



SYNCHROTEQ[®] MV UNITS

DATASHEET



(Panel mount configuration shown here)

STM0x0000

2024-04-30

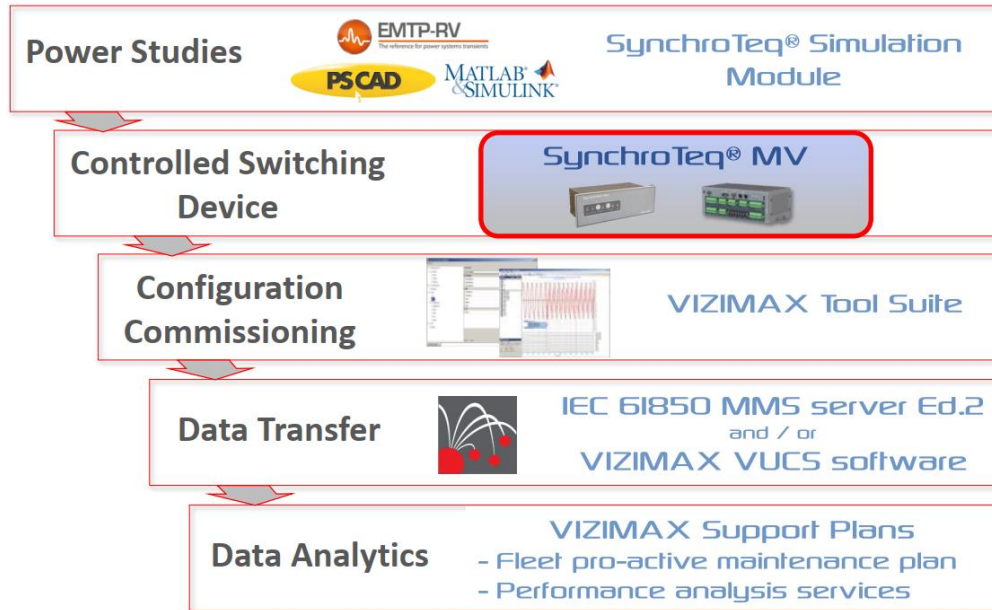
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PRODUCT OVERVIEW

SynchroTeq MV is a component of the SynchroTeq System family aimed at MV switchgears and circuit breakers up to 69kV.



A compact Control Switching Device (CSD) for 1, 2 or 3 phase medium voltage switchgears, the SynchroTeq MV is specifically designed for load switching projects up to 69kV. It is proposed in two versions: **SynchroTeq MVR** and **SynchroTeq MVX** respectively.

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

TABLE 1 SYNCHROTEQ UNIT VS LOAD SWITCHING APPLICATION

Load Switching Application	SynchroTeq MV		SynchroTeq Plus	
	SynchroTeq MVR	SynchroTeq MVX	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)*		☑		☑
Compensated / Uncompensated Transmission lines (any kV level)				☑
Cables (MV, HV, submarine)		☑	☑	
Partially Charged Capacitor Banks – MSC/FLT		☑	☑	
CB and a half (any kV level)			☑	☑
Voltage range	Up to 69kV		Up to EHV and UHV	

SynchroTeq MV is also a manufacturer agnostic solution suitable for ‘DC controlled’ switchgears and circuit breakers (C/Bs) or load break switches regardless of the make.

The appropriate circuit breaker / switchgear type and configuration must be carefully selected according to the considered load and application, as outlined in the following Table 2.

TABLE 2 CIRCUIT BREAKER / SWITCHGEAR TYPE VS LOAD SWITCHING APPLICATION

Load Switching Application	Circuit Breaker / Switchgear		
	Single Pole Operation (Independent poles)	Three Pole Operation w/ Pole Staggering	Three Pole Operation (Simultaneous poles)
Capacitor Banks - MSC / MSCDN Filter – SVC and STATCOM	☑	☑	
Shunt Reactors – MSR	☑	☑	
Power Transformers (Peak Voltage)	☑	☑	
Power Transformers (Residual Flux)	☑		☑
Power Transformers in Parallel (Residual Flux)*	☑		☑
Transmission lines	☑		
Cables	☑		

(*): Requires RWS055000 or TRAS

NOTE: a set of two or three unipolar switches or circuit breakers is eligible as a 1-p operated, two or three-phase switchgear configuration. Likewise dual-single or triple-single recloser mechanisms may also be considered.

For example:

- SynchroTeq MVX is suitable for energizing a MV power transformer and features a dedicated control mode for a 3-p operated (or gang operated) switchgear or C/B.
- In general, SynchroTeq MVR or SynchroTeq MVX in capacitor bank switching projects must be matched with 1-p operated switchgears, as well as with 3-p operated switchgears with pole-staggering, or with a relevant combination of unipolar switches or circuit breakers.
- Both SynchroTeq MVR and SynchroTeq MVX are suitable for unipolar switchgears and loads in MV switching projects

APPLICATIONS OF SYNCHROTEQ MV

The outstanding performance of SynchroTeq MV devices apply to a variety of MV switchgears – regardless of the make – and can be leveraged for optimized switching of shunt reactors, discharged and partially charged capacitors bank, harmonic filters, power transformers and cables.

Among other applications, SynchroTeq MV is a powerful, communication-enabled IED suitable for:

- **Renewable Power Generation:**
 - Solar farms: energizing inverters' transformers for inrush current/voltage drop mitigation, improved power delivery, connection to the grid, grid code compliancy.
 - Wind: energizing power transformers in WTGs, advanced switching of feeders, for inrush current/voltage drop mitigation, improved power delivery, connection to the grid, grid code compliancy, energizing step-up transformers in STATCOMs.
 - Switching reactive loads, in standalone or in SVC/hybrid-STATCOM systems.
 - Energizing power cables.
- **Conventional Power Generation:**
 - Energizing power transformers in grid-scale waste-to-energy or CHP or genset or gas turbine projects.
 - Energizing power transformers in off-grid power generation: gensets, gas turbines and more.
 - Switching reactive loads.
 - Energizing power cables.
- **Industry:**
 - Electrical Arc Furnaces: transformer switching, MSC/MSR/FLT in SVC or STATCOM systems, reduction of switchgear wear, preservation and lifespan improvement of MV switchgears and transformers.
 - Transportation & Railways: energizing power transformers for rectifiers and inverters in DC traction substations, MV capacitor banks for VAR Compensation.
 - Oil&Gas: energizing power transformers with limited impacts of voltage disturbances/inrush currents on gensets, MV drives, power distribution. Capacitor bank switching, MV cables.
- **MV Equipment / FACTS:**
 - Fast-switching of capacitor banks (MSC), shunt reactor switching (MSR), harmonic filters (FLT) combined with power electronics (ie: hybrid STATCOMs).
 - Energizing step-up transformers in Energy Storage systems.
 - Capacitors bank switches for PF Correction/VAR Compensation.
 - Advanced MV switchgears for power transformer energization.
- **Power Grids:**
 - MV power transformers in substations.
 - Enhanced penetration of Renewable Energy.
 - Grid connection of DERs: waste-to-energy, CHP...etc
 - Capacitor bank switching.

SYNCHROTEQ MV HIGHLIGHT

- **For All MV Switchgears up to 69kV**
 - ✓ 3-p operated, w/ and w/o pole staggering
 - ✓ 1-p operated (IPO)

- **Various Apps and Loads**
 - ✓ Discharged reactive loads
 - ✓ Single or Three phase Transformers
 - ✓ Advanced Switching of partially charged capacitor banks and filters w/ residual charge measurement.
 - ✓ Supports nominal grid frequency at 50 Hz or 60 Hz or $16^{2/3}$ Hz.

- **Strong Engine, Web-based operation**
 - ✓ Stores up to 500 events and waveforms
 - ✓ Secured Web-Based interface

- **Best-in-class MV transformer energization**
 - ✓ MVX version w/ residual flux calculation
 - ✓ For 1-p and 3-p operated Switchgears

- **Data transfer to central site:**
 - ✓ Native IEC 61850 MMS server Ed.2 including XCBR control model.



SYNCHROTEQ MV UNITS - MAJOR FEATURES

Features	SynchroTeq MVR	SynchroTeq MVX
Circuit breaker coils control outputs	6x Coil control outputs (3x Open + 3x Close coils)	
AC current inputs	3x AC current measurement inputs (magnetic CT: 1 or 5 A) Optionally: 3x LPCT type, Rogowski coil, current sensor inputs (substituted to the 3 CT inputs)	
AC voltage input	1x AC voltage input for source voltage measurement	
Additional AC voltage inputs	N/A	3x AC voltage inputs for the measurement of the power transformer voltage or bus bar voltage for partially charged capacitors
Digital Inputs	10x digital inputs: <ul style="list-style-type: none"> • Three inputs for C/B contact position (52a contacts) • Two inputs for C/B or switchgear control (OPEN/CLOSE commands) • One input to set SynchroTeq MV Out of Service • One input to set SynchroTeq MV in Local / Remote mode • three programmable inputs for C/B monitoring and commands (with separate returns) 	
DC measurement inputs with compensation function	2x DC measurement inputs with C/B timing compensation function: <ul style="list-style-type: none"> • Temperature input (RTD or 4-20 mA from external sensor) • C/B coil voltage input 	
Signalization Outputs	4x dry contact relay outputs: Alarms	
Power Supply	24Vdc or 48Vdc or 110Vdc or 125Vdc or 220Vdc	
Local user Interface	<ul style="list-style-type: none"> • Two push buttons (rear and front panel) • Five LEDs (front panel) – Seven LEDs (rear panel) 	
Communications ports	<ul style="list-style-type: none"> • 1x USB port • 2x 100Base-TX Ethernet • 1x RS-232 Serial port • 1x RS-485 Isolated Serial port 	
Time synchronization	<ul style="list-style-type: none"> • NTP/SNTP time server on Ethernet • IEEE PTP 1588 clock source on Ethernet • IRIG-B clock source using the optional IRIG-B RWC0Y0001 module: <ul style="list-style-type: none"> • IRIG-B format selectable by software • Manual synchronization from PC computer 	
Native protocol	<ul style="list-style-type: none"> • IEC 61850 MMS server Ed.2 <ul style="list-style-type: none"> • XCBR control • Full dataset refreshed every second • 4 predefined unbuffered reports • 120 COMTRADE waveform retrieval. 	
Functional tools	<ul style="list-style-type: none"> • Event capture (up to 500 events including COMTRADE compatible waveform files) • SynchroTeq Event Analyzer • Secured web interface 	
C/B wear monitoring	<ul style="list-style-type: none"> • Electrical wear monitoring (i²t) including warning and alarm function. • Mechanical wear monitoring including warning and alarm function 	

LOW ENERGY ANALOG SENSOR - FEATURE OVERVIEW

LOW ENERGY ANALOG VOLTAGE MEASUREMENT

This feature, available on all SynchroTeq units delivered after March 31st, 2021, allows acquiring both synchronization and load voltages (VS, VA, VB and VC) from very low voltage measurement levels.

This allows deploying SynchroTeq MV in applications using Low Energy Analog (LEA) voltage sensor such as capacitive or resistive voltage divider, commonly used in medium voltage switchgear application.

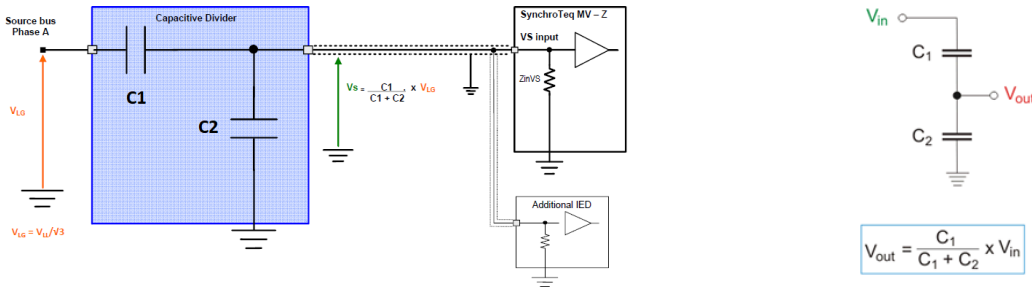


FIGURE 1 EXAMPLE OF CAPACITIVE VOLTAGE DIVIDER ON VS INPUT

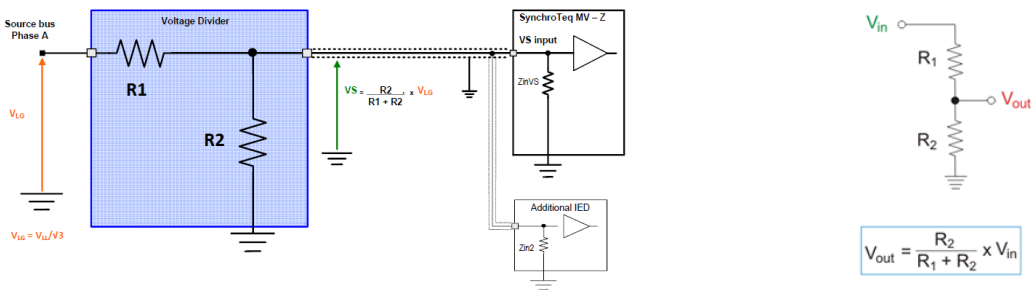


FIGURE 2 EXAMPLE OF RESISTIVE VOLTAGE DIVIDER ON VS INPUT

The LEA voltage feature offers 2 measurement input voltage ranges, and the associated gain is selectable by software:

- Low Gain used for up to 200Vac input measurement range (usually voltage transformer).
- High Gain used for low input voltage range, up to 20Vac maximum (capacitive or resistive voltage divider).

Input range configuration of source voltage (VS) and load voltage (VA, VB, VC) are independent.

ROGOWSKI COIL CURRENT MEASUREMENT

This input type applies with special orders only.

Please contact your Vizimax representative for more details.

This input type allows acquiring load currents (IA, IB and IC) from low power current transformer (LPCT) Rogowski type, instrument transformers.

This allows deploying SynchroTeq MV in applications using Low Energy Analog (LEA) sensors, commonly used in medium voltage switchgear application.

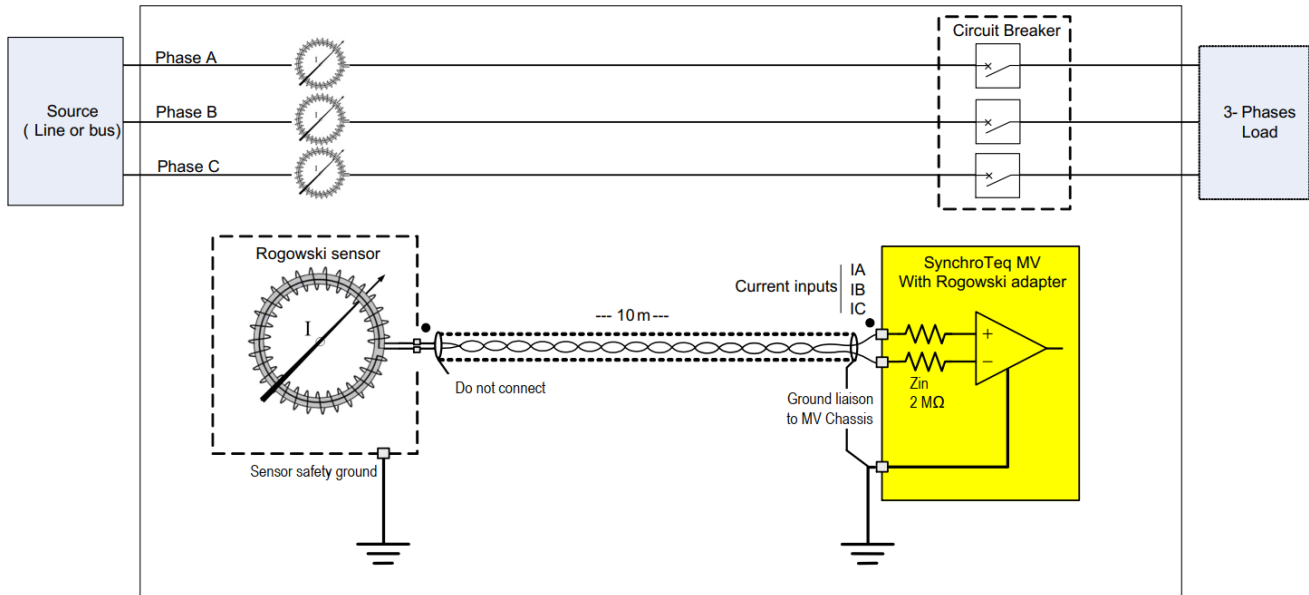


FIGURE 3 EXAMPLE OF ROGOWSKI COIL CURRENT TRANSFORMER INPUT (SPECIAL ORDER))

SynchroTeq MV offers 2 measurement input ranges for each nominal frequency (250 mV & 1200 mV at 50Hz or 300mV & 1440mV at 60Hz), allowing to support a wide range of Rogowski sensors commonly used in medium voltage switchgear. The input range (and the nominal system frequency) must be defined at SynchroTeq MV order and cannot be modified in the field.

The best appropriate range is calculated from the Rogowski sensor sensitivity (in mV / A), the nominal load current and the maximum clipping current (in PU).

Please refer to the smart coding document to calculate your appropriate input range.

NOTE: Please note that Rogowski input type substitutes the standard magnetic CT inputs (connector L).

Vizimax offers several optional LEA adapters for current and voltage sensors (per phase cable with unterminated (open wire end) or with RJ45 female connector compatible with commonly used current and voltage sensors). Please refer to the smart coding document to select the STALxxx adapters fitting your current and voltage sensors.

CONTROLLED SWITCHING

SynchroTeq MV units perform the controlled closing and/or opening of switchgear/circuit breaker poles. They are applicable to multiple switchgear/circuit breaker types and operation modes:

- Three-pole switchgear with Single-pole operation / independent pole operation.
- Three-pole operation / simultaneous pole operation (ie: metal enclosed switchgears as per IEC62271-1, 100, 200)
- Three-pole operation with pole staggering,
- Unipolar switchgears in 1, 2 or 3 phase configurations (resulting in single-pole operation).

Closing/Opening switchgear poles at optimal angles (simultaneously or individually when feasible) 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 MV assets such as switchgears, switched loads (power transformers, reactive loads, cables), and sensitive equipment (generators, power electronics incl. inverters, drives and more).

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

- A predicted switchgear 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,

Circuit breaker 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.

Contrary to conventional CSDs, the SynchroTeq MV not only achieves “fixed switching strategies” (targeting predetermined switching angles – or fixed settings) but also performs advanced switching strategies with on-the-fly computation of optimal target angles according to relevant information retrieved in real time from the load status/environment.

In example, SynchroTeq MVX performs dynamic target angle calculations in the following contexts:

- **Power transformers:** switching angles are derived from voltage acquisition and Residual Flux Calculation, making it a highly effective inrush current limiter for energizing MV power transformers through 1-p as well as through 3-p operated switchgears/circuit breakers.
- **Partially charged Capacitors or Filters:** switching angles are derived from voltage acquisition and computation of trapped charges, making it possible to fast-switch capacitor banks and filters (ie: enabling an instantaneous restoration of reactive capacity, or the execution of fast C-O-C-O cycles in bursts without capacitor discharge).

CIRCUIT BREAKER WEAR MONITORING

SynchroTeq MV is not only a CSD, but also a circuit breaker monitoring tool that drastically reduces the C/B maintenance costs by allowing for scheduling maintenance only when required due to excessive wear.

SynchroTeq MV offers 2 C/B monitoring functions:

- **Electrical wear monitoring**

For each phase, SynchroTeq MV measures the electrical wear of the circuit breaker 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.

- **Mechanical wear monitoring**

SynchroTeq MV 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.

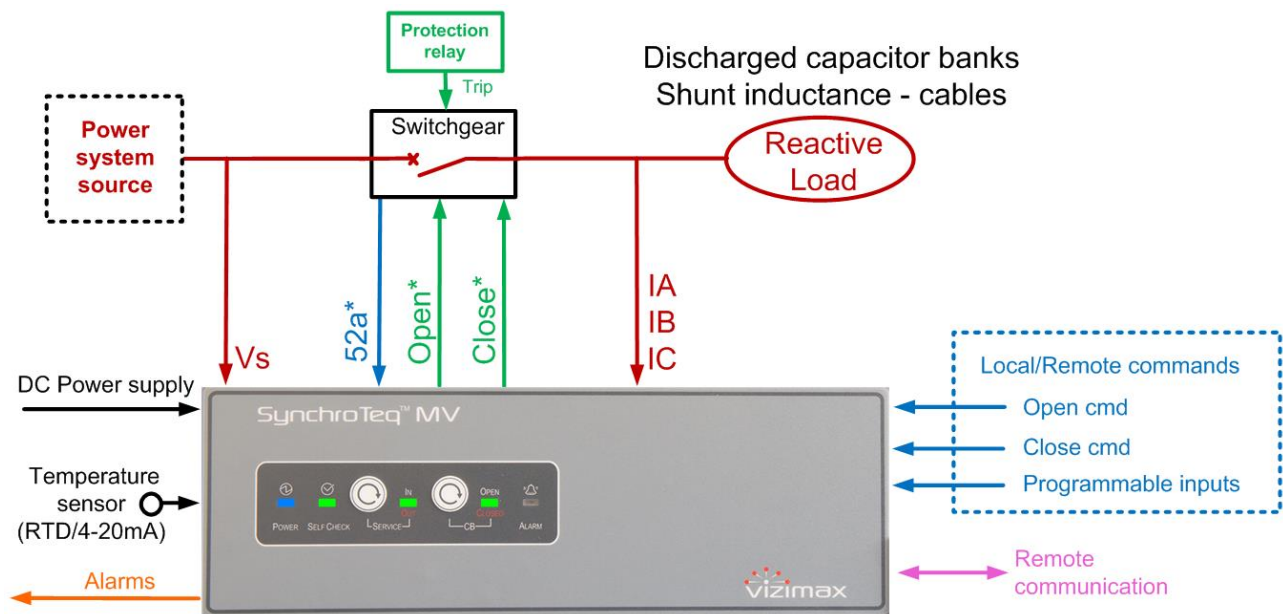
OPERATING ENVIRONMENT

SynchroTeq MV can be installed in the low voltage/control compartments of switchgears, as well as in control & relay rooms, or in independent cabinet. It is therefore offered in three housing versions for easy integration in various applications (see MOUNTING CONFIGURATIONS for details). SynchroTeq MV is typically connected to the following subsystems:

- DC power supply: uninterruptible power source for the substation / switchgear control and protection equipment.
- Controlled MV switchgear or circuit breaker: control outputs, statuses/pole positions.
- Protection relays.
- AC measurements: system/source voltage, load current, as well as load voltage when applicable.
- Condition measurements: temperature or pressure transducer when applicable.
- Local control panels, networked SCADA/DCS systems, network infrastructure: switchgear or C/B control in substations or in equipment.

SWITCHING A DISCHARGED CAPACITOR BANK OR SHUNT REACTOR

SynchroTeq MVR is intended for the controlled switching of shunt reactors, discharged capacitor banks, harmonic filters, power cables, power transformers, all based on fixed switching angle strategies.

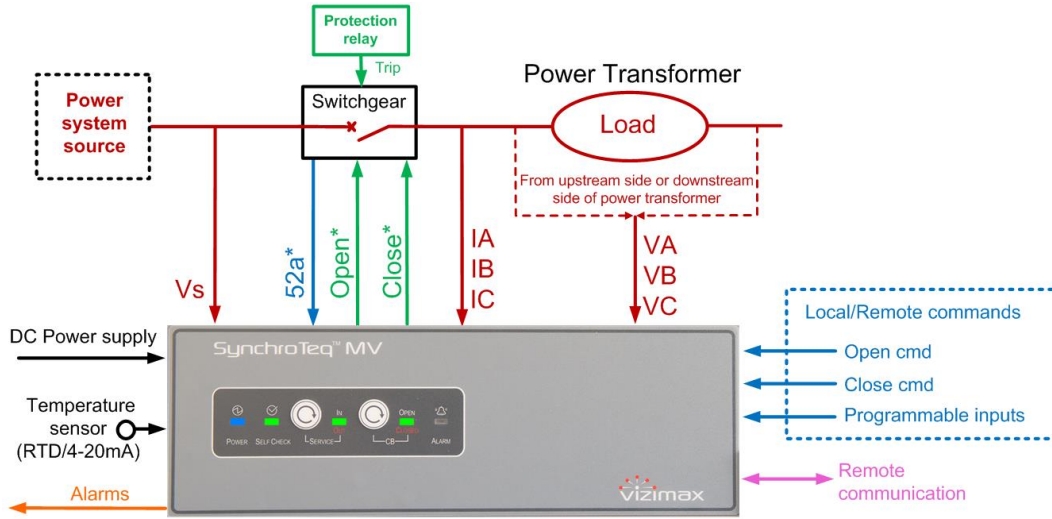


* The number of inputs and outputs depends on the switchgear configuration.

FIGURE 4 EXAMPLE OF SYNCHROTEQ MVR IN DISCHARGED CAPACITOR BANK OR SHUNT REACTOR APPLICATION

ENERGIZING POWER TRANSFORMERS WITH RESIDUAL FLUX MANAGEMENT

SynchroTeq MVX features AC voltage measurement channels for the acquisition of power transformer voltage (from primary or secondary winding) and residual flux calculation for each phase. When re-energizing, the optimal closing angle is derived from the residual flux in transformer’s core for the mitigation or elimination of the inrush currents (Figure 5).



* The number of inputs and outputs depends on the switchgear configuration.

FIGURE 5 EXAMPLE OF SYNCHROTEQ MVX FOR ENERGIZING A POWER TRANSFORMER

SWITCHING A PARTIALLY CHARGED CAPACITOR BANK OR FILTER

SynchroTeq MVX features AC voltage measurement channels suitable for the acquisition of residual charges trapped in capacitive loads such as partially charged capacitor banks or harmonic filters (Figure 6).

Each time the C/B is opened, the capacitive load is ‘initially charged’ at the magnitude of source voltage corresponding to the moment of current interruption.

- If the opening is controlled by the SynchroTeq MV (controlled opening), this assessment of residual voltage is done automatically during the opening event, for any type of load connection (WYE-grounded, WYE-floating or delta).
- If the opening is external (protection trip or uncontrolled), a dedicated signal should be wired to a digital input (by default DI8), configured as “External Trip” as shown below. The assessment of residual voltage in case of external trip is only accurate for WYE-grounded load. In case of WYE-floating or delta load, it is recommended NOT to perform closing operation until the load is fully discharged.

Re-closing angles are dynamically computed to match the residual charge, thus avoiding voltage disturbances/inrush currents and allowing for fast-switched MSC applications.

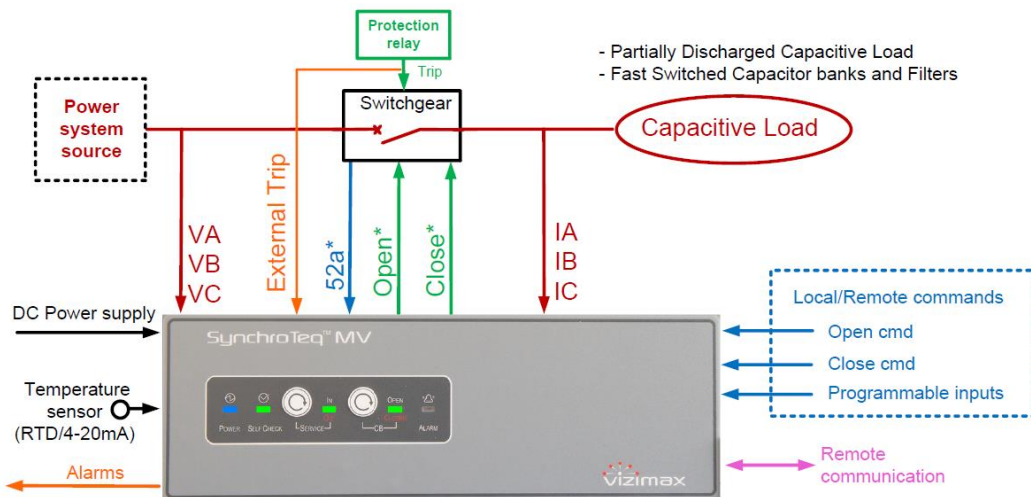


FIGURE 6 EXAMPLE OF SYNCHROTEQ MVX IN FAST SWITCHING OF A CAPACITIVE LOAD

The SynchroTeq MV offers the following performances with extremely short intervals between controlled open and controlled close commands:

- Close-160ms*-Open-15 seconds. Can be repeated any number of times (no limit)
- Open-160ms*-Close-15 seconds. Can be repeated any number of times (no limit)
- Open-160ms*-Close-160ms*-Open-160ms*-Close-30 seconds. Can be repeated 20 times (After 20 times, it’s recommended waiting for at least 1 minute before the cycle repeats).
- Close-160ms*-Open-160ms*-Close-160ms*-Open-30 seconds. Can be repeated 20 times (After 20 times, it’s recommended waiting for at least 1 minute before the cycle repeats).

NOTE:* the 160ms takes into account command duration of 25ms, MVX output pulse duration of 50ms, C/B close time of 30ms and open time of 20ms.

COMMUNICATION LINKS – TIME SYNCHRONIZATION - SOFTWARE

All SynchroTeq MV units feature built-in communication ports for network integration and external devices:

- Two 100Base-TX Ethernet ports:
 - Ethernet-based Service Port.
 - Ethernet-based general purpose network interface and IEC 61850 MMS.
- Two serial communication ports:
 - One isolated RS-232/RS-485 port generally used for the optional SynchroTeq Communication module (RWK 000016)
 - RS232 port for service operations

The communication ports are located on the rear panel, excepted for the Ethernet service port which is relocated to the front panel in the rack mount version.

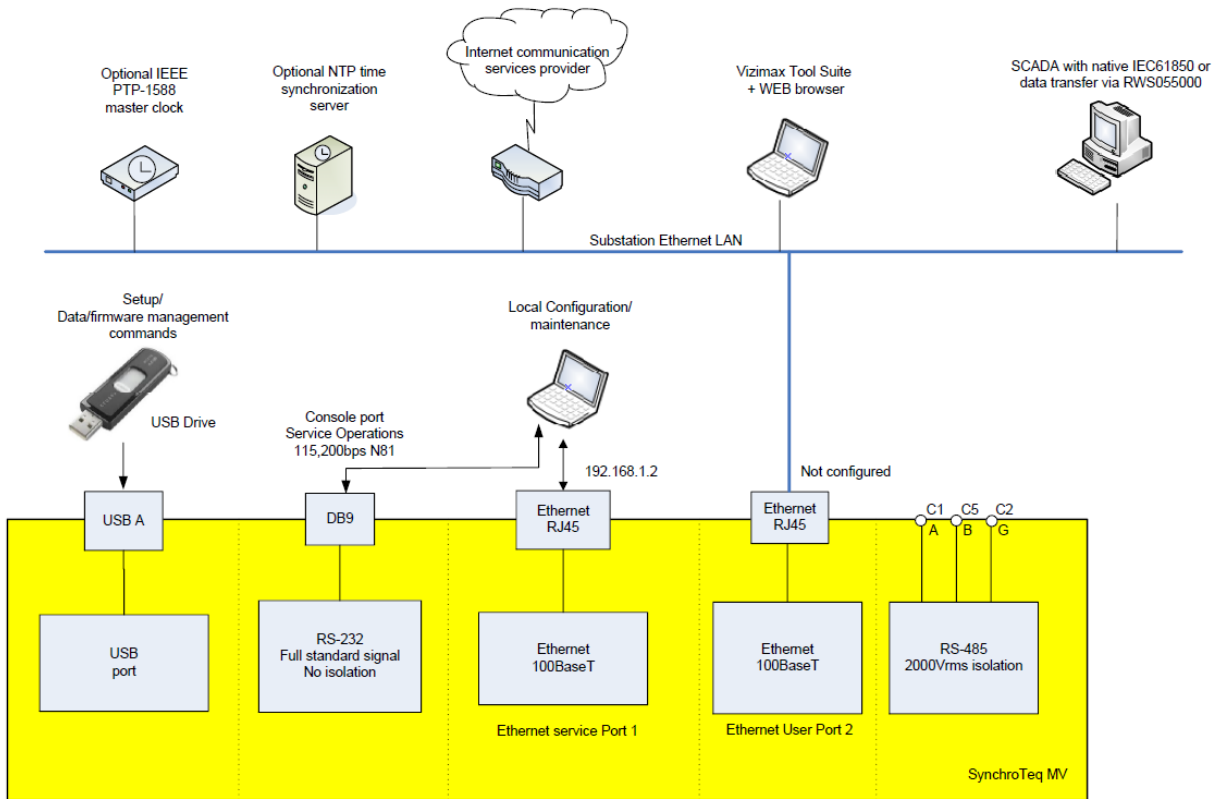


FIGURE 7 COMMUNICATION PORTS

TIME SYNCHRONIZATION

SynchroTeq MV time synchronization can be achieved with either:

- PTP-1588 (IEEE Standard Precision Time Protocol) service over the Ethernet network. Supported profile is: "PTP/IEEE-1588v2 UDP/IPv4, Multicast, End-to-End/Peer-to-Peer, Slave Only".
- 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
- NTP/SNTP (Network Time Protocol) service over the Ethernet network
- Protocol using the optional SynchroTeq Communication module RWK000016.

Any one of these approaches allows to time stamp recorded operational events for remote data analysis.

FRONT PANEL / LOCAL HMI - REMOTE CONTROL

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

- The VIZIMAX Commissioning Tool (VCT) in remote mode
- IEC 61850 substation automation environment (MMS protocol)
- Substation automation: Native IEC 61850 MMS server Ed.2, optional DNP3.0 and MODBUS via SynchroTeq Communication Module (RWK000016)
- Dry contacts (commands) and relay outputs (statuses).

The SynchroTeq web-based interface (requires a web-browser) offers several system operation, event and alarm monitoring panels.

COMMUNICATIONS AND DATA ANALYTICS SOLUTIONS

SynchroTeq MV supports native IEC 61850 MMS Server Ed.2 protocol (including the XCBR control model), for substation automation and SCADA system interfacing.

VIZIMAX also offers a full set of software tools to address client requirements for communication, data transfer to central site and Data Science (Big Data Analysis).

VIZIMAX CB Angel: A fleet-wide Asset Health Management System for the predictive and proactive maintenance of HV and MV circuit breakers fitted with VIZIMAX's Controlled Switching Devices (CSDs).

- Multi-tiered computing environment
- Cloud-based or on-premise, secure web portal

VIZIMAX Unified Communication Services: CSD fleet management interface + background communication service for PC computer or server with MS-Windows operating system.

- Automatic event and data collection, transfer and storage

Please contact your VIZIMAX representative for more details on the VIZIMAX Communication and Data Analytics solutions.

SYNCHROTEQ COMMUNICATION MODULE (OPTION RWK000016)

SynchroTeq MV natively supports IEC 61850 MMS Server Ed.2 protocol. For application requiring other substation protocols like DNP3.0 and MODBUS, VIZIMAX offers an optional SynchroTeq Communication Module (RWK000016).

(This option is not available when SynchroTeq RS-485 serial port is assigned to another function).

Please contact your VIZIMAX representative for more details on the SynchroTeq Communication Module (RWK000016).

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 firmware update or system backup;
- Local web based contextual help site including documentation in PDF format

The Vizimax Commissioning Tool (VCT) is used to customize the operation of the SynchroTeq MV 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 MV unit. Typically, the configuration files are designed and managed offline on a maintenance PC and are uploaded to the SynchroTeq MV as part of the system commissioning.

The VIZIMAX Event Analyzer is a COMTRADE compatible enhanced waveform viewer that displays the waveforms and the C/B operation simultaneously.

SYNCHROTEQ WEB INTERFACE

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

The SynchroTeq Web interface is dedicated to system operation and alarm monitoring, event details and analysis of the SynchroTeq units. The Web interface offers several dedicated panels:

- **Dashboard:** This page displays real time status of the SynchroTeq unit, the circuit breaker and the load.
- **Details:** This page provides access to detailed statuses, including the SynchroTeq and C/B alarms and the C/B operating time predictions and electrical wear information.
- **Events:** List of the most recent 500 events recorded and stored in the SynchroTeq MV.
- **Snapshot:** List of the most recent waveform captures manually triggered by the user.
- **System:** System page used to manage the SynchroTeq configuration files and provides hardware information.

EVENTS AND WAVEFORM RECORDING

At each switching operation, SynchroTeq MV records current and voltage waveforms including the C/B interface signals (52a/Trip/Close/inputs/commands) over a period of 1250 ms including 250 ms pre-trigger (default configured values).

The recording period length can be configured up to 3000 ms including 1000 ms pre-trigger in some specific applications such as power transformer with RFC.

Waveform sampling rate is 80 samples / cycle (at nominal frequency).

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 MV's complete status and operating environment to allow for detailed further analysis. The SynchroTeq MV has a memory capacity of 500 events, including waveforms.

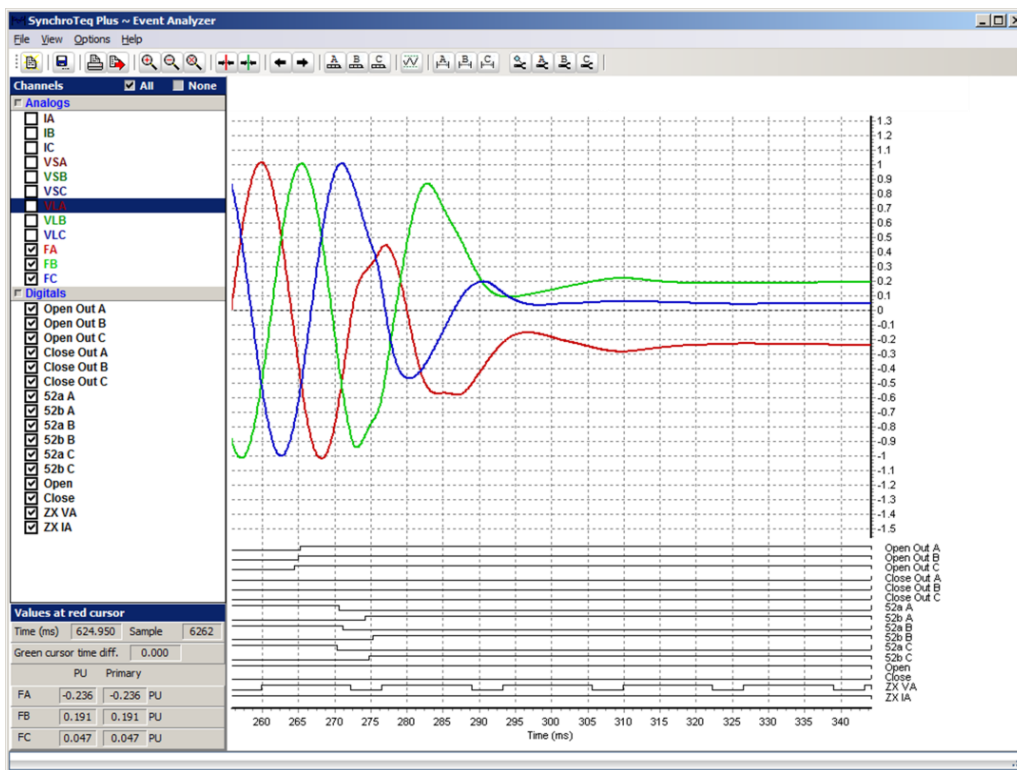
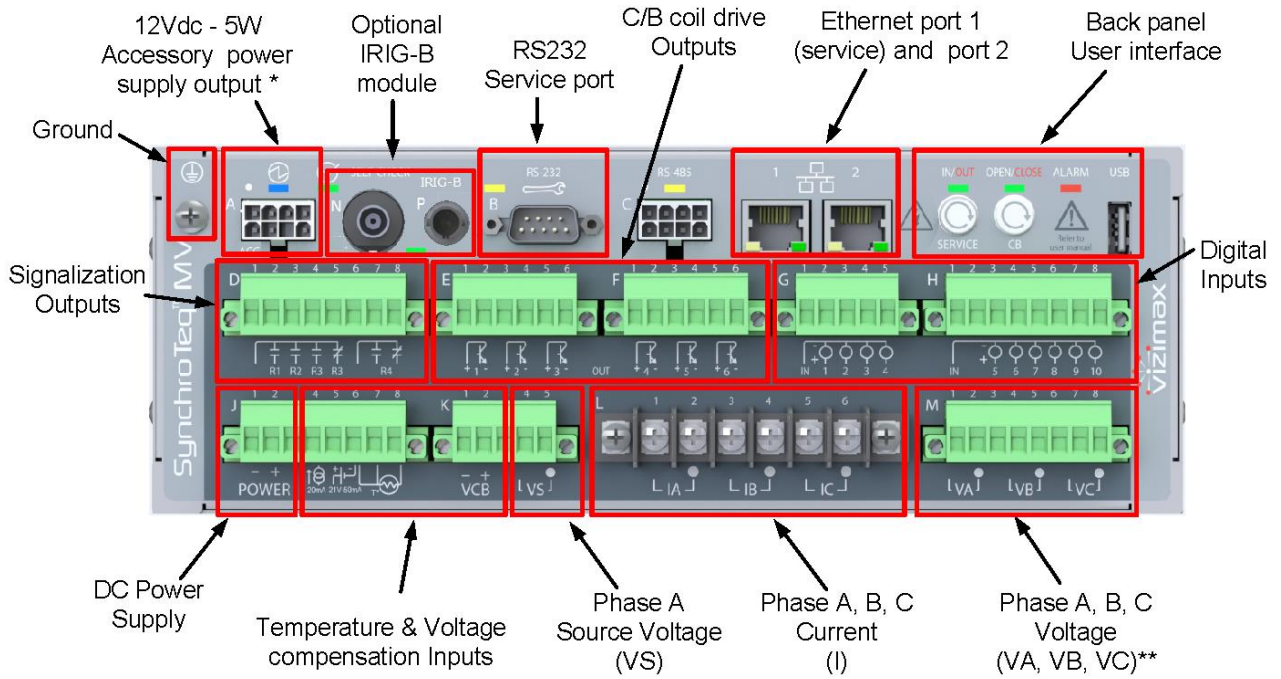


FIGURE 8 VIZIMAX EVENT ANALYZER

SYNCHROTEQ MV CONNECTORS AND HMI IDENTIFICATION

BACK PANEL CONNECTORS IDENTIFICATION



* Was rated to 24Vdc, 3W on units delivered before April 4th, 2017
 ** Available in SynchroTeq MVX only

FRONT PANEL USER INTERFACE



(Panel mount configuration shown here)

TECHNICAL SPECIFICATIONS

COMPLIANCE AND CERTIFICATIONS



TEST TYPE

Test type	Standard	Value
Temperature range	Operating temperature	-40°C to +85°C (*see note)
	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	2000 m
Mechanical resistance to vibrations	Performance	IEC 60255-21-1
	Endurance	IEC 60255-21-1
Dielectric withstand	AC Inputs and I/Os	IEC 60255-5
	Communication	IEC 60255-5
Impulse voltage withstand	IEC 60255-5	5 kV
Electrostatic discharge (ESD)	Air discharge	IEC 61000-4-2
	Direct contact discharge	IEC 61000-4-2
Damped Oscillatory Wave (1MHz burst)	Common mode	IEC 60255-22-1
	Differential mode	IEC 60255-22-1
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 2150 MHz
	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 edition ISO 14971 : 2012	Safety for measurement, control, and laboratory use

*Internal operating temperature; please refer to 'Temperature Test Performances' table below for more details.

TEMPERATURE TEST PERFORMANCES

Test type		Standard	Value
Temperature Type testing	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% R.H. (144 hours)
	UL Safety	IEC 61010-1	-40°C to +70°C

MEAN TIME BEFORE FAILURE (MTBF)

Specification	Value
MTBF	28 years estimated

POWER SUPPLY

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

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)	70 V dc - 140 V dc
Power supply rating (220 V)	180 V dc - 280 V dc
Rated power	15W max. (typical 9W, 0.07 A @ 125 V dc) – Idle 6W - The external power supply must be able to sustain a 6A cold start current for 50ms at unit start up (See note below). - When a SynchroTeq Communication Module (RWK000016) is powered by the SynchroTeq MV accessory power supply output (connector A), the external power supply must be sized accordingly to feed this module.
Connector	Phoenix MSTB 5.08mm
Isolation	3000V during 1 second
Fuse	Time delay, 2 x 2 A (not user serviceable)
Voltage interrupt (max)	100ms @ 100%

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

ACCESSORY POWER SUPPLY OUTPUT

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

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

NOTE: The auxiliary power supply was rated at 24Vdc, 3W for units manufactured before April 4th, 2017.

CONTROL – TIME SYNCHRONIZATION - COMMUNICATION

CONTROLLER

Parameter	Value
Main processor	32-bit, 400 MHz high performance ARM processor
OS	Linux
Memory	512 MB Flash memory / 128 MB RAM
Real time clock	±3 ppm typical 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 (see Note) or SynchroComm (RWK000016)
I/O board controller	32 bits, 168 MHz ARM processor with RTOS. 16 bit ADC.
Field upgrade	Field upgradable firmware available from VIZIMAX web site, support section

NOTE: Several different configurations (profiles) are defined with the PTP-1588 protocol. SynchroTeq MVX and SynchroTeq MVR supports version 2 using UDP (layer 3) as defined by: “PTP/IEEE-1588v2 UDP/IPv4, Multicast, End-to-End/Peer-to-Peer, Slave Only”.

LOCAL USER INTERFACE

Parameter	Value
Two push buttons (back and front panel)	<ul style="list-style-type: none"> - Open/Close - In/Out of Service
Seven LEDs (back panel)	Service, Circuit breaker position, Communication activity (2x), System status, Alarms and Power.
Five LEDs (front panel)	Service, Circuit breaker position, System status, Alarms and Power.

OPTIONAL IRIG-B TIME SYNCHRONIZATION MODULE (RWC0Y0001)

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 : $Z_{in} = 500 \Omega$ Input level : 2.5V to 5.0 Vdc Base inaccuracy ≤ 10.0 μs + source inaccuracy
Voltage isolation level	500 Vdc
IRIG-B formats (selectable by software)	<ul style="list-style-type: none"> - IRIG-B000/B004 IEEE-C37.118 (default setting) - IRIG-B000/B004 IEEE-1344 - IRIG-B003

COMMUNICATION PORTS

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	1500 VRMS
	Name	Port 1
	Function	Initial unit configuration and setup
100Base-TX Ethernet 2 (User communication link)	Interface	10/100 Mbps
	Connector	RJ-45
	Isolation	1500 VRMS
	Name	Port 2
RS-232 Serial	Function	Console port, service Operations
	Connector	DB-9 (connector C)
	Bit rate	115 kbps
RS-485 Isolated Serial	Function	Generally used by the optional SynchroTeq Communication Module (RWK 000016)
	Connector	Molex Mini-Fit junior (connector A)
	Bit rate	38.4 kbps
	Mode	Two wire interface (A-B) with jumper selectable 120 Ω terminations. Reference wire (0V) provided for high common mode voltage capability
	Isolation	2000 VRMS

NATIVE PROTOCOL

Protocol	Characteristics
IEC 61850 MMS server Ed.2	<ul style="list-style-type: none"> • XCBR control • Full dataset refreshed every second • 4 predefined unbuffered reports • 120 COMTRADE waveform retrieval.

AC MEASUREMENT INPUTS

SynchroTeq MV 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 C/B operation synchronization and frequency measurement.

Example of supported measurement devices (VS):

- Voltage measurement transformer (Output usually rated from 69 to 120 V ac)
- Resistive voltage divider (Direct connection) Low Energy Analog sensor usually rated from 2.0 to 10 V ac.
- Capacitive voltage divider (Direct connection) from VDS/VPI device and usually rated around 7.0 V ac.

- **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.

Alternately (Special order applies), Magnetic CT inputs can be substituted by low power current measurement inputs for Rogowski type coil instrument transformers (LPCT). Two input measuring ranges are offered to cover a wide range of nominal current / LPCT combinations.

- **Phase A, B and C voltage (VA, VB and VC) SynchroTeq MVX only:** these measurements are taken from voltage sensors located on the power transformer's primary or secondary winding to measure the power transformer voltage in order to calculate the residual flux resulting from transformer de-energization. When energizing the transformer, the residual flux calculation is used to reduce the inrush current to a magnitude comparable to the magnetization current by automatically adjusting the closing angle. For capacitive load switching applications (partially discharge capacitor bank or harmonic filters, cables) with fast switching capability, these measurements are used to measure phase A, B and C of the source side.

Example of supported measurement devices (VA, VB and VC):

- Voltage measurement transformer (Output usually rated from 69 to 120 V ac)
- Resistive voltage divider (Direct connection) Low Energy Analog sensor usually rated from 2.0 to 10 V ac.
- Capacitive voltage divider (Direct connection) from VDS/VPI device and usually rated around 7.0 V ac.

NOTE: Low energy voltage divider measurement device can be used for fast switching of capacitor banks applications (SynchroTeq MVX) only through Firmware 1.15.2 and up.

AC CURRENT MEASUREMENT INPUTS: MAGNETIC CT

Parameter	Value	
Name	IA, IB and IC (connector L)	
Number of inputs	3	
Connector type	Barrier strip, screw type 14AWG - 2.5 mm ²	
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	3000 VRMS	
Asymmetrical current	80% after 100 ms	
Nominal Frequency	50 Hz or 60 Hz or 16 ^{2/3} 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)	10 to 70 Hz
	Minimum current	50 mA
	Accuracy	10 μs
Insensitivity to harmonic contents	Up to 25 % of 'In' for 2nd to 10th harmonics	

AC CURRENT MEASUREMENT INPUTS: ROGOWSKI OPTION (SPECIAL ORDER APPLIES)

Parameter	Value
Name	IA, IB and IC (connector L)
Number of inputs	3
Connector type	Barrier strip, screw type (RJ45 adapter available) 14AWG - 2.5 mm ²
Maximum measuring range at clipping	250mV or 1200mV (@ 50Hz)
	300mV or 1440mV (@ 60Hz)
Measurement category	MEAS CAT IV
Isolation	1000 VRMS
CMRR	90dB
Accuracy	±0.4% (±60 PPM/°C)
Zero crossing detection. Min. Level	25mV

AC SOURCE VOLTAGE MEASUREMENT INPUT (VS)

Parameter	Value		
Name	VS (connector K)		
Number of input	1		
Connector type	Phoenix MSTB 5.08mm, pluggable screw type AWG 13-24 (2.5 mm ² – 0.2 mm ²)		
Rated voltage (Vn)	2 measurement ranges selectable by software: - 0-200Vac with 'low gain' setting. (usual measurement PT are rated to 69 V ac, 110 V ac, 120 V ac) - 0-20Vac with 'High gain' setting. (Low Energy Analog sensors are usually rated between 2.0 and 10V ac)		
Thermal capacity	300 V ac (No time limit)		
Measurement category	MEAS CAT IV		
Maximum Burden	0.005 VA (see note below)		
Isolation	2000 VRMS – 1 min		
Nominal Frequency	50 Hz or 60 Hz or 16 ^{2/3} 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)	10 to 70 Hz	
	Minimum voltage	Default (static)	40 V ac
		'DynamicZX' = ON	4 V ac @ Low gain 0.4 V ac @ High gain
	Accuracy	10 μs	
Insensitivity to harmonic contents	Up to 50 % of Vn for 2nd to 10th harmonics		
Input Impedance	10.58 MΩ (common mode) / 21.2 MΩ (differential mode) <u>Caution:</u> units manufactured before April 4th, 2017 have VS input impedance of 1000 KΩ only and cannot be used with capacitive voltage divider.		
Common Mode Voltage Range	700 V ac		
Common Mode Rejection Ratio	65 dB in 'low gain' setting (0-200Vac measuring range) 55 dB in 'high gain' setting (0-20Vac measuring range)		

NOTE: Please take note the burden of this input is very low. In case of lightly loaded PT or a non standard PT, a parallel resistance of 5 KΩ (10 watts or more) must be added on this input.

ADDITIONAL AC VOLTAGE MEASUREMENT INPUTS (SYNCHROTEQ MVX ONLY)

Specifications	Value		
Name	VA, VB and VC (connector M)		
Number of inputs	3		
Connector type	Phoenix MSTB 5.08mm, pluggable screw type AWG 13-24 (2.5 mm ² – 0.2 mm ²)		
Rated voltage (Vn)	2 measurement ranges selectable by software: - 0-200Vac with 'low gain' setting. (usual measurement PT are rated to 69 V ac, 110 V ac, 120 V ac) - 0-20Vac with 'High gain' setting. (Low Energy Analog sensors are usually rated between 2.0 and 10V ac)		
Thermal capacity	300 V ac (No time limit)		
Measurement category	MEAS CAT IV		
Maximum Burden	0.005 VA (see note below)		
Isolation	2000 VRMS		
Nominal Frequency	50 Hz or 60 Hz or 16 ^{2/3} 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 (Applicable only when signal is used as synchronization signal)	Range (frequency)	10 to 70 Hz	
	Minimum voltage	Default (static)	40 V ac
		'DynamicZX' = ON	4 V ac @ Low gain 0.4 V ac @ High gain
	Accuracy	10 μs	
Insensitivity to harmonic contents	Up to 50 % of Vn for 2nd to 10th harmonics		
Input Impedance	10.58 MΩ (common mode) / 21.2 MΩ (differential mode) <u>Caution:</u> units manufactured before April 4th, 2017 have VS input impedance of 1000 KΩ only and cannot be used with capacitive voltage divider.		
Common Mode Voltage Range	700 V ac		
Common Mode Rejection Ratio	65 dB in 'low gain' setting (0-200Vac measuring range) 55 dB in 'high gain' setting (0-20Vac measuring range)		

NOTE: Please take note the burden of this input is very low. In case of lightly loaded PT or a non standard PT, a parallel resistance of 5 KΩ (10 watts or more) must be added on this input.

DC MEASUREMENT INPUTS WITH COMPENSATION FUNCTION

SynchroTeq MV performs the following functions:

- Monitor C/B operating temperature using a 4-20 mA loop powered sensor or a 100 Ohm Platinum RTD sensor installed in the C/B mechanical housing. SynchroTeq MV provides an isolated 24 V dc power supply for an external 4-20mA conditioner when a remote sensor is used. The sensor has programmable limits to define out of range alarms.
- Monitor the C/B DC control voltage using a 0-300V isolated analog input.

The C/B operating time prediction can be influenced by both the ambient temperature and the C/B DC control voltage. With compensation functions enabled, SynchroTeq MV automatically adjusts the OPEN/CLOSE coil commands according to the predicted time to operate the C/B at the optimal point on the wave. C/B timing compensation curves are defined in the SynchroTeq MV configuration file.

TEMPERATURE MONITORING INPUT WITH COMPENSATION FUNCTION (USER SELECTABLE, PT100 RTD OR 4-20mA)

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)
4-20mA	Range	4-20mA
	Accuracy	±0.4% (± 40 PPM/°C)
Sensor supply	21V - 50mA output for current loop supply	
Connector	Phoenix MSTB 5.08mm, pluggable screw type.	
Measuring Category	MEAS CAT IV	
Input impedance	Current (4-20mA): 15 Ω	
Resolution	16-bit	
Update rate	1 update /sec	

C/B COIL DC VOLTAGE MONITORING INPUT WITH COMPENSATION FUNCTION

Parameter	Value
Name	VCB (connector K)
Number of input	1
Rated voltage	0-300V dc
Connector	Phoenix MSTB 5.08mm, 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 /sec
Common Mode Voltage Range	700 V ac
Dielectric Test	2000 VRMS – 1 min

DIGITAL INPUTS / OUTPUTS

DIGITAL INPUTS

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

- Three inputs for C/B position (52a contacts)
- Two inputs for the control of the C/B (OPEN/CLOSE commands)
- Five programmable inputs for C/B monitoring and commands with separate returns

Parameter	Value
Name	DI 1 to 10 (connectors G-H)
Number of inputs	10 (6+4)
Maximum input voltage (24V power supply)	30 V dc, (detection threshold 16 V dc)
Maximum input voltage (48V power supply)	72 V dc, (detection threshold 28 V dc)
Maximum input voltage (110V power supply)	Max: 140 V dc Threshold: 52a inputs: 56 V dc Threshold: all other inputs: 69 V dc ($\pm 10\%$)
Maximum input voltage (125V power supply)	Max: 140 V dc Threshold: 52a inputs: 66 V dc Threshold: all other inputs: 74 V dc ($\pm 10\%$)
Maximum input voltage (220V power supply)	Max: 280 V dc Threshold: 52a inputs: 113 V dc Threshold: all other inputs: 137 V dc ($\pm 10\%$)
Isolation	Opto-coupler, 2000 VRMS
Measuring Category	MEAS CAT IV
Burden	2 mA to 5 mA
Maximum Hardware response Time	0.10 ms at nominal voltage 1.00 ms at 80% of nominal voltage
Software Filter	Programmable, 5 ms increments up to 250ms
Connector	Phoenix MSTB 5.08mm, pluggable screw type.

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

NOTE: For 3-phase switchgear with simultaneous pole operation or staggered pole operation with single 52a auxiliary contact, this contact must be wired on DI1 and chained in parallel on DI2 and DI3 for proper operation of several major SynchroTeq features.

CIRCUIT BREAKER COILS CONTROL OUTPUTS

SynchroTeq MV has potential free and isolated solid state coil driver outputs to control the opening and closing of the switchgear or C/B.

SynchroTeq MV unit has 3 CLOSE and 3 OPEN outputs allowing the control of three phase independent pole operated switchgear.

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).

SynchroTeq MV unit only supports 'DC controlled' switchgear / circuit-breaker.

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	20V dc - 280 V dc
DC rated Output current	5A dc continuous 22 A for 1s 35 A for 200 ms 70 A pulsed 10 ms
Maximum breaking current	7A @ L/R=40ms
Type	Independent, sourcing or sinking outputs
Output pulse width (activation time)	10 ms to 1000 ms (by programmable increments of 10 ms or 100ms)
Coil Output command accuracy	10 μ s (see note *)
Isolation	2000 VRMS
Over Voltage Category	OVC CAT III
Connector	Phoenix MSTB 5.08mm, pluggable screw type.

For 3-phase switchgear with simultaneous pole operation or staggered pole operation with single mechanism, wire the control outputs from phase A only.

(*) Important note on the C/B operating time accuracy:

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

- C/B mechanical scatter: Each C/B 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...). It is important to mention that the mechanical deviation we are talking about (generally from 0.1ms 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...).

- Availability of compensation data and their accuracy: Most of C/Bs are affected by the environmental operating parameters. If these effects are not taken into consideration, the overall C/B 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 C/B manufacturer) is also accurate. The SynchroTeq MV can compensate for the ambient temperature variation, and the DC coil voltage variation. Also, the SynchroTeq MV 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 C/B manufacturers cannot provide it.

For example, let us assume the following situation:

- Circuit-breaker with a natural mechanical scatter of +/- 0.3ms 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 C/B manufacturer stated that the effect of the ambient temperature on the main chamber operating time is +/- 2ms

In this case, since no compensation data is provided, we can expect **an overall C/B operation precision of +/- 2.31ms** :

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

SIGNALIZATION RELAY OUTPUTS

SynchroTeq MV 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:** C/B Temperature or C/B DC control voltage monitoring alarm, form A
- **R3:** C/B Operation limits and inrush current alarm, form C
- **R4:** System OK (watchdog), form C. The NC contact is used to indicate that the system is failed.

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:	5000 VRMS (coil to contacts)
Over Voltage Category	OVC CAT III
Connector:	Phoenix MSTB 5.08mm, pluggable screw type.

FUNCTIONAL ANALYSIS TOOLS

WAVEFORM CAPTURE

Parameter	Value
Memory capacity	Up to 500 events (waveforms are stored in events)
Capture trigger	C/B commands from SynchroTeq MV (OPEN and CLOSE) Voltage changes on switched side of C/B (for power transformer applications) Manual trigger using snapshot capture
Sampling rate	80 samples/cycle (at nominal frequency)
Recording time	1250 ms including 250 ms pre-trigger (default values) Configurable up to 3000 ms including 1000 ms pre-trigger for specific applications such as Power transformer with RFC.
Recorded signals	Voltage on unswitched side of C/B (1) Load current (3) Option: power transformer application (3) C/B control commands (3 x Open, 3 x close) C/B position contacts (3 x 52a) SynchroTeq MV command inputs (OPEN and CLOSE) User programmable digital inputs (5) Phase A synchronization (1 x I, 1 x V)

EVENT MEMORY

Parameter	Value
Memory capacity	500 events, including waveforms when applicable
Recording trigger sources	C/B commands from SynchroTeq MV Voltage changes on switched side of C/B (for power transformer applications) Status change (local/remote, in/out of service, cold start, reset, etc.) Alarms (self-check, sensors, C/B timing problems, C/B interface problem, loss of synchronization signal, etc.) Configuration changes (new parameters) Operation failure (rejected commands) Manual waveform capture Operation commands to SynchroTeq MV (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

UNIT HOUSING CONFIGURATIONS

SynchroTeq MV is available in Standard mount (SM model, without face plate), in Panel mount (PM model, with a 12" face plate) or in a 19" Rack mount configuration (RM model, with a 19" face plate).



The SynchroTeq MV unit is cooled by convection; it does not have a built in fan. For this reason, install the SynchroTeq MV unit well away from any heat producing equipment.

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: 132.5mm/5.22 in for Rack mount installation.
Depth	134 mm/5.25 in
Weight	Standard mount 3.0 kg (6.6 lbs); Panel mount 3.3 kg (7.3 lbs); Rack mount 3.6 kg (8 lbs).

STANDARD MOUNT (NO FACE PLATE)

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

NOTE: SynchroTeq MV 'SM model' does not include front panel interface. All connectors, ports, LEDs and command push buttons are located on the rear panel.



FIGURE 9 STANDARD MOUNT CONFIGURATION (SM MODEL)

PANEL MOUNT (12" FACE PLATE)

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



FIGURE 12 PANEL MOUNT (PM MODEL)

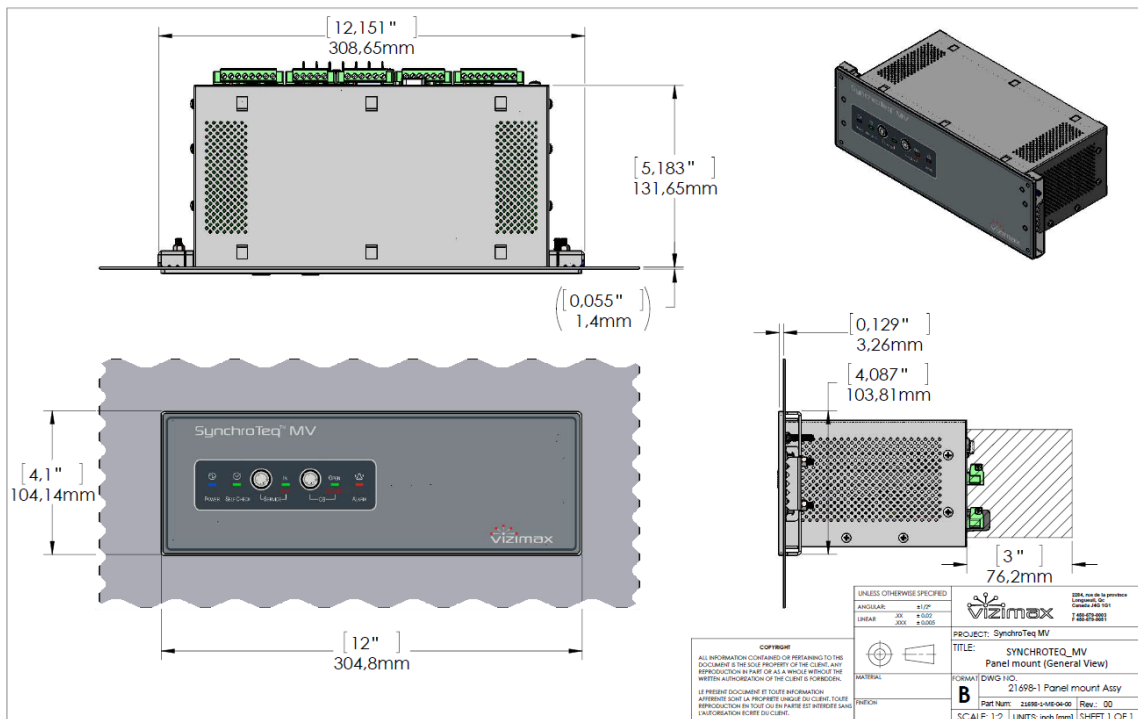


FIGURE 13 PANEL MOUNT DIMENSIONS

RACK MOUNT (19" FACE PLATE)

The SynchroTeq MV rack mount (RM model) is for mounting on an EIA 482.6 mm (19 in) rack in the MV switchgear. Panel size: 3U standard panel (5.219 x 19 in).

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

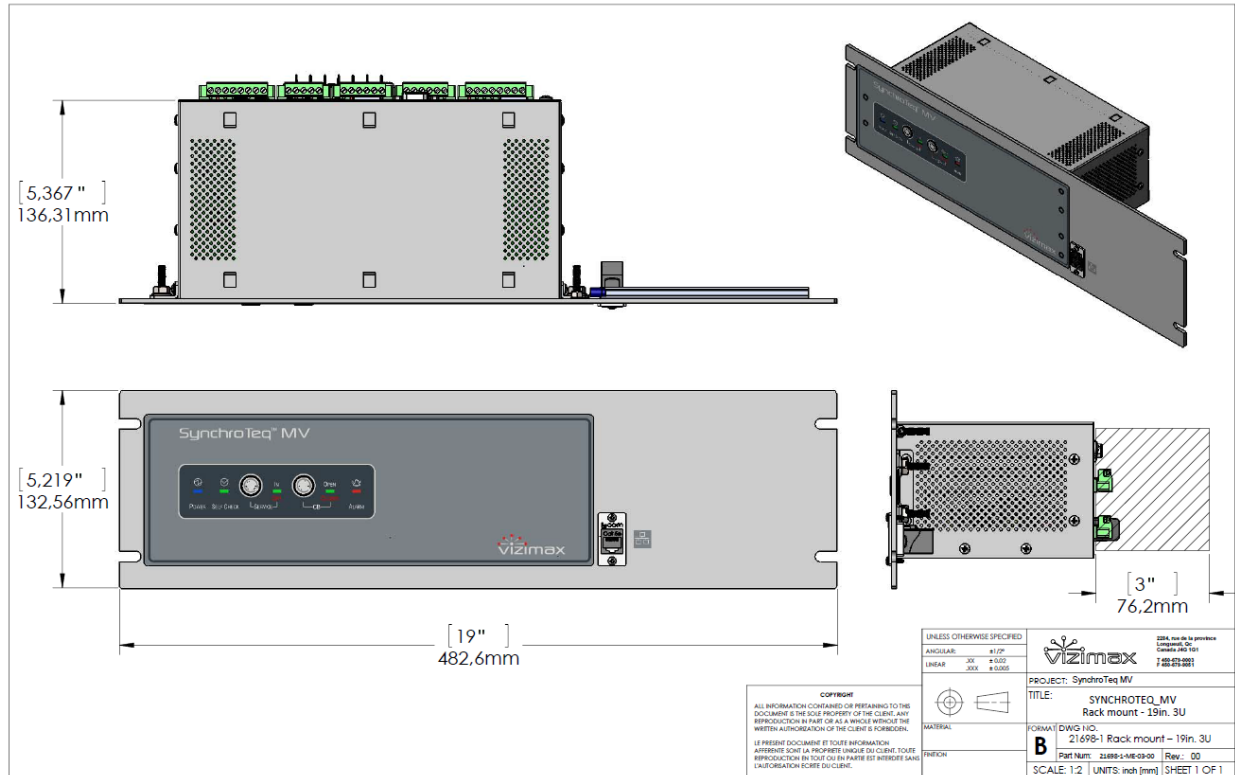


FIGURE 14 19" RACK MOUNT CONFIGURATION (RM MODEL)

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



ORDERING INFORMATION

STM010000 **SynchroTeq MVR** base unit (Smart Coding to be confirmed at order) for the controlled switching of shunt reactors, discharged capacitor banks, harmonic filters, power cables, power transformers, all based on fixed switching angle strategies.

STM030000 **SynchroTeq MVX** base unit (Smart Coding to be confirmed at order) for three-phase MV power transformer switching applications with residual flux calculation and partially discharged capacitor banks and filters and cables with the acquisition of residual charges.

To select ordering options such as, housing configuration, or power supply voltage, or IRIG-B synchronization option or LPCT Rogowski coil current measurement input type, please refer to the 'smart coding' document 'STM0x0000-SC' available in the VIZIMAX web site <https://www.VIZIMAX.com>.

Options:

STALxxx Optional LEA adapters for current and voltage sensors: per phase cable with unterminated (open wire end) or with RJ45 female connector compatible with commonly used current and voltage sensors.

STA030302 Diode trio with transient suppressors : May be required in some situations such as when a bypass logic is installed with an IPO C/B not having a GO command input.

RWC0Y0001 IRIG-B time synchronization 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.

RWK000016 SynchroTeq Communication Module including: (2x) Ethernet 100BASE-T + (1x) Ethernet 100BASE-FX multimode + (2x) serial ports and enables connection SynchroTeq MV with DNP3.0 or MODBUS based SCADA. (This option is not available when SynchroTeq RS-485 serial port is assigned to another function).

RWS055000 SynchroTeq Unified Communication Services: For automatic data transfer to a centralized site of events and waveforms.

VIZIMAX also offers commissioning and training services: for more details, please contact us.

NOTE: These specifications are subject to change without prior notice.



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