Vizimax
A PGC Company

SynchroTeq® Lite
Datasheet

19" rack mount model shown

STL0x0000-SP-en
2025-09-03

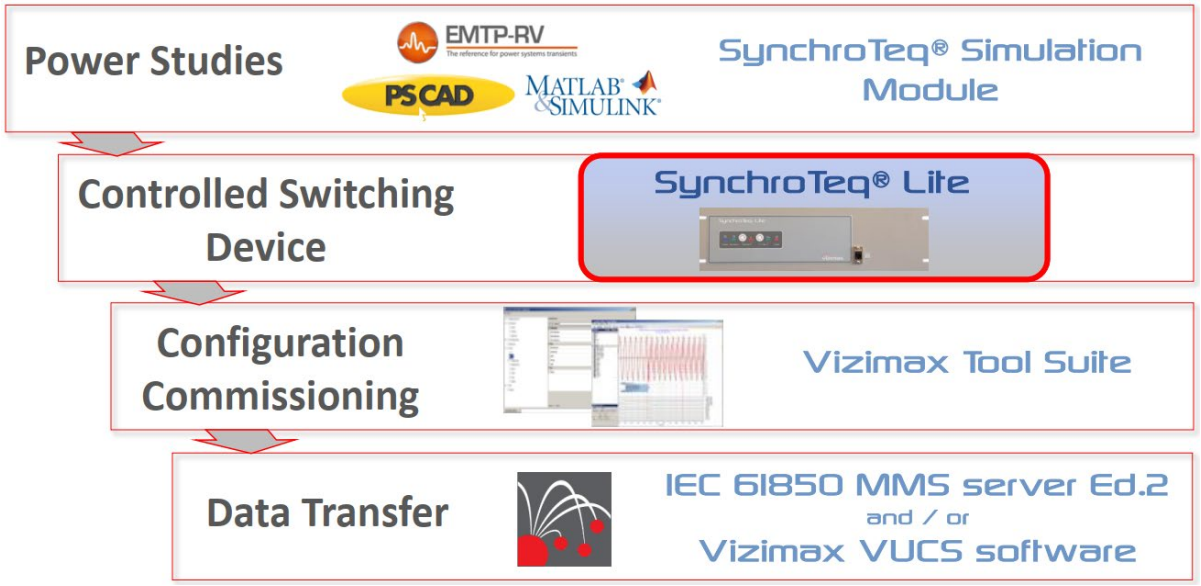
Table of contents

List of tables

List of figures

1 Product overview

SynchroTeq® Lite is an extension of the SynchroTeq® Plus aimed at HV circuit breakers (CB).



A compact Control Switching Device (CSD) for HV circuit breakers with independent pole mechanism, the SynchroTeq Lite is specifically designed for capacitor banks, shunt reactors, filters and power transformers switching projects at fixed settings.

The SynchroTeq Lite features a comprehensive set of Controlled Switching modes, and performs significantly well in a variety of applications as shown in Table 1.

Table 1 Comparison between SynchroTeq models by load switching application

Load Switching Application	SynchroTeq Lite	SynchroTeq Plus	
		SynchroTeq Plus	SynchroTeq Plus + VL measurement
Discharged capacitor banks – MSC / MSCDN	☑	☑	☑
Shunt reactors – MSR	☑	☑	☑
Power transformers (Peak voltage)	☑	☑	☑
Power transformers (Residual flux)			☑
Power transformers in parallel (Residual flux)			☑
Uncompensated transmission lines (any kV level) with trapped charges (reclosing)		☑	
Compensated transmission lines (any kV level) with trapped charges (reclosing)			☑
Discharged transmission lines and cables		☑	
Partially charged capacitor banks – MSC/FLT		☑	☑
CB and a half (any kV level)		☑	☑
Voltage range	Up to UHV		

SynchroTeq Lite is a manufacturer agnostic solution suitable for 'DC controlled' spring mechanism CBs or load break switches regardless of the make.

1.1 Applications of SynchroTeq Lite

The outstanding performance of SynchroTeq Lite devices applies to a variety of HV CBs – regardless of the make – and can be leveraged for optimized switching of shunt reactors, capacitors banks, harmonic filters and power transformers at peak voltage (fixed settings without residual flux calculation).

Among other applications, SynchroTeq Lite is a powerful, communication-enabled intelligent electronic device (IED) suitable for:

Renewable power generation

- Switching reactive loads in standalone.

Conventional power generation

- Switching reactive loads.

Industry

- Electrical Arc Furnaces: MSC/MSR/FLT in SVC, reduction of switchgear wear, preservation and lifespan improvement of switchgears.
- Transportation & Railways: energizing capacitor banks for VAR Compensation.
- Oil&Gas: Capacitor bank switching.

Equipment / FACTS

- Switching of capacitor banks (MSC), shunt reactor switching (MSR), harmonic filters (FLT).
- Capacitors bank switches for PF Correction/VAR Compensation.

Power grids

- Capacitor bank switching.
- Shunt reactor switching.

1.2 SynchroTeq Lite highlights

Advanced controlled switching

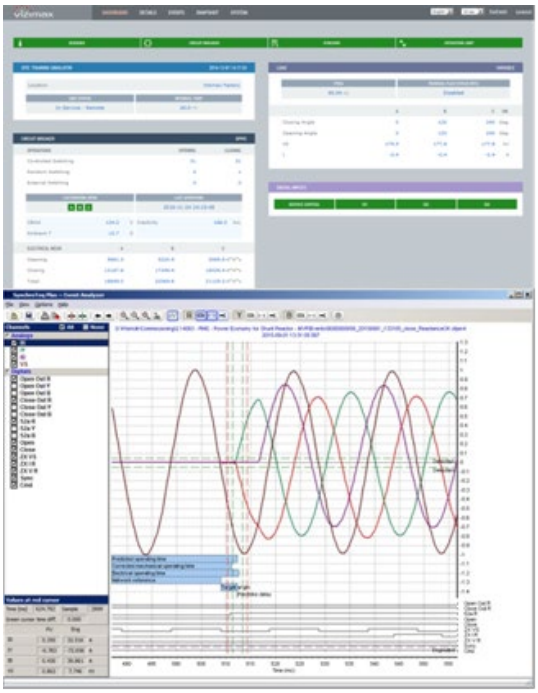
- HV capacitor banks
- Shunt reactors
- Filters

Manufacturer agnostic solution[1]

- Spring mechanism CBs
- Load break switches

Monitoring tools

- Web operational interface
- Event analyzer
- Waveform viewer
- Electrical wear (i^2t)



CB timing compensation

- Control voltage
- Temperature
- Idle time
- Adaptive control

Strong Engine, Web-based operation

- 500 events and waveforms storage
- Secured Web-Based interface

Data transfer for SCADA / DCS (native protocols)

- IEC61850 MMS server Ed.2 including XCBR control model
- DNP3.0
- Modbus-TCP (Slave)

NOTE [1] SynchroTeq Lite functions with circuit breakers of any brand.

1.3 SynchroTeq Lite units – Major features

Table 2 SynchroTeq Lite major features

Features	SynchroTeq Lite
CB coils control outputs	6x Coil control outputs (3x Open + 3x Close coils)
AC current inputs	3x AC current measurement inputs (1 or 5 A)
AC voltage inputs	1x AC voltage input for source voltage measurement and synchronization
Digital inputs	10x digital inputs: • Three inputs for CB contact position (52a contacts) • Two inputs for CB control (OPEN/CLOSE commands) • One input to set SynchroTeq Lite Out of Service • One input to set SynchroTeq Lite in Local / Remote mode • Three programmable inputs for CB monitoring and commands
Compensation inputs	2x CB timing compensation inputs: • Temperature input (RTD or 4-20 mA from external sensor) • CB coil voltage input
Signalization outputs	4x dry contact relay outputs: Alarms and Bypass
Power supply	24 V_{DC} or 48 V_{DC} or 110 V_{DC} or 125 V_{DC} or 220 V_{DC}
Local user interface	• Two push buttons (rear and front panel) • Five LEDs (front panel) – Seven LEDs (rear panel)
Communications ports (all models)	• 1x USB port • 1x RS-232 Serial port • 1x RS-485 Isolated Serial port
Network links (STL010000 only)	• 2x 100Base-TX on RJ45 connectors[1]
Network links (STL020000 only)	• 1x 100BASE-TX on RJ45 connectors for service only • 2x 100BASE-TX on RJ45 connectors for PRP[2] (copper) or • 2x 100BASE-FX on LC connectors for PRP[2] (multimode optical fiber)

Time synchronization	• NTP – SNTP time server on Ethernet
	• IEEE PTP 1588 clock source on Ethernet
	  ○ 4 profiles supported
	• IRIG-B clock source using the optional IRIG-B RWC0Y0001 module[3]
	  ○ 5 profiles supported
	• Manual synchronization from PC computer

Native protocols	• IEC 61850 server MMS
	  ○ XCBR control
	  ○ Full dataset refreshed every second
	  ○ 4 predefined unbuffered reports
	  ○ 120 COMTRADE waveform retrieval.
	• DNP3.0
	• Modbus-TCP (Slave)

CB wear monitoring	• Electrical wear monitoring (i^2t) including warning and alarm function. • Mechanical wear monitoring including warning and alarm function
Functional tools	• Event capture (up to 500 events including COMTRADE compatible waveform files) • SynchroTeq Event Analyzer • Secured web interface

[1] STL010000 does not support the Parallel Redundancy Protocol (PRP)
[2] Parallel Redundancy Protocol
[3] Only available on STL010000 models.

1.4 Controlled switching

SynchroTeq Lite units perform the controlled closing and/or opening of CB poles. They are applicable to multiple CB types and operation modes:

- Single pole operation with independent mechanism (IPO).
- Three pole operation with pole staggered

Closing/Opening CB poles at optimal angles (individually) results in a dramatic reduction of inrush currents, voltage transients and stresses, thus improving the quality of power delivery and preserving the health/lifespan of all assets such as CBs, reactive loads and apparatus.

When receiving a command (OPEN or CLOSE) SynchroTeq Lite intercepts either a zero-crossing of the source voltage or a zero-crossing of the current, whichever is appropriate, for accurate switching synchronization. SynchroTeq Lite then computes and executes a delay/timer consisting of:

- A predicted CB operation time taking into account variations due to operating conditions, idle time, as well as timing measurements observed during previous operations (adaptive control for mechanical wear) and pole pre-arcing & arcing times (to avoid re-ignition while opening). When applicable, operation times are calculated for each individual pole.
- A synchronization delay,

CB coil control output signals are then generated at very precise instants within the wave. The targeted electrical switching instants are determined according to the controlled switching strategy applicable to the considered load.

1.5 Circuit breaker wear monitoring

SynchroTeq Lite is not only a CSD, but also a CB monitoring tool that drastically reduces the CB maintenance costs by allowing for scheduling maintenance only when required due to excessive wear.

SynchroTeq Lite offers two CB monitoring functions.

1.5.1 Electrical wear monitoring

For each phase, SynchroTeq Lite measures the electrical wear of the CB at each operation (i^2t), including protection and local switching operations. The i^2t value for each Phase is reported in the switching operation event. The accumulated electrical wear for each Phase is also computed and stored in the unit and displayed by the web interface or the configurator tool in remote mode.

An electrical wear alarm function can be enabled, including a warning threshold.

1.5.2 Mechanical wear monitoring

SynchroTeq Lite counts all the switching operations (closing + opening, controlled + random + external). The accumulated values are displayed by the web interface or the configurator tool in remote mode.

A mechanical wear alarm function can be enabled, including a warning threshold.

1.6 Operating environment

SynchroTeq Lite can be installed in the control compartments of switchgears, as well as in control & relay rooms, or in independent enclosures. It is therefore offered in rackmount versions for easy integration in 19″ rack applications, or in ‘panel mount’ or ‘standard mount’ version when form factor is critical. SynchroTeq Lite is typically connected to the following subsystems:

- DC power supply: uninterruptible power source for the substation / CB control and protection equipment.
- Controlled CB: control outputs, statuses/pole positions.
- Protection relays.
- AC measurements: system/source voltage, load current.
- Condition measurements: DC control voltage, temperature.
- Local control panels, networked SCADA/DCS systems, network infrastructure: CB control in substations or in equipment.

1.6.1 Switching of capacitor bank or shunt reactor

SynchroTeq Lite is intended for the controlled switching of shunt reactors, discharged capacitor banks and harmonic filters, all based on fixed switching angle strategies.

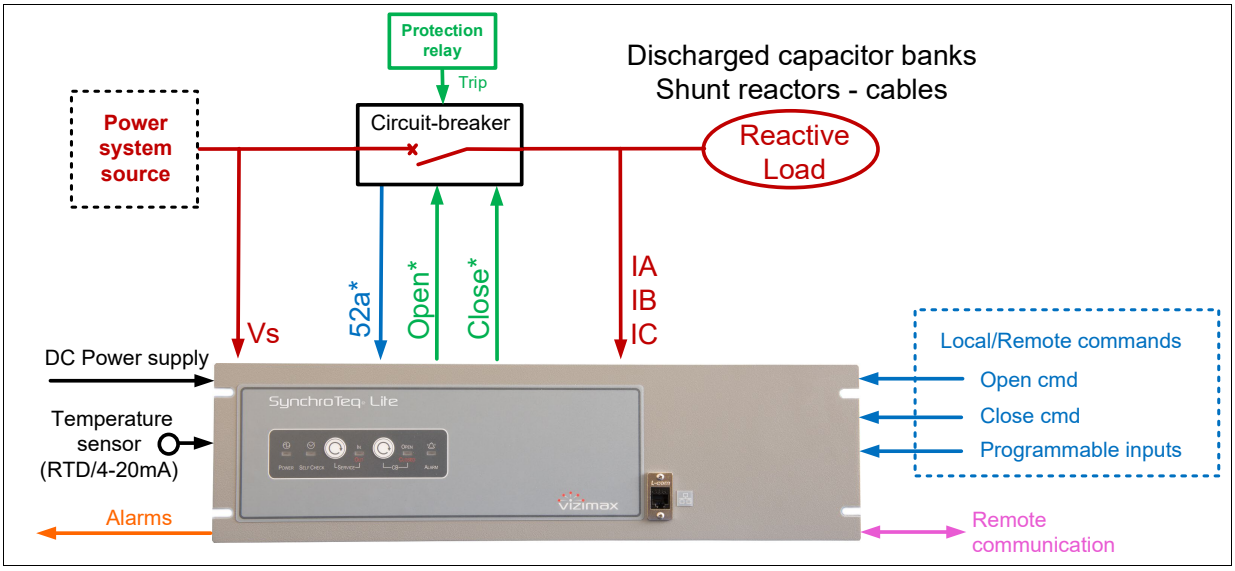


Figure 1 Example of SynchroTeq Lite in discharged cap. bank or shunt reactor application

1.7 Communication protocols for unit management, time synchronization and data transfer

1.7.1 Communication ports

All SynchroTeq Lite units feature the following communication links on their rear panel:

- 1x Service port – 100 Base-TX Ethernet[1,2]
- 1x RS232 port
- 1x RS-485 port reserved for the optional legacy SynchroTeq Communication module (RWK000016).

The STL010000 includes:

- 1x General use network interface[3] – 100 Base-TX Ethernet

The STL020000 includes:

- 1x PRP Network interface[3] over either:
  - 2x 100Base-TX Ethernet ports or
  - 2x 100BASE-FX on LC connectors (multimode optical fiber)

NOTE

[1] The ethernet service port is relocated to the front on 19" rackmount models.
[2] The physical location of the rear ethernet service port (Eth-1) differs between STL010000 and STL020000. Refer to section 1.9.1 for details.
[3] Support IEC61850 MMS.

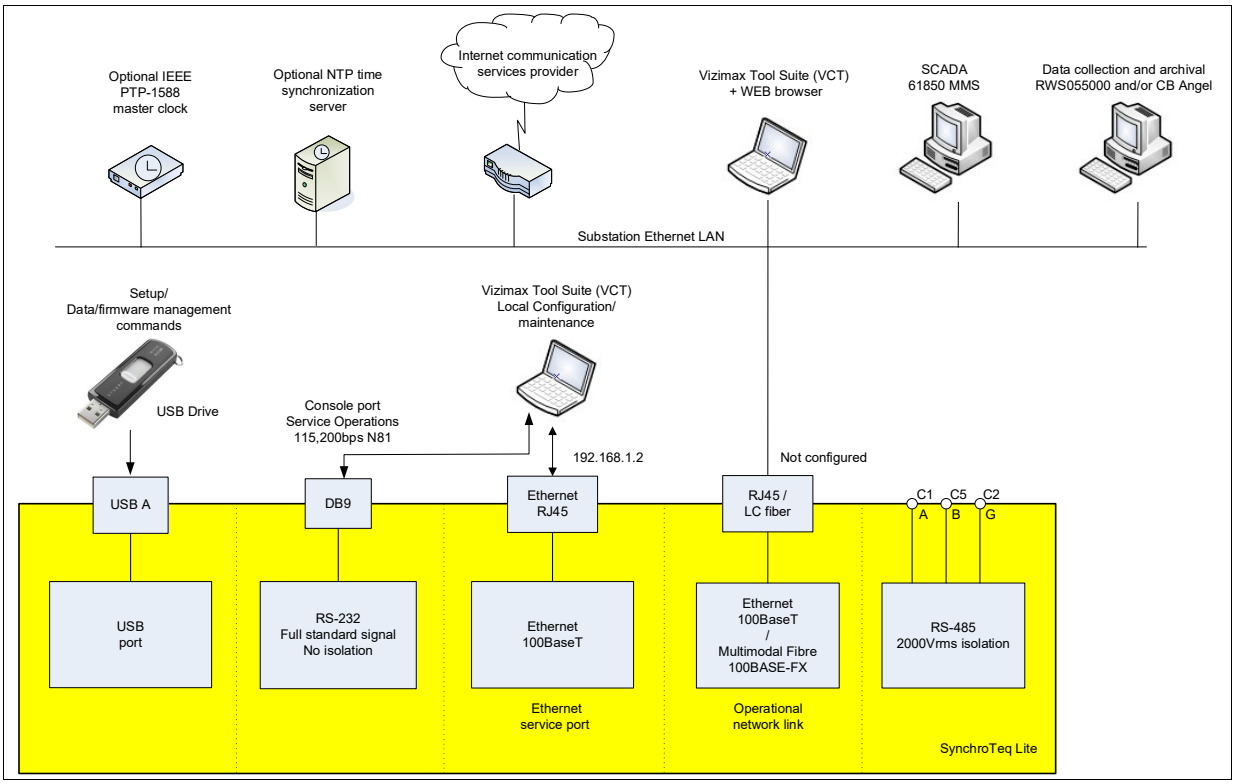


Figure 2 SynchroTeq Lite Communication links

1.7.2 Time synchronization

For all models of SynchroTeq Lite, time synchronization can be achieved with either:

- PTP-1588 (IEEE Standard Precision Time Protocol) service over the Ethernet network. Supported profiles are:
  - IEC 61850-9-3
  - IEEE C37-238 Profile (2011 and 2017)
  - L3_UDP_E2E (Layer 3 UDP end-to-end time delay measurements)
- NTP – SNTP (Network Time Protocol) service over the Ethernet network

The STL010000 also supports IRIG-B time synchronization protocol using the optional RWC0Y0001 module over either:

- BNC connector with a compliant IEC 60044-8 TTL signal
- Fiber optic ST type connector with a compliant IEC 61869-9 signal

The IRIG-B supported formats are:

- IRIG-B000/B004 IEEE C37.118
- IRIG-B000/B004 IEEE-1344
- IRIG-B003

NOTE In power utility automation, current standards strongly recommend the use of PRP (Parallel Redundancy Protocol) and time synchronization via PTP-1588 using what is commonly called the “power profile”, formally known as IEC/IEEE 61850-9-3: Communication networks and systems for power utility automation – Part 9-3: Precision time protocol profile for power utility automation.

This is fully supported natively by the STL020000.

1.7.3 Front panel / local HMI – Remote control

SynchroTeq Lite can be managed locally (front panel and built-in HMI) and/or remotely through either:

- The Vizimax Tool Suite (VCT) in remote mode.
- The SynchroTeq web-based operation interface (requires a web-browser).
- IEC61850 substation automation environment (MMS protocol).
- Native substation automation protocols: IEC 61850 MMS server Ed.2 or DNP3.0 or MODBUS.
- Dry contacts (commands) and relay outputs (statuses).

1.7.4 Communications and data analytics solutions

SynchroTeq Lite natively supports the following protocols:

- IEC 61850 MMS Server Ed.2 protocol (including the XCBR control model), for substation automation and SCADA system interfacing.
- DNP3.0[1]
- Modbus-TCP (Slave)[1]

NOTE [1] Available with SynchroTeq firmware 2.3 and up.

1.8 Vizimax tool suite and web interface

The Vizimax Tool Suite is a user interface for configuring and operating the SynchroTeq product family. This multi-language software is composed of the following components:

- PC based configuration tool software for operation parameters (VCT)
- Vizimax Event Analyzer waveform viewer, which displays the waveform captured by SynchroTeq (COMTRADE format) for operation and functional analysis
- USB port driver for the SynchroTeq product family
- Web based local and online help site including documentation in PDF format

The Vizimax Commissioning Tool (VCT) is used to customize the operation of the SynchroTeq Lite and its Web interface using system and application configuration files. It supports both offline and online modes of operation and provides features to exchange these configuration files with the SynchroTeq Lite unit. Typically, the configuration files are designed and managed offline on a maintenance PC and are uploaded to the SynchroTeq Lite as part of the system commissioning.

The Vizimax Event Analyzer is a COMTRADE compatible enhanced waveform viewer that displays the waveforms and the CB operation simultaneously.

1.8.1 SynchroTeq web interface

The unit status, alarms, readings values and event list can be displayed on any PC using a Web browser. The SynchroTeq Lite Web interface is secured via (https://) and access is granted only to authenticated users.

The SynchroTeq Web interface is dedicated for remote operation, control and analysis of the SynchroTeq units. The Web interface offers several dedicated panels:

Dashboard tab
Displays real time status of the SynchroTeq unit, the CB and the load.

Details tab
Provides access to detailed statuses, including the SynchroTeq and CB alarms, the CB operating time predictions, and electrical wear information.

Events tab
Lists the 500 most recent events recorded and stored in the SynchroTeq Lite.

Snapshot tab
List of the most recent waveform captures manually triggered by the user.

System tab
System page used to manage the SynchroTeq configuration files and provides hardware information.

1.8.2 Events and waveform recording

At each switching operation, SynchroTeq Lite records current and voltage waveforms including the CB interface signals (52a/Trip/Close/inputs/commands) over a period of 1250 ms (250 ms pre-trigger). These waveforms are part of the events list which includes alarms and operations performed on the unit (for example, alarm reset, in/out of service). Each event includes the SynchroTeq Lite's complete status and operating environment to allow for detailed further analysis. The SynchroTeq Lite has a memory capacity of 500 events, including waveforms.

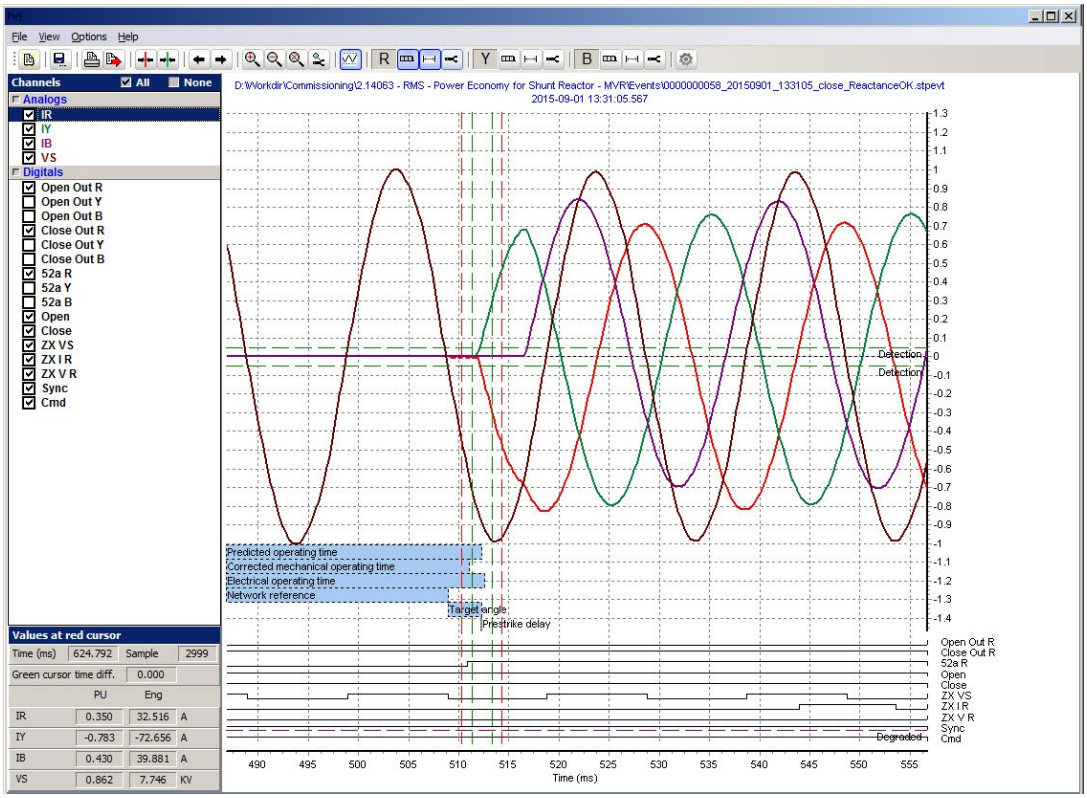


Figure 3 SynchroTeq Lite – Vizimax event analyzer

1.9 SynchroTeq Lite connectors and HMI identification

1.9.1 Back panel connectors identification

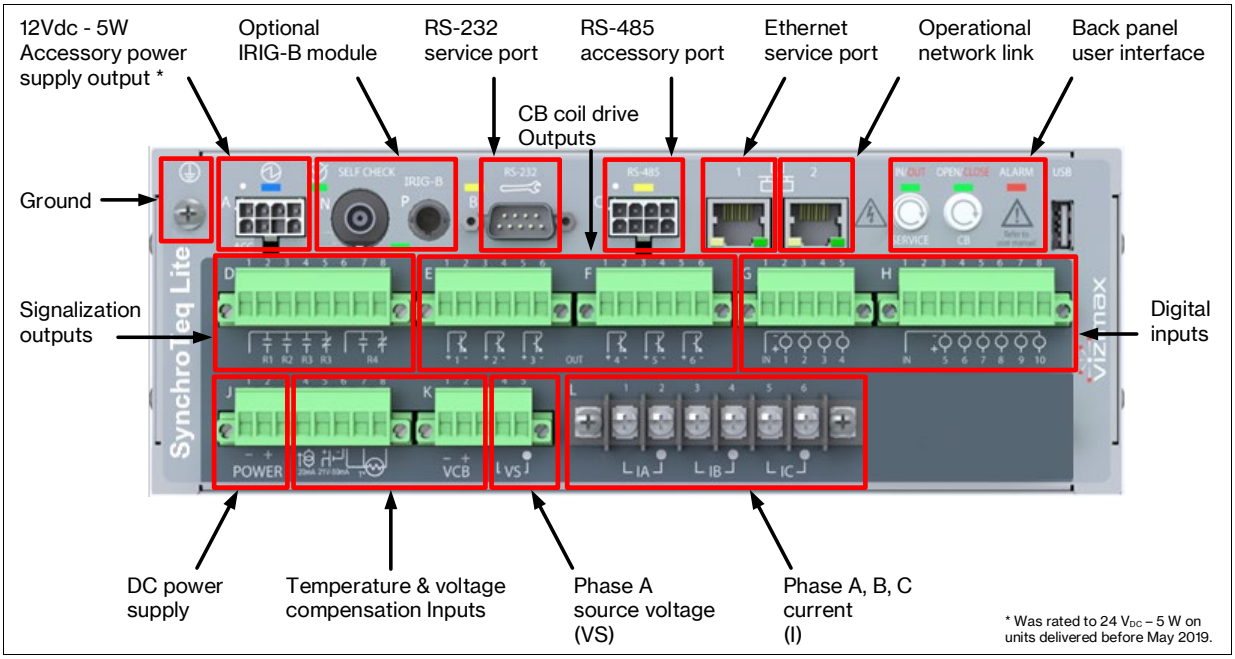


Figure 4 SynchroTeq Lite model STL010000 – rear panel

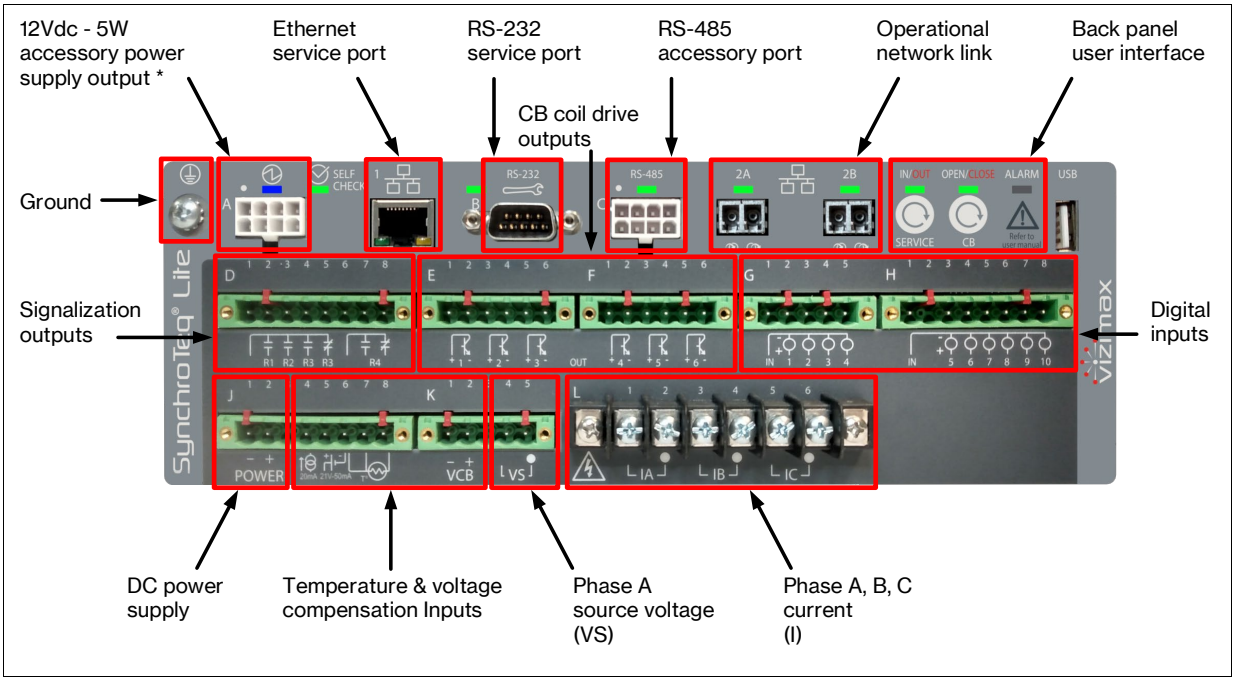


Figure 5 SynchroTeq Lite model STL020000 – rear panel

1.9.2 Front panel user interface

Figure 6 SynchroTeq Lite rack mount version front panel

1.9.3 Ethernet signalization LEDs

Table 3 SynchroTeq Lite Ethernet signalization LEDs – Interface and state

Interface Type	LED State	Definition
RJ-45 2x LEDs per connector – 1x green, 1x yellow	All OFF	Link is down
	Yellow ON	Link is up
	Green Flashing	Traffic activity
Fiber optic 1x green LED per connector	OFF	Link is down
	Solid	Link is up
	Flashing	Traffic activity

2 Technical specifications

2.1 Compliance and certifications

2.1.1 Test type

Table 4 SynchroTeq Lite test type

Test type		Standard	Value
Temperature range		Operating temperature	-40 °C to +85 °C[1]
		Storage temperature	-50 °C to +85 °C
Maximum relative humidity (R.H.)		IEC 60068-2-30	95% without condensation
IP Rating		IEC 60529	IP30
Normal environmental conditions		IEC 60255-1 IEC 60947-1	No significant air pollution Pollution degree 2
Maximum altitude		IEC 61010-1	2.0 km
Mechanical resistance to vibrations	Performance	IEC 60255-21-1	Class 2
	Endurance	IEC 60255-21-1	Class 1
Dielectric withstand	AC Inputs and I/Os	IEC 60255-5	2.2 kV_{AC}, 1 s
	Communication	IEC 60255-5	1.65 kV_{AC}, 1 s
Impulse voltage withstand		IEC 60255-5	5 kV
Electrostatic discharge (ESD)	Air discharge	IEC 61000-4-2	15 kV
	Direct contact discharge	IEC 61000-4-2	8 kV
Damped oscillatory wave (1MHz burst)	Common mode	IEC 60255-22-1	2.5 kV
	Differential mode	IEC 60255-22-1	1.0 kV
Fast transients (bursts)		IEC 60255-22-4	Level 4
RF Immunity		IEC 61000-4-3	20 V/m, from 80 MHz to 1 GHz
		IEC 60255-26	Spot Frequencies: 80 MHz to 2,15 GHz
		ANSI/IEEE 1613	10 V/m, from 1.4 GHz to 2.7 GHz
		SN62. 1008-1	3 V/m, from 5.15 GHz to 5.75 GHz
Conducted disturbance immunity		IEC 61000-4-6	150 kHz to 80 MHz
RF emissions		CISPR 11, CISPR 22, FCC	Class A
Safety		IEC 61010-1, 3rd ed. ISO 14971: 2012	Safety for measurement, control, and laboratory use

[1] Internal operating temperature; please refer to Table 5 SynchroTeq Lite temperature test performance for more details.

2.1.2 Temperature test performances

Table 5 SynchroTeq Lite temperature test performance

Test type	Standard	Value
Cold	IEC 60068-2-1	-40 °C (16 hours) after cold start at -50 °C
Dry heat	IEC 60068-2-2	+75 °C (16 hours)
Damp heat cyclic	IEC 60068-2-30	+55 °C at 95% RH (144 hours)
UL Safety	IEC 61010-1	-40 °C to +70 °C

2.1.3 Mean time before failure (MTBF)

Table 6 SynchroTeq Lite mean time before failure (MTBF)

Specification	Value
MTBF	28 years estimated

2.2 Power supply

The power supply is set in factory according to the ordering option.

Table 7 SynchroTeq Lite power supply specifications

Parameter	Value
Power supply rating (24 V)	20 V_{DC} – 35 V_{DC}
Power supply rating (48 V)	36 V_{DC} – 72 V_{DC}
Power supply rating (110 V)	70 V_{DC} – 140 V_{DC}
Power supply rating (125 V)	100 V_{DC} – 140 V_{DC}
Power supply rating (220 V)	180 V_{DC} – 280 V_{DC}
Rated power	15 W max. (typical 9 W, 0.07 A @ 125 V_{DC}) – Idle 6 W • The external power supply must be able to sustain a 6 A cold start current for 50 ms at unit start up.[1] • When a SynchroTeq Communication Module (RWK000016) is powered by the SynchroTeq Lite accessory power supply output (connector A), the external power supply must be sized accordingly to feed this module.
Connector	Phoenix MSTB 5.08 mm
Isolation	3 kV during 1 s
Fuse	Time delay, 2 x 2 A (not user serviceable)
Voltage interrupt (max)	100 ms @ 100%

[1] The DC power supply includes a power reserve capable of sustaining a 100 ms power interruption. The energy storage components may induce a 6 A cold start current for 50 ms at unit start up. The external power supply must be able to sustain this inrush current when energizing.

2.2.1 Accessory power supply output

SynchroTeq Lite offers an accessory power supply output rated at 12 V_{DC}, 5 W maximum and internally referred to the chassis (PE). This power supply output (connector A) is reserved for feeding power to the optional legacy SynchroTeq Communication Module (RWK000016).

Table 8 SynchroTeq Lite accessory power supply output specifications

Parameter	Value
Power supply rating (12 V)	5 Watts maximum recommended load

NOTE The auxiliary power supply was rated at 24 V_{DC}, 3 W for units manufactured before May 2019.

2.3 Control – Time synchronization – Communication

2.3.1 Controller and time synchronization

Table 9 SynchroTeq Lite controller and time synchronization specifications

Parameter	Value
Main processor	32-bit, 400 MHz high performance ARM processor
OS	Linux
Memory	512 MB Flash memory / 128 MB RAM
I/O board controller	32-bit, 168 MHz ARM processor with RTOS. 16-bit ADC.
Field upgrade	Field upgradable firmware available from VIZIMAX web site, support section
Real time clock	±3 ppm initial accuracy. Stability is ± 5 ppm across the complete operating temperature range. Autonomy is 36 hours without power (no battery required)
RTC Synchronization	IRIG-B protocol using the optional RWC0Y0001 module LAN synchronization: NTP/SNTP or IEEE 1588

2.3.2 Local user interface

Table 10 SynchroTeq Lite local user interface features

Parameter	Value
Two push buttons (back and front panel)	• Open/Close • In/Out of Service
Seven LEDs (back panel)	• Service • CB position, • Communication activity (2x) • System status • Alarms and • Power
Five LEDs (front panel)	• Service • CB position • System status • Alarms • Power

2.3.3 Optional IRIG-B time synchronization module (RWC0Y0001)

Table 11 SynchroTeq Lite – Optional IRIG-B time synchronization module specifications

Specification	Value
Typical base inaccuracy	≤ 10 µs
IRIG-B DCLS (Un-modulated) over Fiber Optic ST type (connector N)	Frequency range: 820 – 850 nanometers Base inaccuracy ≤ 1.0 µs + source inaccuracy
IRIG-B DCLS (Un-modulated) on BNC BNC type (connector P)	Input impedance: Zin = 500 Ω Input level: 2.5 V to 5.0 V_{DC} Base inaccuracy ≤ 10.0 µs + source inaccuracy
Voltage isolation level	500 V_{DC}
IRIG-B formats (selectable by software)	• IRIG-B000/B004 IEEE-C37.118 (default setting) • IRIG-B000/B004 IEEE-1344 • IRIG-B003

NOTE IRIG-B is only available on the STL010000.

2.3.4 Communication ports

Table 12 SynchroTeq Lite communication ports specifications

Port	Characteristics	Value
USB port (back panel)	Interface compatibility	2.0
	Maximum speed	480 Mbit/sec
	Connector type	Type A
	Voltage isolation level	N/A
100Base-TX Ethernet 1 (Service port)	Interface	10/100 Mbps
	Connector	RJ-45
	Isolation	1.5 kV_{rms}
	Name	Port 1
	Function	Initial unit configuration and setup
100Base-TX Ethernet 2 (User communication link) STL010000 model	Interface	10/100 Mbps
	Connector	RJ-45
	Isolation	1.5 kV_{rms}
	Name	Port 2
2x 100Base-TX Ethernet 2 (Redundant user communication link) STL020000 model only	PRP standard	IEC 62439-3 Clause 4
	Interface	100BASE-T
	Connector	Dual RJ-45 connectors
	Isolation	1.5 kV_{rms}
	Name	Port 2A/2B
2x 100Base-FX Ethernet 2 optional (Redundant user communication link) STL020000 model only	PRP standard	IEC 62439-3 Clause 4
	Interface	100BASE-FX
	Communication link	Multimode optical fiber
	Connectors	Dual LC connectors
	Name	Port 2A/2B
RS-232 Serial	Function	Console port, service Operations
	Connector	DB-9 (connector C)
	Bit rate	115 kbps
RS-485 Isolated serial	Function	Reserved for legacy SynchroTeq Communication Module link (RWK000016)
	Connector	Molex Mini-Fit junior (connector A)
	Bit rate	38.4 kbps
	Mode	Two wires interface (A-B) with jumper selectable 120 Ω terminations. Reference wire (0 V) provided for high common mode voltage capability
	Isolation	2 kV_{rms}

2.3.5 Native protocols

Table 13 SynchroTeq Lite native protocols specifications

Protocol	Characteristics
IEC 61850 MMS server Ed.2	• XCBR control • Full dataset refreshed every second • 4 predefined unbuffered reports • 120 COMTRADE waveform retrieval.
DNP3.0	• CB control • SynchroTeq status • Alarms • Measurements
Modbus-TCP (Slave)	• CB control • SynchroTeq status • Alarms • Measurements

2.4 AC measurement inputs

SynchroTeq Lite measures the following AC signals from current and voltage sensors:

Source voltage (VS) Phase A

This measurement is taken from a voltage sensor located on Phase A of the source side. This signal is used for the CB operation synchronization and frequency measurement.

Phase A, B and C load current (IA, IB and IC)

These measurements are taken from current sensor located on either side of the switchgear to measure the load current for excessive inrush current detection, switchgear electrical closing time calculation and switchgear opening synchronization (Phase A). These inputs can be connected to either protection or measurement CTs.

2.4.1 AC current measurement inputs

Table 14 SynchroTeq Lite AC current measurement inputs specifications

Parameter		Value
Name		IA, IB and IC (connector L)
Number of inputs		3
Connector type		Barrier strip, screw type 14 AWG – 2.5 mm²
Rated current (In)		50 mA to 12.5 A (usual measurement CT are rated to 1 A, 5 A)
Thermal capacity (1 minute)		30 A
Measurement category		MEAS CAT IV
Maximum burden @ rated current		0.50 VA
Isolation		3 kV_{rms}
Asymmetrical current		80% after 100 ms
Nominal frequency		50 Hz or 60 Hz
Measurement bandwidth (-3 dB)		4 Hz to 4 kHz
Sampling frequency		80 samples/cycle at nominal frequency
Conversion resolution		16-bit
Accuracy		±0.4% (±60 ppm/°C)
Zero crossing detection	Range (frequency)	40 to 70 Hz
	Minimum current	50 mA
	Accuracy	10 µs
Insensitivity to harmonic contents		Up to 25% of 'In' for 2nd to 10th harmonics

2.4.2 AC source voltage measurement input (VS)

Table 15 SynchroTeq Lite AC source voltage measurement input (VS) specifications

Parameter		Value
Name		VS (connector K)
Number of input		1
Connector type		Phoenix MSTB 5.08 mm, pluggable screw type AWG 13-24 (2.5 mm^2 – 0.2 mm^2)
Rated voltage (Vn)		0 to 200 V_{AC} (usual measurement PT|CVT rated to 69 V_{AC}, 110 V_{AC}, 120 V_{AC})
Thermal capacity (1 minute)		300 V_{AC}
Measurement category		MEAS CAT IV
Maximum burden		0.005 VA
Isolation		2,000 V_{rms}
Nominal frequency		50 Hz or 60 Hz
Measurement bandwidth (-3 dB)		DC to 4 kHz
Sampling frequency		80 samples/cycle at nominal frequency
Conversion resolution		16-bit
Accuracy		±0.3% (±50 PPM/°C)
Zero crossing detection	Range (frequency)	40 to 70 Hz
	Minimum voltage	60% of Vn or 40 V_{AC} depending of 'DynamicZX' parameter setting
	Accuracy	10 µs
Insensitivity to harmonic contents		Up to 50% of Vn for 2^{nd} to 10^{th} harmonics
Input impedance		10.58 MΩ (common mode) / 21.2 MΩ (differential mode) Caution: units manufactured before April 4th, 2017 have VS input impedance of 1 MΩ only.
Common mode voltage range		700 V_{AC}

2.5 DC measurement inputs

SynchroTeq Lite performs the following functions:

- Monitor CB operating temperature using a 4-20 mA loop powered sensor or a 100 ohms Platinum RTD sensor installed in the CB mechanical enclosure. SynchroTeq Lite provides an isolated 24 V_{DC} power supply for an external 4-20 mA conditioner when a remote sensor is used. The sensor has programmable limits to define out of range alarms.
- Monitor the CB DC control voltage using a 0-300 V isolated analog input.

The CB operating time prediction can be influenced by both the ambient temperature and the CB DC control voltage. SynchroTeq Lite automatically adjusts the OPEN/CLOSE coil commands according to the predicted time to operate the CB at the optimal point on the wave. Compensation can be fine-tuned and activated through the SynchroTeq configuration.

2.5.1 Temperature compensation input (user selectable, Pt100 RTD or 4-20mA)

Table 16 SynchroTeq Lite temperature compensation input specifications

Parameter		Value
Name		RTD/4-20 mA (connector J)
Number of inputs		1
RTD	Range	-50 °C to +100 °C
	Accuracy	±0.8 °C (±200 ppm/°C)
4-20 mA	Range	4-20 mA
	Accuracy	±0.4% (±40 ppm/°C)
Sensor supply		21 V – 50 mA output for current loop supply
Connector		Phoenix MSTB 5.08 mm, pluggable screw type.
Measuring category		MEAS CAT IV
Input impedance		Current (4-20 mA): 15 Ω
Resolution		16-bit
Update rate		1 update/s

2.5.2 CB coil DC voltage compensation input

Table 17 SynchroTeq Lite CB coil DC voltage compensation input specifications

Parameter	Value
Name	VCB (connector K)
Number of input	1
Rated voltage	0-300 V_{DC}
Connector	Phoenix MSTB 5.08 mm, pluggable screw type.
Input impedance	21.2 MΩ differential, 10.58 MΩ common
Measuring category	MEAS CAT IV
Accuracy	±0.3% (±50 ppm/°C)
Resolution	16-bit
Update rate	1 update/s
Common mode voltage range	700 V_{AC}
Dielectric test	2 kV_{rms} – 1 min

2.6 Digital inputs / outputs

2.6.1 Digital inputs

SynchroTeq Lite provides 10 opto-isolated digital inputs distributed in two isolated groups:

- Three inputs for CB position (52a contacts)
- Two inputs for the control of the CB (OPEN/CLOSE commands)
- Five programmable inputs for CB monitoring and commands

Table 18 SynchroTeq Lite digital inputs specifications

Parameter	Value
Name	DI 1 to 10 (connectors G-H)
Number of inputs	10 (6+4)
Maximum input voltage (24 V power supply)	30 V_{DC}, (detection threshold 16 V_{DC})
Maximum input voltage (48 V power supply)	72 V_{DC}, (detection threshold 28 V_{DC})
Maximum input voltage (110 V power supply)	Max: 140 V_{DC} Threshold: 52a inputs: 56 V_{DC} Threshold: all other inputs: 69 V_{DC} (±10%)
Maximum input voltage (125 V power supply)	Max: 140 V_{DC} Threshold: 52a inputs: 66 V_{DC} Threshold: all other inputs: 74 V_{DC} (±10%)
Maximum input voltage (220 V power supply)	Max: 280 V_{DC} Threshold: 52a inputs: 113 V_{DC} Threshold: all other inputs: 137 V_{DC} (±10%)
Isolation	Opto-coupler, 2 kV_{rms}
Measuring category	MEAS CAT IV
Burden	2 mA to 5 mA
Maximum hardware response time	0.10 ms at nominal voltage[1] 1.00 ms at 80% of nominal voltage
Software filter	Programmable, 5 ms increments up to 250 ms
Connector	Phoenix MSTB 5.08 mm, pluggable screw type.

[1] For 3-Phase CBs with staggered pole operation and a single 52a auxiliary contact: this contact must be wired on DI1 and chained in parallel on DI2 and DI3 for the proper operation of several major SynchroTeq features.

NOTE Digital inputs operating range is set according to the ordered power supply operating range.

2.6.2 Circuit breaker coils control outputs

SynchroTeq Lite has potential free and isolated solid state coil driver outputs to control the opening and closing of the switchgear or CB.

SynchroTeq Lite unit has 3 CLOSE and 3 OPEN outputs allowing the control of three Phase independent pole operated CB.

Since the outputs are floating type, they can either source coil current (coil common to 0V supply) or sink coil current (coil common to +DC supply).

NOTE SynchroTeq Lite unit only supports 'DC controlled' circuit-breaker.

Table 19 SynchroTeq Lite digital outputs specifications

Specifications	Value
Name	Out 1 to 6 (connectors E-F)
Number of outputs	6 (3+3)
Output driver technology	Solid State, Select Before Operate (SBO)
Rated voltage	20 V_{DC} – 280 V_{DC}
DC rated output current	5 A DC continuous 22 A for 1 s 35 A for 200 ms 70 A pulsed 10 ms
Maximum breaking current	7 A @ L/R=40 ms
Type	Independent, sourcing or sinking outputs
Output pulse width (activation time)	10 ms to 1 s (by programmable increments of 10 ms or 100 ms)
Coil output command accuracy	10 µs[1]
Isolation	2 kV_{rms}
Over voltage category	OVC CAT III
Connector	Phoenix MSTB 5.08 mm, pluggable screw type.

[1] For 3-Phase CBs with staggered pole operation (single mechanism), wire the control outputs from Phase A only.

2.6.3 Important note on CB operating time accuracy

In the SynchroTeq unit, the coil output control command precision is ±10 µs. However, it is important to understand that the overall operation precision of the breaker depends on many parameters:

- **CB mechanical scatter**: Each CB has a natural mechanical deviation on his main chamber operating times. This deviation is due to the overall imprecision in the mechanical moving parts of the breaker (shafts, gears, etc.). It is important to mention that the mechanical deviation we are talking about (generally from 0.1 ms up to several ms) refers to the “intrinsic” deviation of the mechanical operating times of the breaker main chamber under constant operation circumstances (temperature, coil voltage, pressure, humidity, etc.).
- **Availability of compensation data and their accuracy**: Most of CBs are affected by the environmental operating parameters. If these effects are not taken into consideration, the overall CB operation precision would be seriously degraded compared to the absolute mechanical scatter. The SynchroTeq unit is able to accurately compensate for all the operational parameters as long as the provided compensation data (generally from the CB manufacturer) is also accurate. The SynchroTeq Lite can compensate for the ambient temperature variation, and the CB coil voltage variation. Also, the SynchroTeq Lite is embedded with powerful idle-time compensation algorithm that predicts the effect of the idle-time on the main chamber operating mechanism. In general, this idle-time compensation data is a field-built information as most of CB manufacturers cannot provide it.

For example, let us assume the following situation:

- Circuit-breaker with a natural mechanical scatter of ±0.3 ms under +15 °C
- The only parameter that affects the mechanical operating time is the ambient temperature
- Ambient temperature operating range: from -20 °C to +55 °C
- No compensation curve for the ambient temperature is provided, but the CB manufacturer stated that the effect of the ambient temperature on the main chamber operating time is ±2 ms

In this case, since no compensation data is provided, we can expect **an overall CB operation precision of ±2.31 ms:**

- ±2 ms for the ambient temperature variation
- ±0.3 ms for the mechanical scatter
- ±0.01 ms for the SynchroTeq unit

2.6.4 Signalization relay outputs

SynchroTeq Lite offers 4 dry contacts digital outputs for alarming and status signalization. The outputs are arranged in two isolated groups with the following functions:

- **R1**: Out of service/Fatal alarm, form A
- **R2**: CB Temperature or CB DC control voltage monitoring alarm, form A
- **R3**: CB Operation limits and inrush current alarm, form C
- **R4**: System OK (watchdog), form C. Used to indicate that the system is failed.

Table 20 SynchroTeq Lite signalization relay outputs specifications

Specifications	Value
Number of outputs	R1 to R4 2x form A and 2x form C dry contact outputs (connector D)
Type	Electromechanical relays
Maximum steady AC current	3 A maximum at 250 V_{AC}
Maximum steady DC current	0.3 A maximum at 250 V_{DC}
Contact ratings	250 V_{AC}, 300 V_{DC}
Contact breaking capacity	10 A at 250 V_{AC} 8 A @ 30 V, 0.5 A @125 V, 0.3 A at 250 V_{DC}
Isolation	5 kV_{rms} (coil to contacts)
Over voltage category	OVC CAT III
Connector	Phoenix MSTB 5.08 mm, pluggable screw type.

2.7 Functional analysis tools

2.7.1 Waveform capture

Table 21 SynchroTeq Lite waveform capture specifications

Parameter	Value
Memory capacity	Up to 500 events (waveforms are stored in events)
Capture trigger	CB commands from SynchroTeq Lite (OPEN and CLOSE) Manual trigger using snapshot capture
Sampling rate	80 samples/cycle at nominal frequency
Recording time	1250 ms with 250 ms pre-trigger
Recorded signals	Voltage on unswitched side of CB (1) Load current (3) CB control commands (3 x Open, 3 x close) CB position contacts (3 x 52a) SynchroTeq Lite command inputs (OPEN and CLOSE) Phase A synchronization (1 x I, 1 x V)

2.7.2 Event memory

Table 22 SynchroTeq Lite event memory features

Parameter	Value
Memory capacity	500 events, including waveforms when applicable
Recording trigger sources	CB commands from SynchroTeq Lite Status change (local/remote, in/out of service, cold start, reset, etc.) Alarms (self-check, sensors, CB timing problems, CB interface problem, loss of synchronization signal, etc.) Configuration changes (new parameters) Operation failure (rejected commands) Manual waveform capture Operation commands to SynchroTeq Lite (alarm reset, operation counters reset, set residual flux, etc.)
Search and display filtering capabilities	The event display can be filtered using one or the combination the following criteria: By event sequential number By date By type (open command, close command, residual flux calculation, sensor problem, etc.) By alarm type (sensor out of range, excessive inrush current, synchronization loss, etc.)
Time tagging display resolution	1 millisecond with time zone management
Time tagging synchronization	NTP – SNTP time server on Ethernet IEEE PTP 1588 clock source on Ethernet IRIG-B protocol using the optional RWC0Y0001 module Manual synchronization from PC computer

3 Mounting configurations

SynchroTeq Lite is available with three mounting configurations:

- 19″ Rack mount (RM model, with a 19″ face plate).
- Panel mount (PM model, with a 12″ front panel)
- Standard mount (SM model, without face plate)

SynchroTeq should be installed away from any heat producing equipment.
The SynchroTeq Lite is cooled by convection; it does not have a built in fan.

3.1 Physical dimensions

Table 23 SynchroTeq Lite physical dimensions

Specifications	Value
Width	257 mm (10.125 in) for standard mount 305 mm (12 in) for panel mount 483 mm (19 in) for Rack mount
Height	92 mm (3.6 in) for standard mount 105 mm (4.1 in) for panel mount 3U: 132.5 mm (5.22 in) for Rack mount installation.
Depth	134 mm (5.25 in)
Weight	Standard mount 3.0 kg (6.6 lb) Panel mount 3.3 kg (7.3 lb) Rack mount 3.6 kg (8 lb)

3.2 Standard mount (standalone)

The SynchroTeq Lite standard mount (SM model) is dedicated for a direct mounting inside a CB enclosure. It includes movable mounting brackets for multiple mounting positions (horizontal or vertical).

NOTE SynchroTeq Lite Standard mount version does not include front panel interface. All connectors, ports, LEDs and command push buttons are located on the rear panel.

Figure 7 SynchroTeq Lite Standard configuration (standalone)

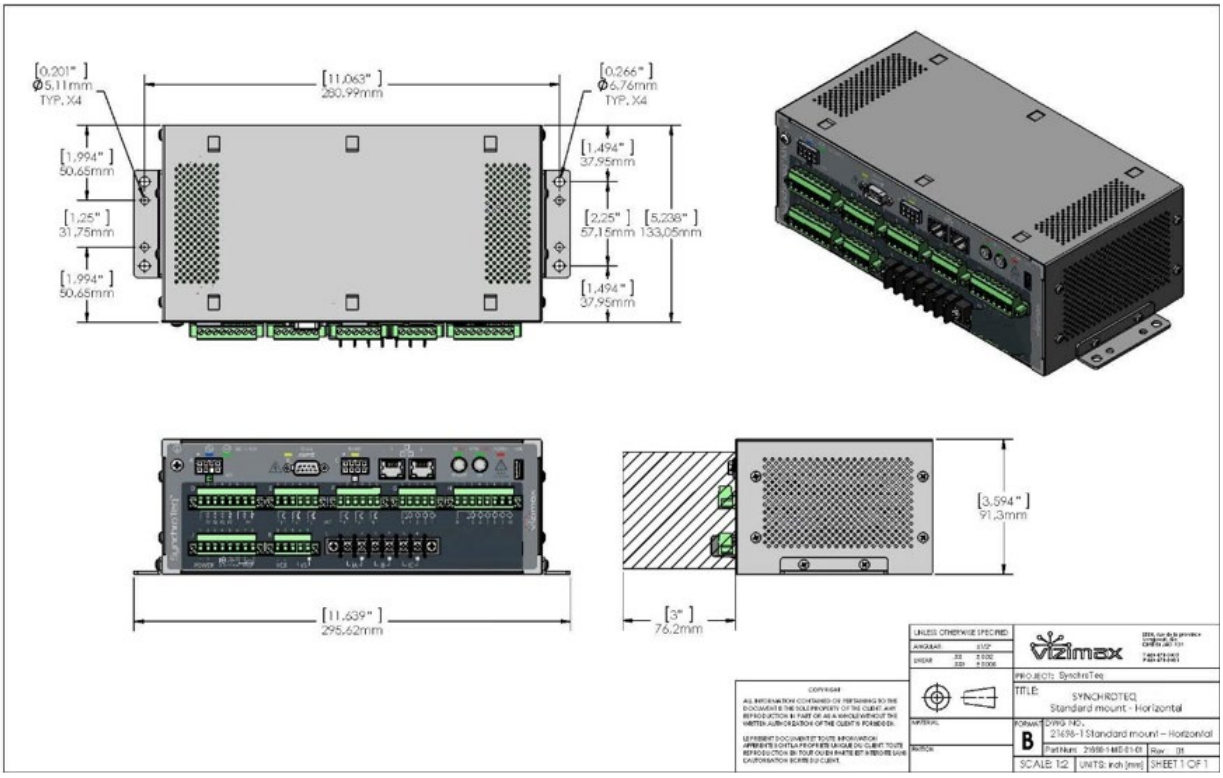


Figure 8 SynchroTeq Lite Standard Mount – Horizontal

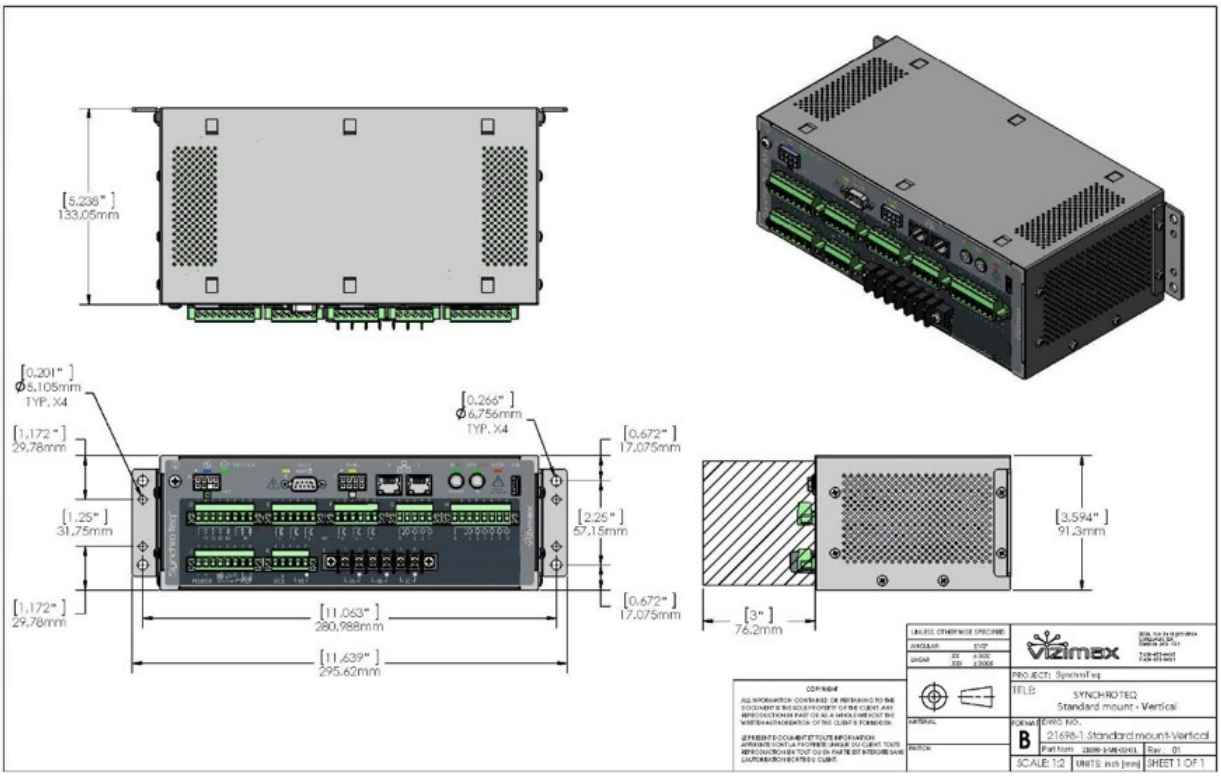


Figure 9 SynchroTeq Lite Standard Mount – Vertical

3.3 Panel mount

The SynchroTeq Lite Panel Mount (PM model) is for mounting to a metallic panel or swing door inside a breaker control or a switchgear enclosure. The mounting brackets are supplied with the unit. The panel face plate is 104.14 x 304.8 mm (4.1 x 12.0 in).

Figure 10 SynchroTeq Lite Panel mount

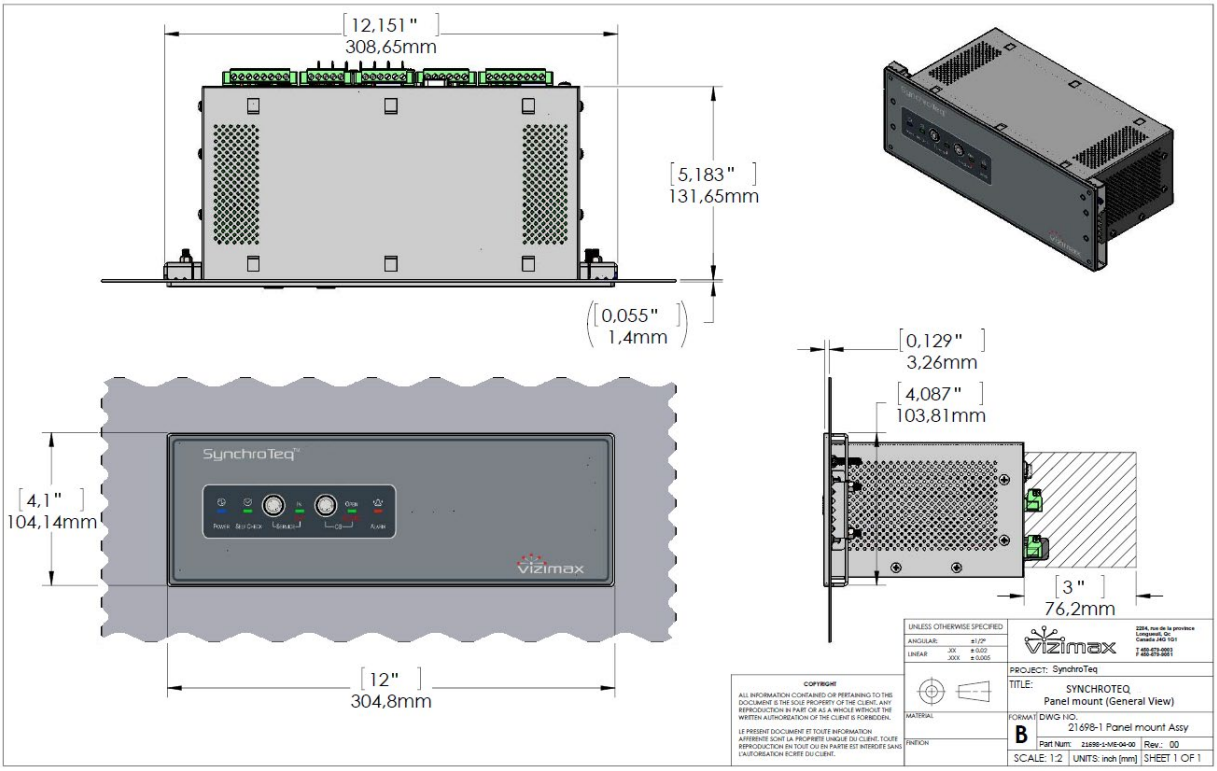


Figure 11 SynchroTeq Lite Panel mount dimensions

3.4 Rack mount

The SynchroTeq Lite rack mount (RM model) is installed on an EIA 482.6 mm (19 in) rack. Panel size: 3U standard panel (5.219 x 19 in).

In this configuration, the Ethernet service port is relocated on the front panel.

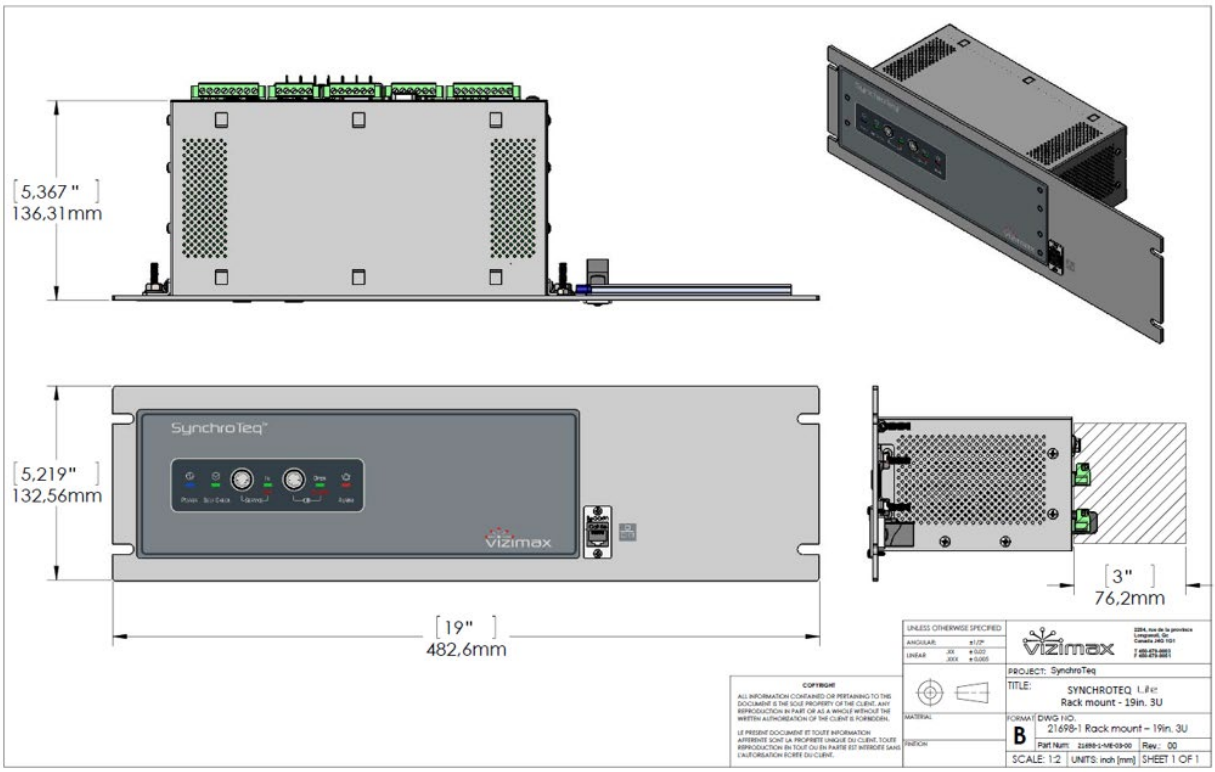


Figure 12 SynchroTeq Lite 19" Rack mount configuration

A DIN rail (120 mm [4.8 in]) is provided on the rear panel to mount terminal blocks or IED accessories.

Figure 13 SynchroTeq Lite DIN rail terminal block mount (STL010000)

4 Ordering information

SynchroTeq Lite Performs fixed angle switching strategies for HV shunt reactors, discharged capacitor banks, filters and power transformers without residual flux.

NOTE These specifications are subject to change without prior notice.

4.1 Base models

All SynchroTeq Lite models include: 10x digital inputs + 10x digital outputs (3x Trip Coils + 3x Close coils + 2x Form C + 2x Form A) + 1x PT input (100/√3 up to 120 V) + 3x CT inputs (1 A or 5 A universal) + 2x monitoring inputs with compensation function (temperature + CB coil voltage), and IEC 61850 MMS Server Ed.2 (XCBR control model), DNP3.0 and MODBUS (only one protocol can be active at a time).

STL010000 **SynchroTeq Lite**
Features one Ethernet remote port (copper, RJ45, 100BASE-T).
One additional local Ethernet port (copper, RJ45, 100BASE-T) is available for maintenance.

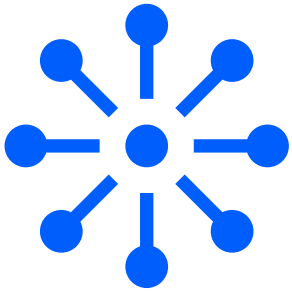
STL020000 **SynchroTeq Lite**
Features two Ethernet remote ports configured as a single PRP (Parallel Redundancy Protocol) link.
Those two Ethernet ports are copper (RJ45, 100BASE-T) or, optionally multimode fiber-optic (duplex LC connector, 100BASE-FX).
One additional local Ethernet port (copper, RJ45, 100BASE-T) is available for maintenance.

4.2 Frequently ordered options

NOTE Refer to the ‘smart coding’ document ‘STL0x0000-SC’ for a complete list of ordering options, including model, mounting configuration, IRIG-B synchronization option and power supply voltage configuration.

RWC0Y0001 **IRIG-B time synchronization**
(only available on STL010000)
Optional module over either:
a BNC connector with a compliant IEC 60044-8 TTL signal; or
a fiber optic ST type connector with a compliant IEC 61869-9 signal.

NOTE Vizimax also offers commissioning and training services: for more details, contact us.



Vizimax

A PGC Company

support@vizimax.com
www.vizimax.com/contact