratings available under request)
Rated short-time thermal and dynamic current	25 kA rms for 3 s, 62.5 kA peak 50 kA rms for 1 s, 125 kA peak 75 kA rms for 1 s, 187.5 kA peak
Rated continuous thermal current	2,500 A rms
Accuracy	0.2 s / P20
Bandwidth	2.4 kHz at 80 samples/cycle 7.6 kHz at 256 samples/cycle
Weight	15 kg
IP protection	IP66
Primary terminal	Aluminum
Temperature	-40°C to +85°C
Humidity	100% Storage 90% Operating
Vibration	1G
Optical connectors	2 x SC/APC
Fiber type for connection with the SDO MU merging unit	Standard duplex single mode

INSULATOR (CUSTOMER SPECIFIED)					
Maximum system voltage (Um)	kV	145	245	420	550
Rated power-frequency withstand voltage	kV rms	275	460	630	680
Rated lightning impulse withstand voltage	kV peak	650	1,050	1,425	1,550
Rated switching impulse withstand voltage	kV peak			1,050	1,175
Minimum creepage distances 31 mm/kV	mm	4,495	7,595	13,020	17,050
Minimum flashover distance	mm	1,200	2,200	3,250	3,800
Static withstand loads FR	N	2,000	2,500	4,000	4,000
MML	N	2,000	2,500	4,000	4,000
SML min	N	5,000	6,250	10,000	10,000



SDO MU MERGING UNIT	
MECHANICAL	
Dimensions	19” Rack, 3U high 429 mm x 133 mm x 285 mm (L x H x W)
Weight	5 kg
ELECTRICAL	
Power supply voltage	88 – 270 Vac/Vdc
Max current	280 mA
Power consumption	Maximum 25 W
ENVIRONMENTAL	
Operating temperature	-5°C to +55°C
Storage temperature	-40°C to +85°C
Humidity	90% Non-condensing
Max. altitude	2,000 m
Vibration	0.5 G
ANALOGUE CURRENT INPUTS	
Number of inputs	1-4
Rated current	1 A or 5 A
Frequency	50/60 Hz
CT accuracy	0.2 s / P20
Burden	<0.2 VA per phase
Thermal withstand	1 second at 500 A Continuous at 20 A
ANALOGUE VOLTAGE INPUTS	
Number of inputs	1-4
VT range	33 to 240 V
VT accuracy	0.2
Burden	< 0.5 VA
Thermal withstand	300 V continuously
OPTICAL CURRENT INPUTS	
Number of inputs (SDO ICT sensors)	3
Optical fiber type	Single mode
Connector type	SC/APC
Optical output safety class	Class 1M
Max fiber length	5 km
CONTACT OUTPUTS	
Number of outputs	3 x Normally closed alarm outputs, user configurable 1 x Normally open or normally closed output, fixed
Rated voltage	250 VAC
Max. switching voltage	400 VAC
Rated current	8 A
Breaking capacity	2,000 VA
PROCESS BUS INTERFACES	
Number of Ethernet ports	2 x 100BaseFX (LC connector)
Protocol	IEC 61850-9-2LE
Max. total number of SV streams	2
Sampling rate	80 smp/cyc and 256 smp/cyc
SYNCHRONIZATION	
Physical interface	1PPS (fiber ST connector, 820 nm)
Option	IEEE1588 (PTP)
HMI	
Display	4 x 20 alphanumerical
LEDs	8 (7 of which are user configurable)
Configuration port	Front 100BaseTX
Configuration software	Web browser

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