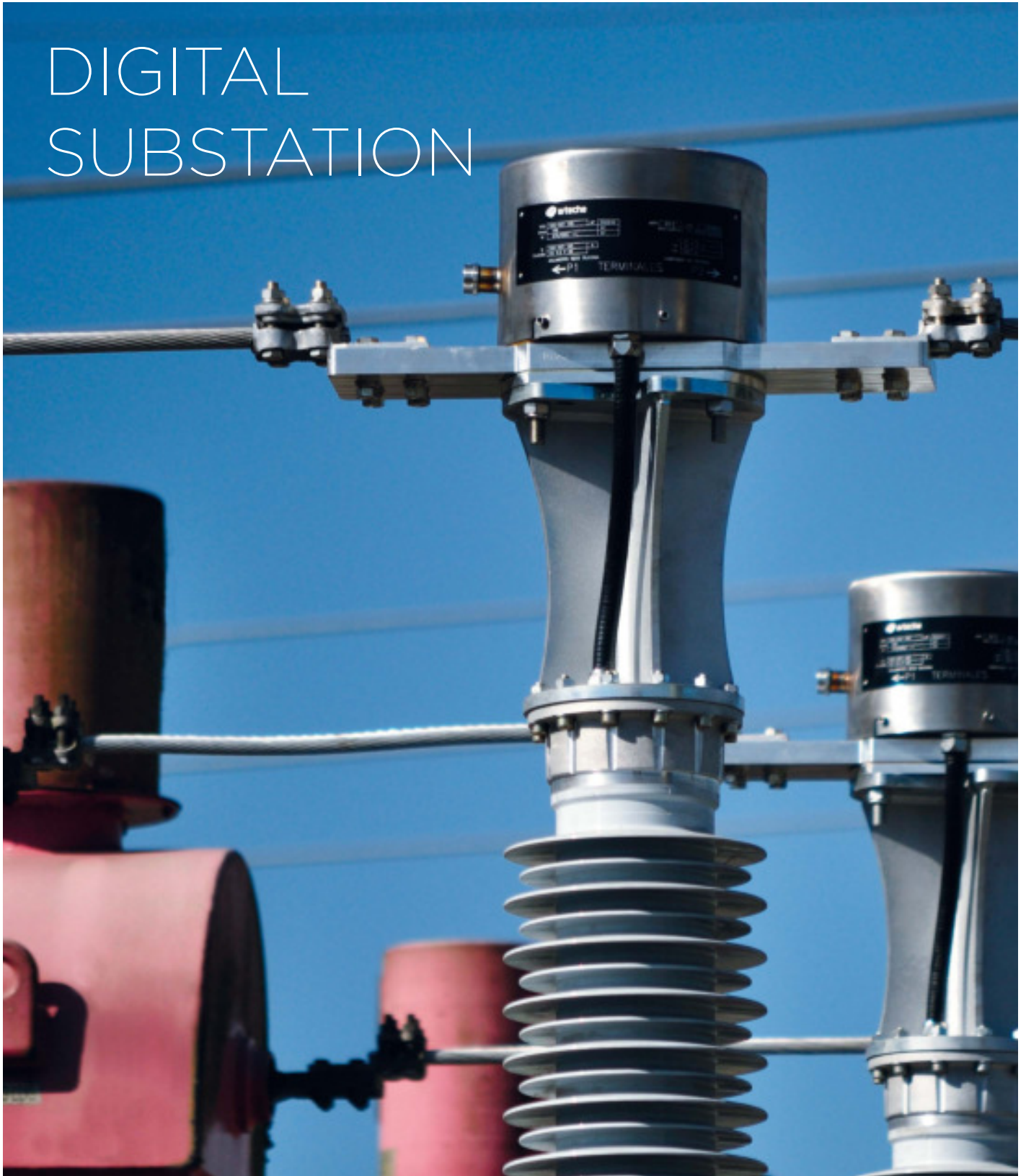


arteche

# DIGITAL SUBSTATION



This document may be subject to changes.  
Contact ARTECHE to confirm the characteristics and  
availability of the products described here.

A decorative graphic consisting of numerous thin, white, curved lines that sweep across the bottom half of the page, creating a sense of motion and depth against the solid blue background.

# Moving together

# OPTICAL CURRENT TRANSFORMER

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.

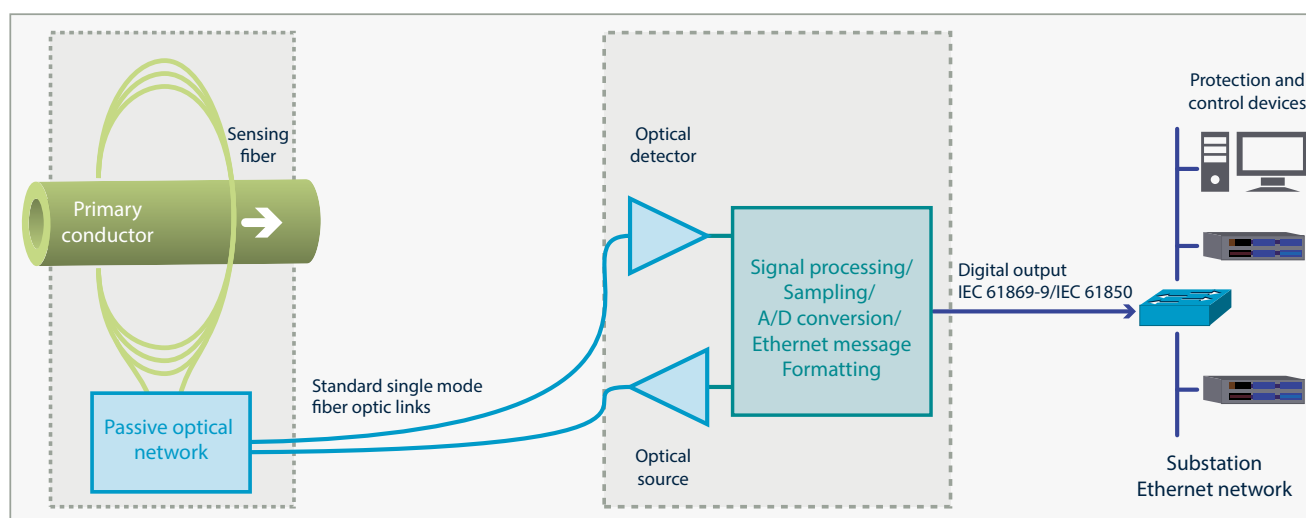
## SDO ICT. Sensor Head.

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.

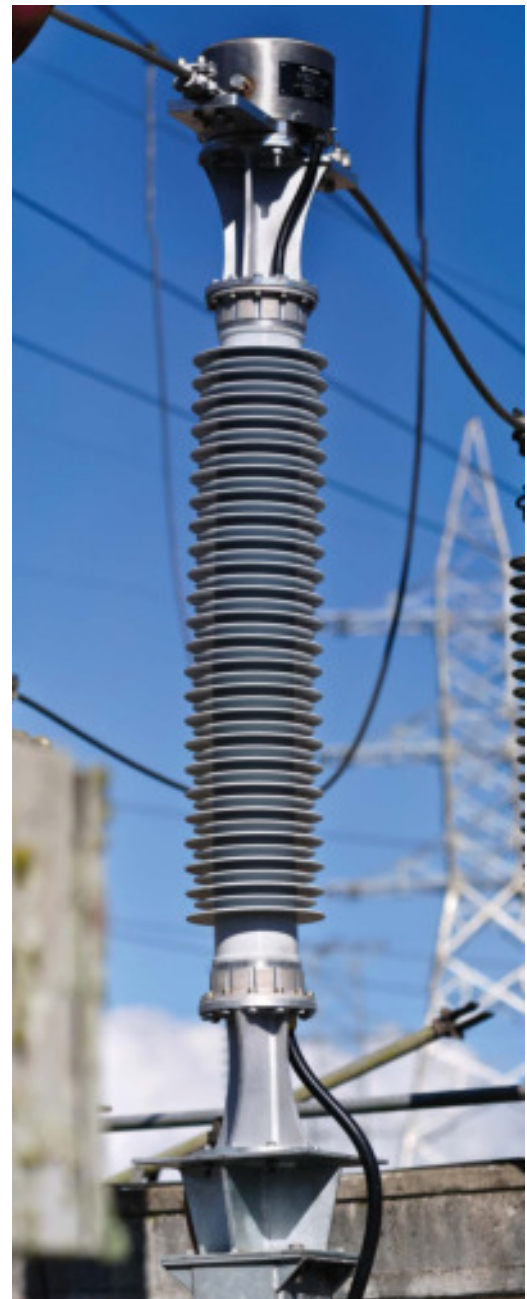
## SYSTEM ARCHITECTURE

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.

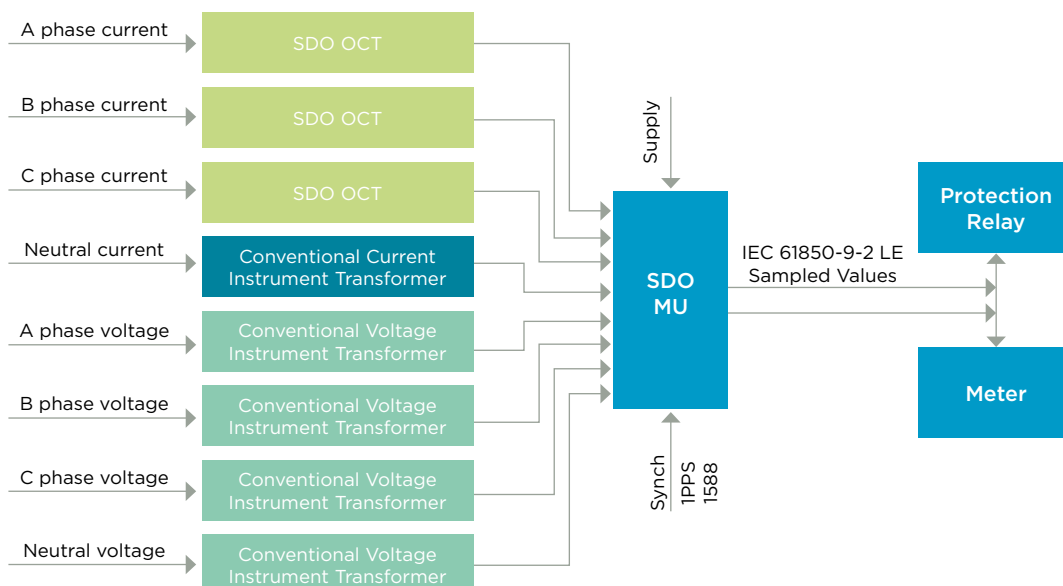
The SDO MU is an integral part of the optical current transformer. It sends and receives the optical signal to and from the sensor controlling up to three SDO ICT current sensors. In addition to that, it can interface with conventional CT's and VTs.

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.



› SDO ICT head and insulator



› 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

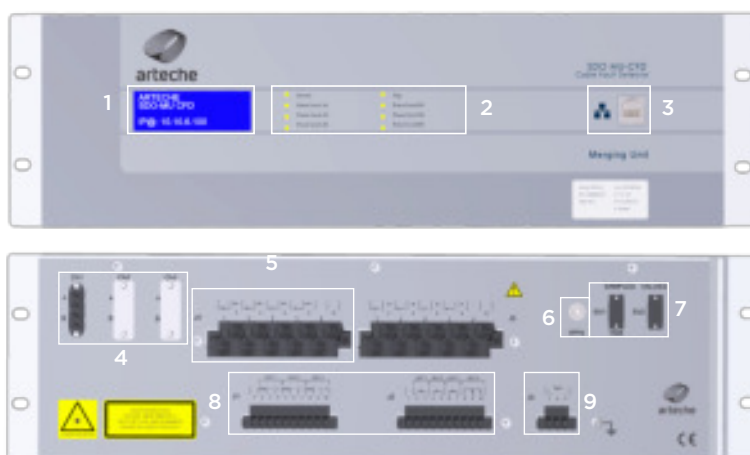
- › Dry solid insulation. No oil or SF<sub>6</sub>.
- › Standard voltage levels: 145 kV, 245 kV, 420 kV and 550 kV. Additional voltage levels available on request.
- › Connectorized fiber link inside allows easy interchangeability of insulator/sensor head.
- › Custom options available using flexible, 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.

## SDO MU MERGING UNIT : FRONT AND REAR VIEW

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



- › 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)

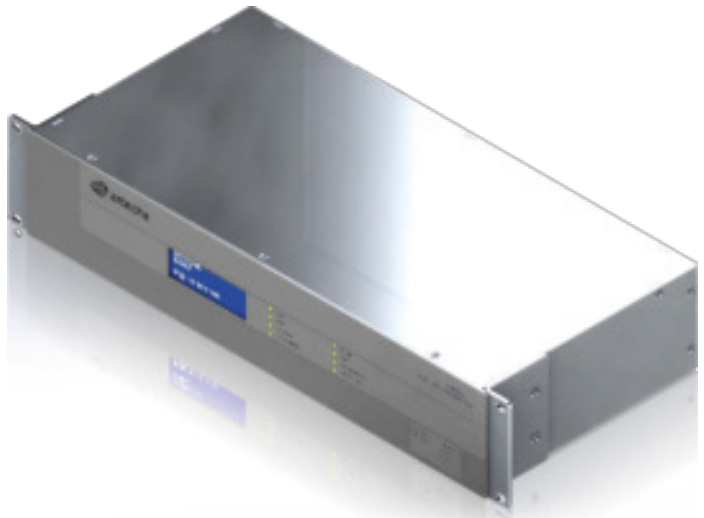
Maximum system voltage (Um)	kV	145	245	420	550
Rated power-frequency withstand voltage	kV rms	275	460	630	680
Rated lightning impulse withstand voltage	kV peak	650	1,050	1,425	1,550
Rated switching impulse withstand voltage	kV peak			1,050	1,175
Minimum creepage distances 31 mm/kV	mm	4,495	7,595	13,020	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	482x287x133 mm • 19" 3U Rack	
Weight	5 Kg	
POWER SUPPLY		
Voltage Range	100 – 230 Vdc/Vac	48 - 125 Vdc
Frequency	50/60Hz	
Power Consumption	25 W	
ENVIRONMENTAL		
Operating temperature	-5°C to +55°C	
Storage temperature	-40°C to +85°C	
Humidity	90% Without Condensation	
Maximum height	2,000 m	
Vibration	0.5 G	
OPTICAL INTERFACE		
Number of channels	Up to 3 Duplex SC/APC	
Wavelength	1550 nm, 1300 nm	
Power Output	< 10dBm	
Type of fiber	SM G.652.D	
ANALOG INPUTS		
Current	4 x 1A / 5A	
Voltage	4 x 300V	
OUTPUT CONTACTS (Configurable by the user)		
Description	Contact 1 NC/NO Service	
	Contact 2 and 3 NC/NO	
	Contact 4 to 8 NO	
SAMPLED VALUES		
Number of ports	2	
Physical interface	2 x 100 Base FX Ethernet	
Type of connector	LC type Optical MM	
Protocol	IEC 61850-9-2 LE IEC 61869-9	
Grids	F4000S1I4U4, F4800S1I4U4, F4800S2I4U4, F12800S8I4U4, F15360S8I4U4, F14400S6I4U4	
SYNCHRONIZATION		
1 PPS	Optical MM ST	
PTP	IEC 61588:2009 profile IEC PAS 61850-9-3 Sampled Values Port 1	
USER-MACHINE INTERFACE		
Display	4x20 Alphanumerical	
LEDs	8 x User Configurable: status & alarms	
Configuration port	Front 10/100 Base TX	
Software configuration	Web Browser	

# STAND ALONE MERGING UNIT (SAMU)

The SAMU Stand Alone Merging Unit is intended for connecting conventional current and voltage instrument transformers to digital protection and control equipment in the substation through the Process Bus, according to the IEC 61850-9-2 LE protocol, providing full digital measurement and IEC 61869-9 protocols (Sampled Values) for metering and protection applications. The SAMU is enclosed on a 19" 2U rack mounted case or a smaller wall mount case without display, with a weight of 3 kg.



› SAMU Merging Unit.

## COMPONENT DESCRIPTION

### SAMU MERGING UNIT

- › 19" 2U Rack or Din Rail Mounted case with a weight of 3 KG.
- › Input interface:
  - 4X Conventional VT
  - 4X Conventional CT.
- › Time Synchronization 1PPS and PTP15800.
- › Network redundancy PRP/HSR.
- › Digital output via dual Ethernet port. Compliant with IEC 61850-9-2LE and IEC 61869-9.



› SAMU Wall Mounted Merging Unit.

### SAMU MERGING UNIT: FRONT AND REAR VIEW:

- |   |   |
|---|---|
| 1. 4x20 LCD display.                        | 6. 1PPS input.                                |
| 2. 8 LEDs for status indications & alarms.  | 7. 2xEthernet 100FX Port Duplex LC connector. |
| 3. Configuration port. Web based interface. | 8. Relay contact outputs.                     |
| 4. Analog CT Inputs.                        | 9. Power supply.                              |
| 5. Analog VT inputs.                        |   |





# TECHNICAL SPECIFICATIONS

## SAMU DIN STAND ALONE MERGING UNIT

### MECHANICAL

Dimensions	Wall mounted DIN rail mounting or panel mounting 255mm x 95mm x 155mm	19" Rack, 2U high 429mm x 88mm x 285mm (L x H x W)
Weight	3 Kg	

### ELECTRICAL

Voltage Range	48-125 Vcc 100-230 Vac/Vdc
Max Current	280 mA
Power Consumption	Maximum 8W

### ENVIRONMENTAL

Operating Temperature	-40°C to +55°C
Storage Temperature	-40°C to +85°C
Humidity	90% Non-condensing
Maximum Altitude	2,000 m
Vibration	0.5 G

### INTERFACE WITH CONVENTIONAL INSTRUMENT TRANSFORMERS

#### ANALOG VOLTAGE INPUTS

Number of inputs	4
Rated voltage	33 to 240V
Accuracy	0.2
Burden	< 0.5VA
Thermal Withstand	300V continuously

#### ANALOG CURRENT INPUTS

Number of inputs	4
Rated current	1 A / 5 A
Accuracy	0.2 s / P20
Burden	< 0.5VA
Thermal Withstand	20 A continuous & 500 A (for 1 s)

#### OUTPUT CONTACTS

Number of outputs	1 NO/NC Watchdog
Rated voltage	250VAC
Max. switching voltage	400VAC
Rated current	8A

### PROCESS BUS INTERFACES

Number of Ethernet ports	2 x 100BaseFX (LC connector)
Protocol	IEC 61850-9-2LE / IEC 61869-9
Max. total number of SV streams	4
Type of frames	F4000S1I4V4 (50 Hz), F4800S2I4V4 (50 Hz), F12800S8I4V4 (50 Hz) , F14400S6I4V4 (50 Hz), F4800S1I4V4 (60 Hz), F4800S2I4V4 (60 Hz), F15360S8I4V4 (60 Hz), F14400S6I4V4 (60 Hz)
Network redundancy	PRP/HSR

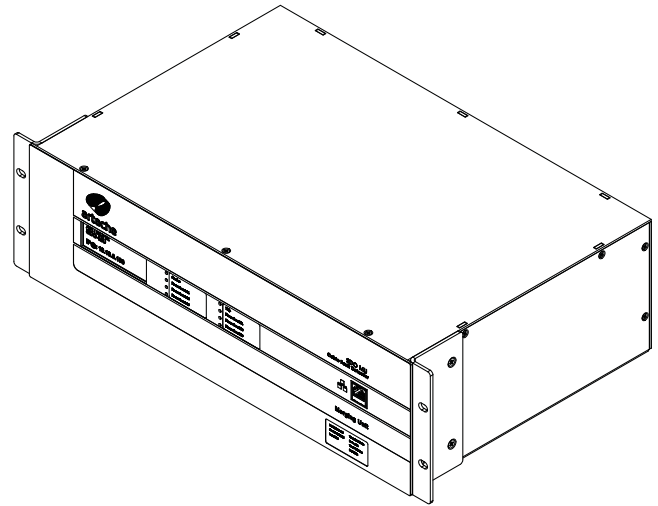
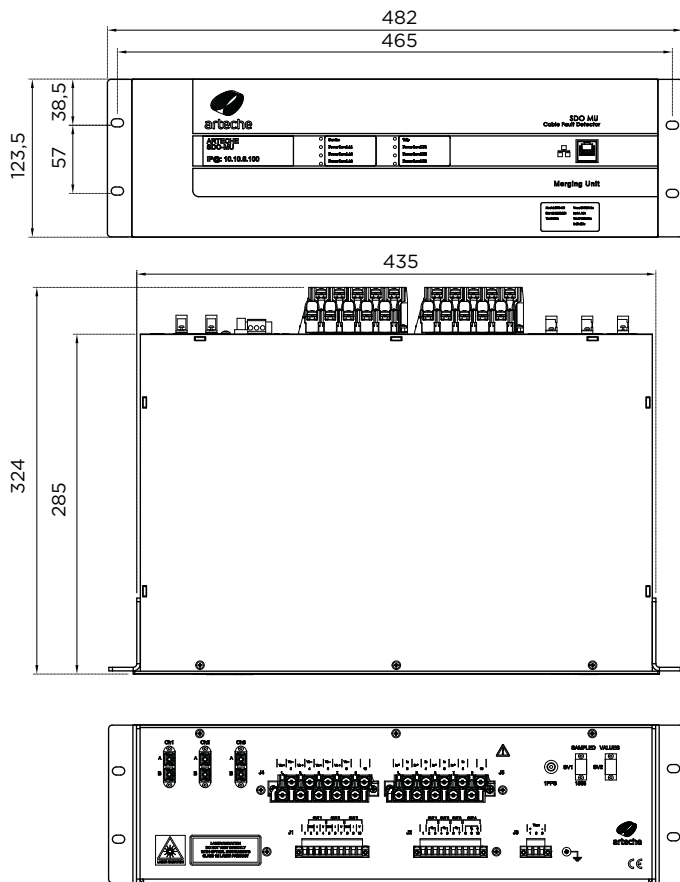
### SYNCHRONIZATION

Physical interface	1PPS (fiber ST connector, 820nm)
PTP	IEEE1588v2

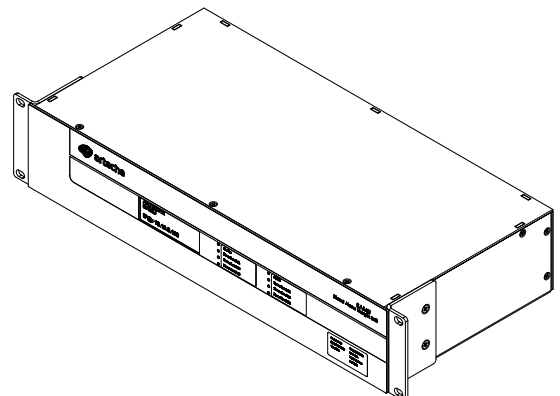
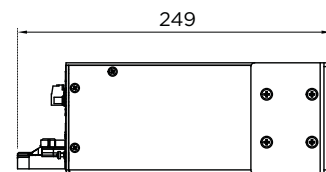
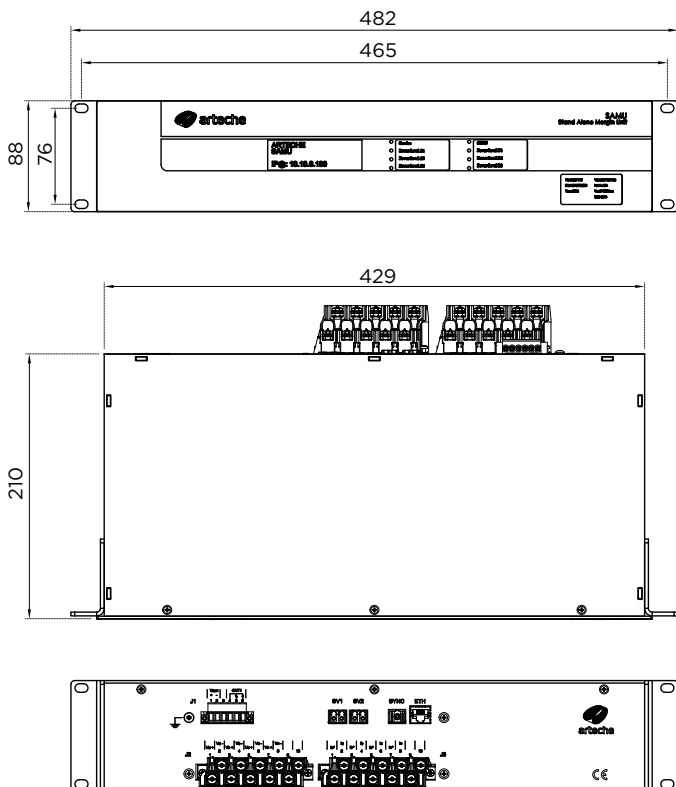
### HMI

LEDs	8	
Configuration port	100BaseTX	
Configuration software	Web browser	
Display	NA	4 x 20 alphanumerical

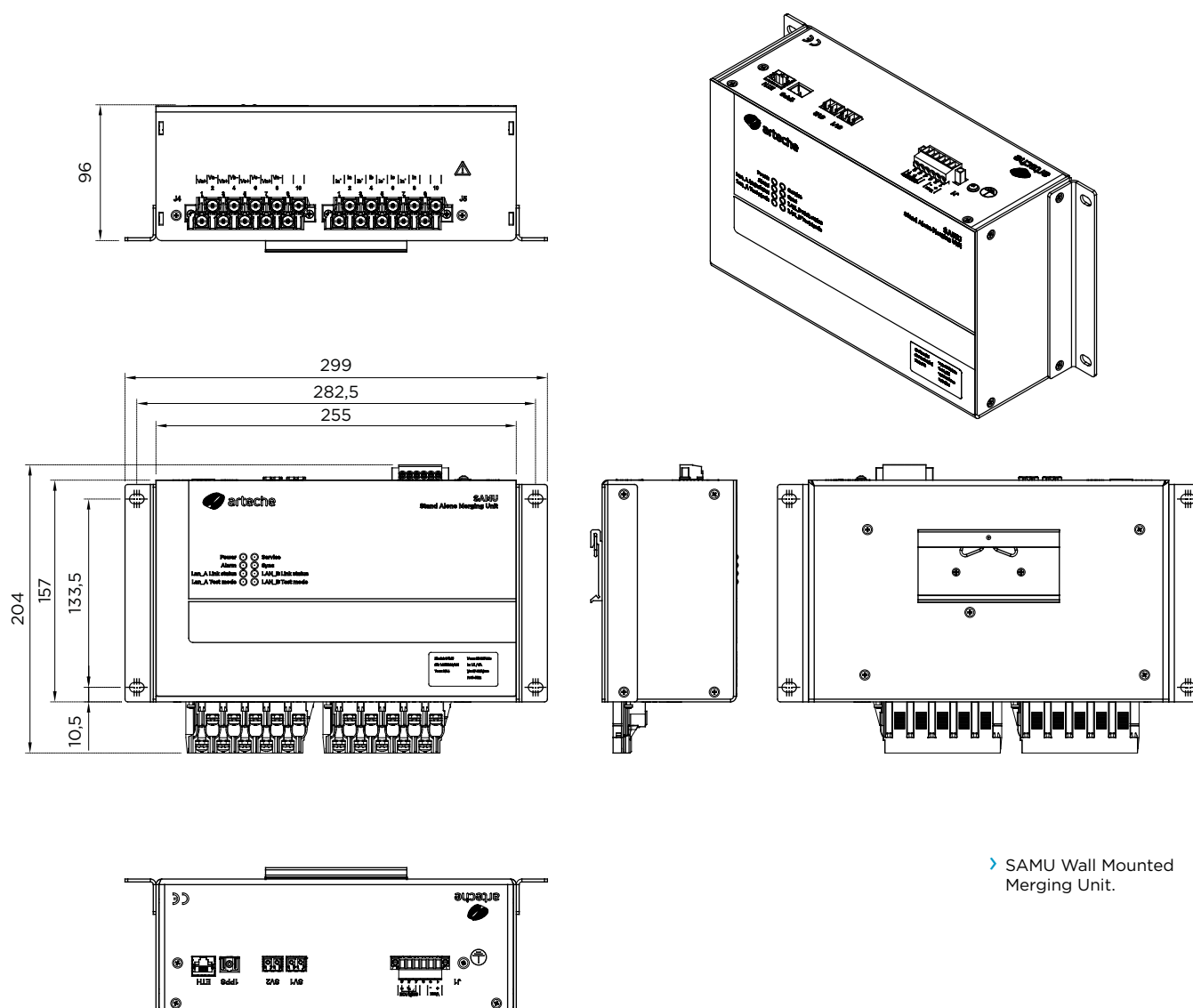
# DRAWING DIMENSIONS



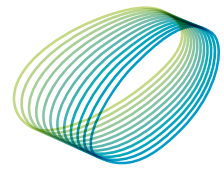
› SDO Merging Unit.



› SAMU Merging Unit.



➤ SAMU Wall Mounted Merging Unit.



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