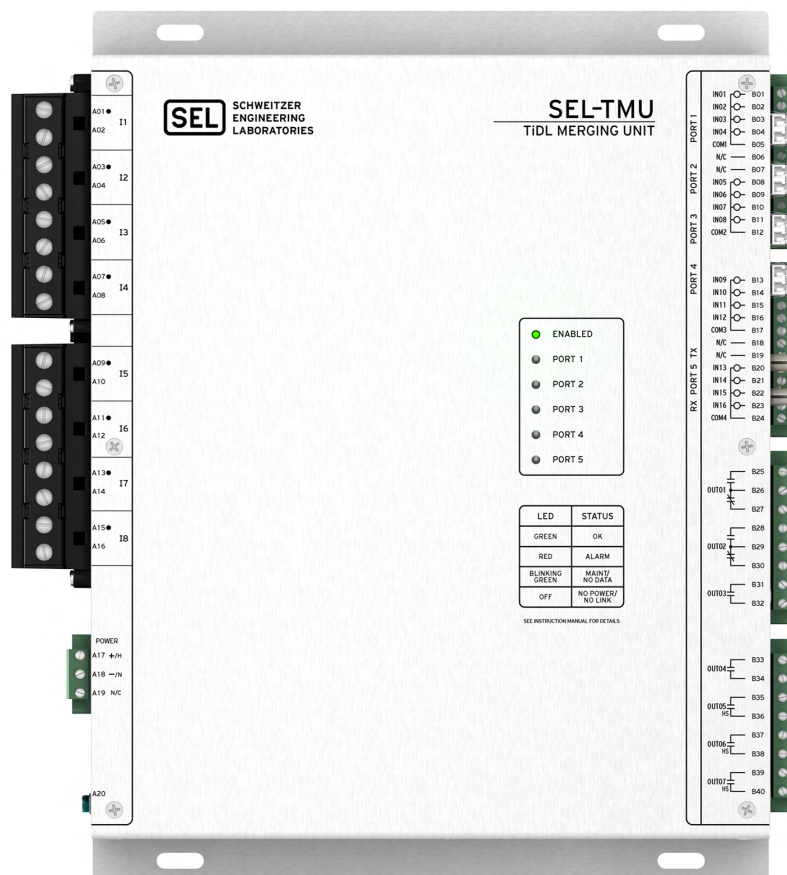




SEL TiDL Merging Unit Instruction Manual



Features and Benefits

The SEL TiDL Merging Unit (SEL-TMU) and SEL Time-Domain Link (TiDL[®]) technology provide the following simplified features for ease of use:

- **Multiple, Point-to-Point Connections.** The SEL-TMU can communicate with as many as four SEL TiDL relays over a direct fiber-optic connection with each relay. Network switches are not required or supported in an SEL TiDL system.
- **Remote Data Source.** The SEL-TMU can be installed in a enclosure remotely located from your TiDL relay. See *Specifications* on page 19 for distance capabilities.
- **Universal, Self-Shorting CT Inputs.** An SEL-TMU CT accepts both 1A and 5A nominal inputs with no required hardware configuration. The CT inputs also provide safety self-shorting terminal blocks that automatically shorts the CT leads when the terminal block is removed from the SEL-TMU.
- **Wide-Range Power Supply.** The SEL-TMU provides a power supply that is capable of operating on a wide dc or ac voltage range. See *Specifications* on page 19 for complete details.
- **Universal Binary Inputs.** The SEL-TMU binary inputs accept a wide range of voltages and are not limited to a specific pickup or dropout threshold.

- **Reduced Security Complexity.** The SEL-TMU communicates directly with the SEL TiDL relays by using a nonroutable protocol and does not offer interactive remote user access. These features minimize security complexity and the associated compliance costs in a distributed remote data acquisition system.
- **Small Form-Factor Pluggable (SFP) Transceivers.** Order and install SFP transceivers as needed based on your installation requirements because the SEL-TMU does not ship with SFP transceivers installed. To ensure device reliability, the SEL-TMU uses SEL-signed SFP transceivers. See *Specifications* on page 19 for a list of supported SFP transceivers.

Safety Information

Aside from installing/de-installing the optional SFP transceivers, the SEL-TMU is not field-serviceable and must be sent back to SEL to be serviced.

Dangers, Warnings, and Cautions

This manual uses three kinds of hazard statements, defined as follows:

DANGER

Indicates an imminently hazardous situation that, if not avoided, **will** result in death or serious injury.

WARNING










Indicates a potentially hazardous situation that, if not avoided, **could** result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation that, if not avoided, **may** result in minor or moderate injury or equipment damage.

Safety Symbols

The following symbols are often marked on SEL products.

	 CAUTION Refer to accompanying documents.	 ATTENTION Se reporter à la documentation.
	Earth (ground)	Terre
	Protective earth (ground)	Terre de protection
	Direct current	Courant continu
	Alternating current	Courant alternatif
	Both direct and alternating current	Courant continu et alternatif
	Instruction manual	Manuel d'instructions

Safety Marks

The following statements apply to this device.

General Safety Marks

⚠ CAUTION To ensure proper safety and operation, the equipment ratings, installation instructions, and operating instructions must be checked before commissioning or maintenance of the equipment. The integrity of any protective conductor connection must be checked before carrying out any other actions. It is the responsibility of the user to ensure that the equipment is installed, operated, and used for its intended function in the manner specified in this manual. If misused, any safety protection provided by the equipment may be impaired.	⚠ ATTENTION Pour assurer la sécurité et le bon fonctionnement, il faut vérifier les classements d'équipement ainsi que les instructions d'installation et d'opération avant la mise en service ou l'entretien de l'équipement. Il faut vérifier l'intégrité de toute connexion de conducteur de protection avant de réaliser d'autres actions. L'utilisateur est responsable d'assurer l'installation, l'opération et l'utilisation de l'équipement pour la fonction prévue et de la manière indiquée dans ce manuel. Une mauvaise utilisation pourrait diminuer toute protection de sécurité fournie par l'équipement.
For use in Pollution Degree 2 (PD2) environment.	Pour utilisation dans un environnement de Degré de Pollution 2.

Other Safety Marks (Sheet 1 of 2)

⚠ DANGER Contact with instrument terminals can cause electrical shock that can result in injury or death.	⚠ DANGER Tout contact avec les bornes de l'appareil peut causer un choc électrique pouvant entraîner des blessures ou la mort.
⚠ WARNING Use of this equipment in a manner other than specified in this manual can impair operator safety safeguards provided by this equipment.	⚠ AVERTISSEMENT L'utilisation de cet appareil suivant des procédures différentes de celles indiquées dans ce manuel peut désarmer les dispositifs de protection d'opérateur normalement actifs sur cet équipement.
⚠ WARNING Have only qualified personnel service this equipment. If you are not qualified to service this equipment, you can injure yourself or others, or cause equipment damage.	⚠ AVERTISSEMENT Seules des personnes qualifiées peuvent travailler sur cet appareil. Si vous n'êtes pas qualifiés pour ce travail, vous pourriez vous blesser, blesser d'autres personnes ou endommager l'équipement.
⚠ WARNING Do not look into the fiber ports/connectors.	⚠ AVERTISSEMENT Ne pas regarder vers les ports ou connecteurs de fibres optiques.
⚠ WARNING Do not look into the end of an optical cable connected to an optical output.	⚠ AVERTISSEMENT Ne pas regarder vers l'extrémité d'un câble optique raccordé à une sortie optique.
⚠ WARNING Do not perform any procedures or adjustments that this instruction manual does not describe.	⚠ AVERTISSEMENT Ne pas appliquer une procédure ou un ajustement qui n'est pas décrit explicitement dans ce manuel d'instruction.
⚠ WARNING During installation, maintenance, or testing of the optical ports, use only test equipment qualified for Class 1 laser products.	⚠ AVERTISSEMENT Durant l'installation, la maintenance ou le test des ports optiques, utilisez exclusivement des équipements de test homologués comme produits de type laser de Classe 1.
⚠ WARNING Incorporated components, such as LEDs and transceivers are not user serviceable. Return units to SEL for repair or replacement.	⚠ AVERTISSEMENT Les composants internes tels que les leds (diodes électroluminescentes) et émetteurs-récepteurs ne peuvent pas être entretenus par l'utilisateur. Retourner les unités à SEL pour réparation ou remplacement.
⚠ CAUTION Equipment damage can result from connecting ac circuits to Hybrid (high-current interrupting) control outputs. Do not connect ac circuits to Hybrid control outputs. Use only dc circuits with Hybrid control outputs.	⚠ ATTENTION Des dommages à l'appareil pourraient survenir si un circuit CA était raccordé aux contacts de sortie à haut pouvoir de coupure de type "Hybrid." Ne pas raccorder de circuit CA aux contacts de sortie de type "Hybrid." Utiliser uniquement du CC avec les contacts de sortie de type "Hybrid."
⚠ CAUTION Insufficiently rated insulation can deteriorate under abnormal operating conditions and cause equipment damage. For external circuits, use wiring of sufficiently rated insulation that will not break down under abnormal operating conditions.	⚠ ATTENTION Un niveau d'isolation insuffisant peut entraîner une détérioration sous des conditions anormales et causer des dommages à l'équipement. Pour les circuits externes, utiliser des conducteurs avec une isolation suffisante de façon à éviter les claquages durant les conditions anormales d'opération.

Other Safety Marks (Sheet 2 of 2)

⚠ CAUTION

Misoperation can result from applying other than specified secondary voltages and currents. Before making any secondary circuit connections, check the nominal voltage and nominal current specified on the nameplate.

⚠ CAUTION

Do not connect power to the SEL-TMU until you have completed these procedures and receive instruction to apply power. Equipment damage can result otherwise.

⚠ ATTENTION

Une opération intempestive du relais peut résulter par le branchement de tensions et courants secondaires non conformes aux spécifications. Avant de brancher un circuit secondaire, vérifier la tension ou le courant nominal sur la plaque signalétique à l'arrière.

⚠ ATTENTION

Ne pas mettre le relais sous tension avant d'avoir complété ces procédures et d'avoir reçu l'instruction de brancher l'alimentation. Des dommages à l'équipement pourraient survenir autrement.

Introduction

The SEL-TMU is a remote data acquisition device designed for use in an SEL TiDL system. Within the SEL TiDL system, the SEL-TMU provides multiple, point-to-point connections with SEL TiDL relays to share data among those relays. The SEL-TMU converts localized CT, PT, and binary inputs into a digital data stream that is processed by connected SEL TiDL relays. Each data stream out of the SEL-TMU is synchronized independently by the TiDL relay connected to the corresponding TiDL communications port of the data stream. Binary output control signals are received from connected TiDL relays and the SEL-TMU asserts outputs based on those incoming control signals. *Figure 1* presents a high-level overview of an SEL TiDL system.

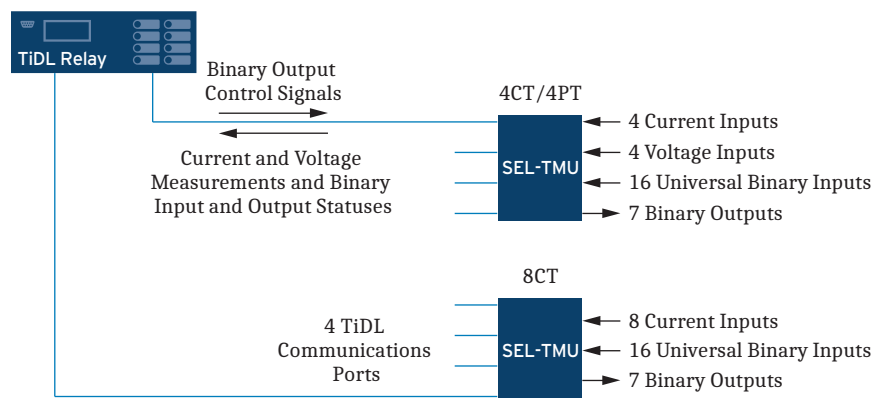


Figure 1 SEL TiDL System Overview

Models and Options

The following SEL-TMU types are available for order (see *SEL-TMU Size* on page 6 for dimensions of the SEL-TMU):

- Type 1: Standard 4CT/4PT
 - Four configurable 1A/5A CT inputs (configured during commissioning)
 - Four 57.7–250 V phase-to-neutral wye configuration PT inputs
- Type 2: Standard 8CT
 - Eight configurable 1A/5A CT inputs (configured during commissioning)

The available types also provide the following common features:

- A wide range power supply.
- Sixteen universal binary inputs and seven binary outputs (three Form A high-speed high-current interrupting, two standard Form A, and two standard Form C).
- Four fiber-optic TiDL communications ports that support SFP transceivers.

Contact the SEL factory or your local Technical Service Center for the particular part number and ordering information (see *Technical Support* on page 25). You can also view the latest part number and ordering information on the SEL website at selinc.com.

Applications

Figure 2 shows an SEL TiDL technology example application using both SEL-TMU model types (4CT/4PT or 8CT).

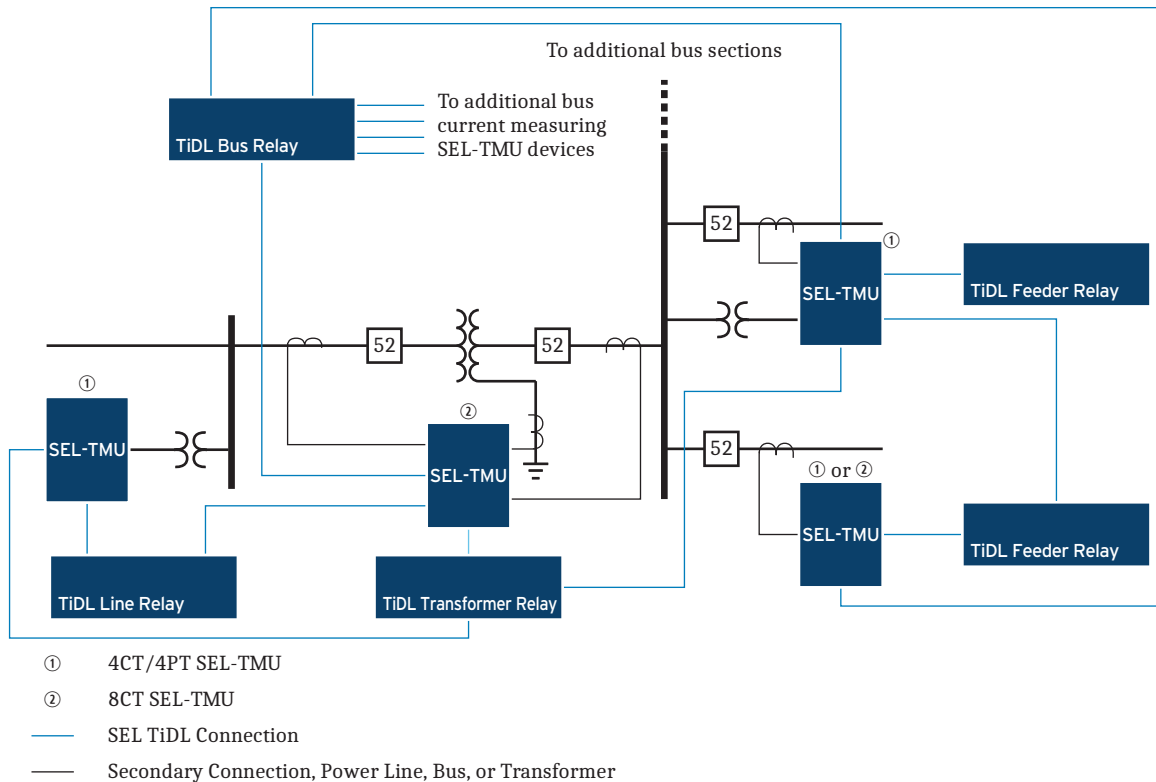


Figure 2 SEL-TMU Application Example

Installation

It is the responsibility of the user to ensure that the SEL-TMU is installed, operated, and used for its intended function in the manner described by SEL. Improper use or installation of this device could result in impaired safeguards of the device.

Configuration Attributes

This section discusses the SEL-TMU physical dimensions, provides a view of SEL-TMU front panel, and highlights the differences in side panels depending on the ordered type.

SEL-TMU Size

Figure 3 highlights the dimensions of the SEL-TMU.

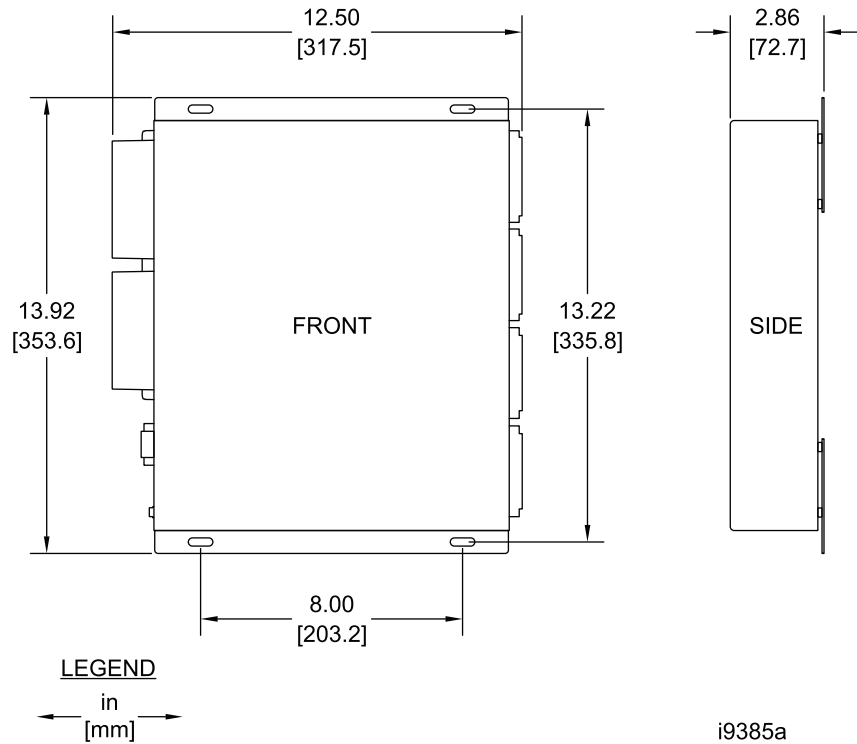


Figure 3 SEL-TMU Physical Dimensions

Front Panel

As shown in *Figure 4*, the SEL-TMU front panel provides LEDs to indicate the status and the health of the SEL-TMU. For additional details, refer to *Troubleshooting* on page 17.

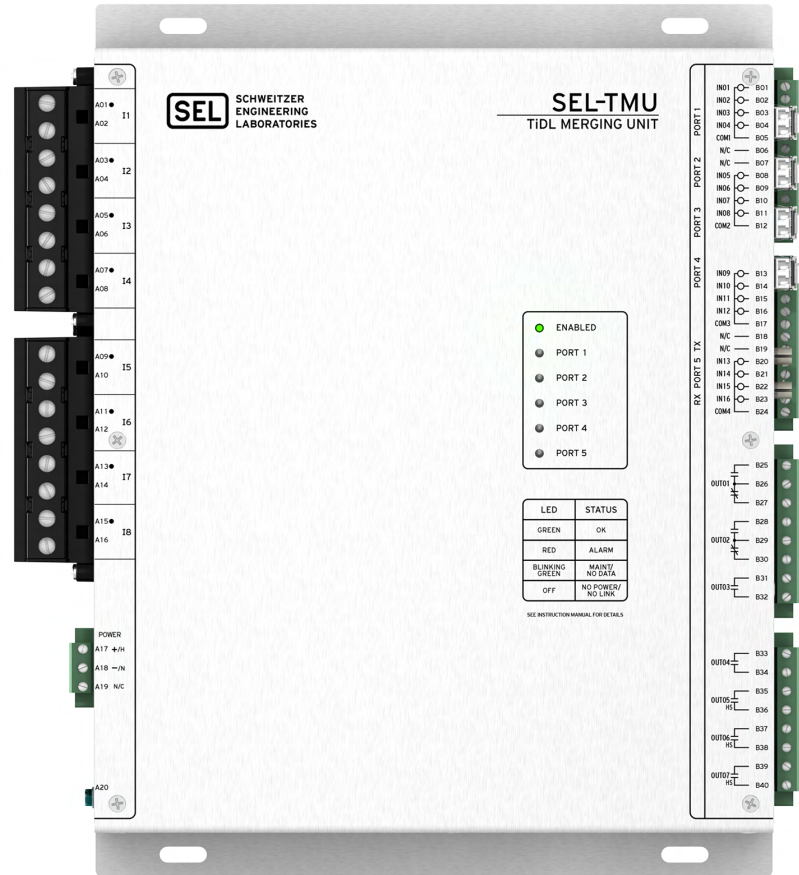


Figure 4 SEL-TMU Front Panel

Side Panels

See Figure 5 for representations of the SEL-TMU side panels.

SEL-TMU Placement

Proper placement of the SEL-TMU helps ensure that you receive years of trouble-free power system protection. Use the following guidelines for proper physical installation of the SEL-TMU.

Physical Location

See *Specifications* on page 19 for rated overvoltage and pollution degree environments. Mount the SEL-TMU in a NEMA Type 4 enclosure or equivalent.

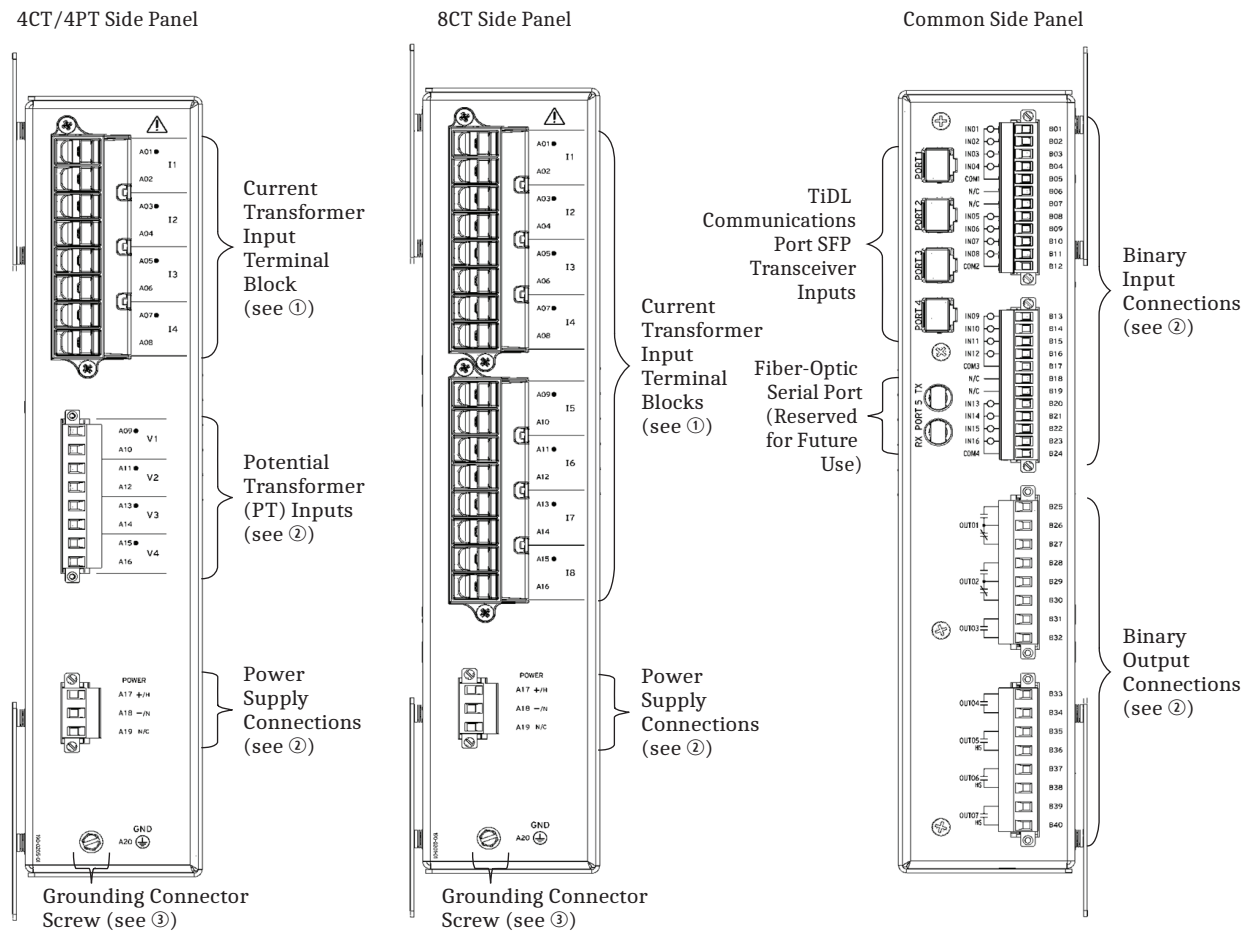
Mounting

See Figure 3 for exact mounting dimensions for the SEL-TMU. The mounting flange openings are sized to accommodate a #10-32 screw. See supporting documentation of the selected enclosure for proper device mounting and clearances.

Connections

Connector Types

Figure 5 shows the provided connectors on the SEL-TMU.



① See Table 1.

② See Table 2.

③ See Table 3.

Figure 5 SEL-TMU Side Panels and Connectors

Table 1 CT Input Terminal Block

Parameter	Value
Supported Wire Gauge	14–10 AWG
Supported Termination	Ring Terminal (#8 Stud Size)
Mounting Ears Torque	Range: 9–12 in-lb Recommended: 9 in-lb
Wiring Terminations Torque	Range: 9–18 in-lb Recommended: 12 in-lb

Table 2 Euro-Style Connectors

Parameter	Value
Supported Wire Gauge	18–12 AWG
Supported Terminations	Blade Ferrule
Mounting Ears Torque	Range: 1.6–2.2 in-lb Recommended: 2 in-lb
Wiring Terminations Torque	Range: 5–7 in-lb Recommended: 6 in-lb

Table 3 Grounding Connector Screw

Parameter	Value
Supported Wire Gauge	14–10 AWG
Supported Termination	Ring Lug (#8 Stud Size)
Wiring Terminations Torque	Range: 9–18 in-lb Recommended: 9 in-lb

Euro-Style Connectors—Binary I/O, Voltage, and Power

Connect to the SEL-TMU binary I/O, PT inputs, and power supply input through Euro-style connectors. You can remove the Euro-style connectors with the incoming wiring attached as needed, and then reinstall the connectors.

Figure 5 shows the Euro-style connectors provided on the SEL-TMU.

Self-Shorting CT Terminal Block Connections

Connect the CT inputs to the removable self-shortening CT terminal blocks. The CT terminal block provides a safety self-shortening feature for each individual CT input when the terminal block is removed from the SEL-TMU. *Figure 5* shows the removable, self-shortening SEL-TMU CT terminal blocks.

TiDL Communications Connection

Figure 5 shows the TiDL communications SFP transceivers.

To install SFP transceivers, remove the blank covering of your desired port. Lower the bail of the SFP transceiver to be directly in-line with the metal case (mid-way between the bail pointing upward or downward). Insert the SFP transceiver with the compression pins on the wider portion of the SFP transceiver metal case towards the **PORT n** lettering above the port.

Continue inserting until the compression pins located on top of the SFP transceiver are fully covered and click into place. The compression pins on the side of the SFP transceiver will be approximately halfway covered. The SFP transceiver is locked in place when the bail is fully rotated up.

To remove SFP transceivers, lower the bail of the SFP transceiver to be directly in-line with the metal case (mid-way between the bail pointing up or down) to unlock the SFP transceiver then gently pull, releasing the SFP transceiver compression pins from the device. The SFP transceiver will click out of place when you remove it.

Analog Secondary Circuits

See *AC Current Inputs* on page 19 for complete CT input specifications, and *AC Voltage Inputs* on page 19 for complete PT input specifications.

Analog Mapping

The PT and CT analog inputs are mapped to the available terminals in the connected SEL TiDL relay according to the user-configured TiDL topology. All analog input measurements can be used by each connected SEL TiDL relay and can map independently in all connected relays.

Binary Inputs

Universal Binary Inputs

All binary inputs on the SEL-TMU are universal. The inputs are bipolar and are arranged in groups of four inputs that share a common terminal. The groups can be wired independently, or groups can be wired to be common by wiring common terminals together. Use these inputs for monitoring logical change-of-state conditions of power system equipment.

Binary input groups of four are galvanically isolated from **GND** and from other groups.

See *Binary Inputs* on page 19 for the complete binary input specifications.

Figure 5 shows the binary input connections provided on the SEL-TMU.

Binary Input Mapping

Binary inputs can be mapped independently in each connected relay. For example, IN01 on the SEL-TMU can map to IN302 of the SEL TiDL relay connected to TiDL Port 1, IN403 of the SEL TiDL Relay connected to TiDL Port 2, IN404 of the SEL TiDL relay connected to Port 3, and IN516 of the SEL TiDL relay connected to Port 4.

Binary Outputs

The SEL-TMU provides a combination of standard and high-speed high-current interrupting binary output contacts. A metal-oxide varistor (MOV) protects against excessive voltage transients for each contact. Each output is individually isolated.

All binary output contacts only support DC connections and are bipolar. See *Binary Outputs* on page 19 for complete specifications.

Figure 5 shows the binary output connections provided on the SEL-TMU.

Binary Output Mapping

Binary output state is determined by the logical OR combination of all incoming control signals mapped to the output. Like binary inputs, binary outputs can rather be mapped independently in each connected relay. For example, OUT01 on the SEL-TMU could map to OUT301 of the SEL TiDL Relay connected to SEL-TMU Port 1, OUT307 of the SEL TiDL Relay connected to SEL-TMU

Port 2, OUT405 of the SEL TiDL relay connected to SEL-TMU Port 3, and OUT503 of the SEL TiDL relay connected to SEL-TMU Port 4. In such a case, the output control equation for OUT01 can be considered as:

$$\text{OUT01}_{\text{TMU}} := \text{OUT301}_{\text{Relay 1}} + \text{OUT307}_{\text{Relay 2}} + \text{OUT405}_{\text{Relay 3}} + \text{OUT503}_{\text{Relay 4}}$$

Because any connected SEL TiDL relay can assert an output, the SEL-TMU provides each connected relay with the current SEL-TMU output statuses. The connected relays then map these statuses based on their TiDL topologies to equivalent OUTxxxS Relay Word bits.

Binary Output Holdover State

If the SEL-TMU loses communications with a connected and commissioned SEL TiDL relay, the SEL-TMU holds the last incoming control signal for that relay for 40 milliseconds. At which point, the control signal defaults to zero in the apparent control equation.

TiDL Communications

The SEL-TMU connects to an SEL TiDL relay over a fiber-optic cable. The SEL-TMU and the TiDL relay support LC connectors only on TiDL communications ports. The correct orientation of installed Tx and Rx fiber leads can be observed on either the SEL-TMU front panel or the SEL TiDL relay TiDL Communications Board (TCB).

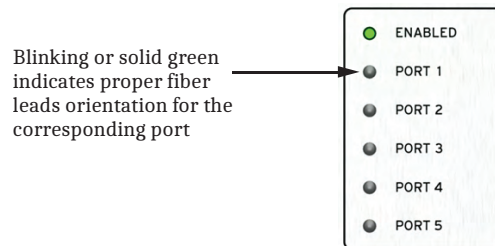


Figure 6 SEL-TMU Proper TiDL Communication Link Indication

See *Table 4* for further troubleshooting.

Wiring Insulation

CAUTION

Insufficiently rated insulation can deteriorate under abnormal operating conditions and cause equipment damage. For external circuits, use wiring of sufficiently rated insulation that will not break down under abnormal operating conditions.

When connecting to the SEL-TMU, refer to your company plan for wire routing and wire-gauge coordination. Be sure to use wire that is appropriate for your installation with an insulation rating of at least 194°F, 90°C.

SEL-TMU Safety Symbols

There are important safety symbols on the SEL-TMU (see *Safety Symbols* on page 2). Observe proper safety precautions when you connect the SEL-TMU at terminals marked by these symbols.

Grounding

For grounding, connect the provided grounding screw, labeled **GND**, to a rack frame ground, equipment ground, or main station ground for proper safety and performance. Follow your local wiring requirements for connecting to an SEL-TMU.

Power Connections

The power supply Euro-style connector is identified on the side panel of the SEL-TMU. See *Specifications* on page 19 for power supply requirements.

Follow your local wiring requirements for connecting to an SEL-TMU. Requirements commonly include a protective overcurrent device that breaks only the hot and neutral connection but not the grounding (bonding) connection. If the neutral connection is a ground conductor, a protective overcurrent device is commonly not required and should only be used if the neutral and hot conductors are switched in the same manner simultaneously.

Typical local wiring requirements also include coordinating the sizing of your protective overcurrent device, supply conductors, and grounding (bonding) wiring. A 15 A molded case circuit breaker is suitable for installations where the grounding wire is sized sufficiently for the application and is equivalent to the 14 AWG copper wire minimum supported size on the SEL-TMU grounding connection. In cases where the grounding wire size is greater than a 14 AWG copper wire equivalent, the size of the molded case circuit breaker shall be sized appropriately.

AC/DC Connection Diagrams

Figure 7 and *Figure 8* show the front overlays for the available variants of the SEL-TMU. *Figure 9* and *Figure 10* provide typical ac/dc connection diagrams for the available variants of the SEL-TMU (4CT/4PT or 8CT).

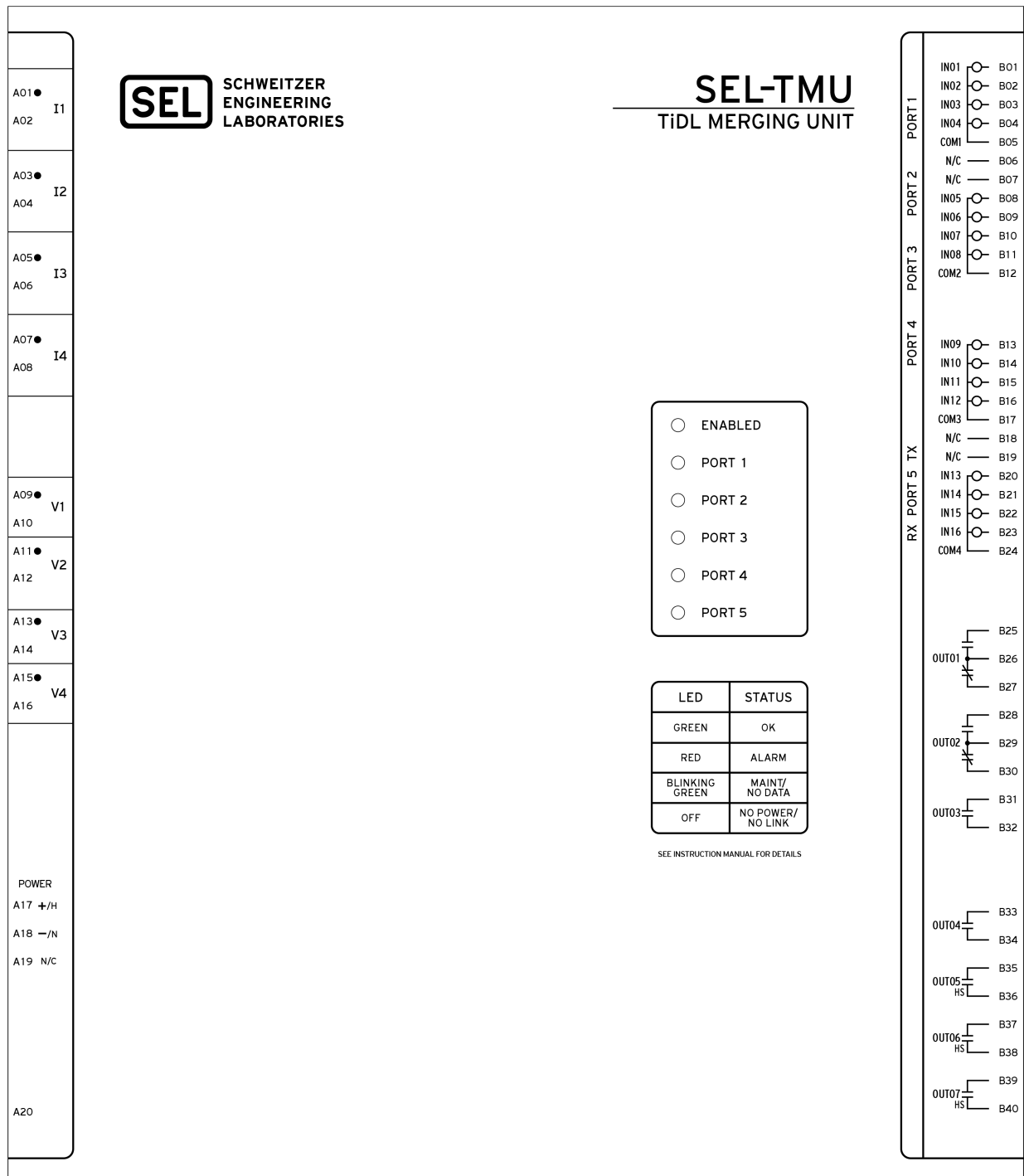


Figure 7 4CT/4PT SEL-TMU Front Panel

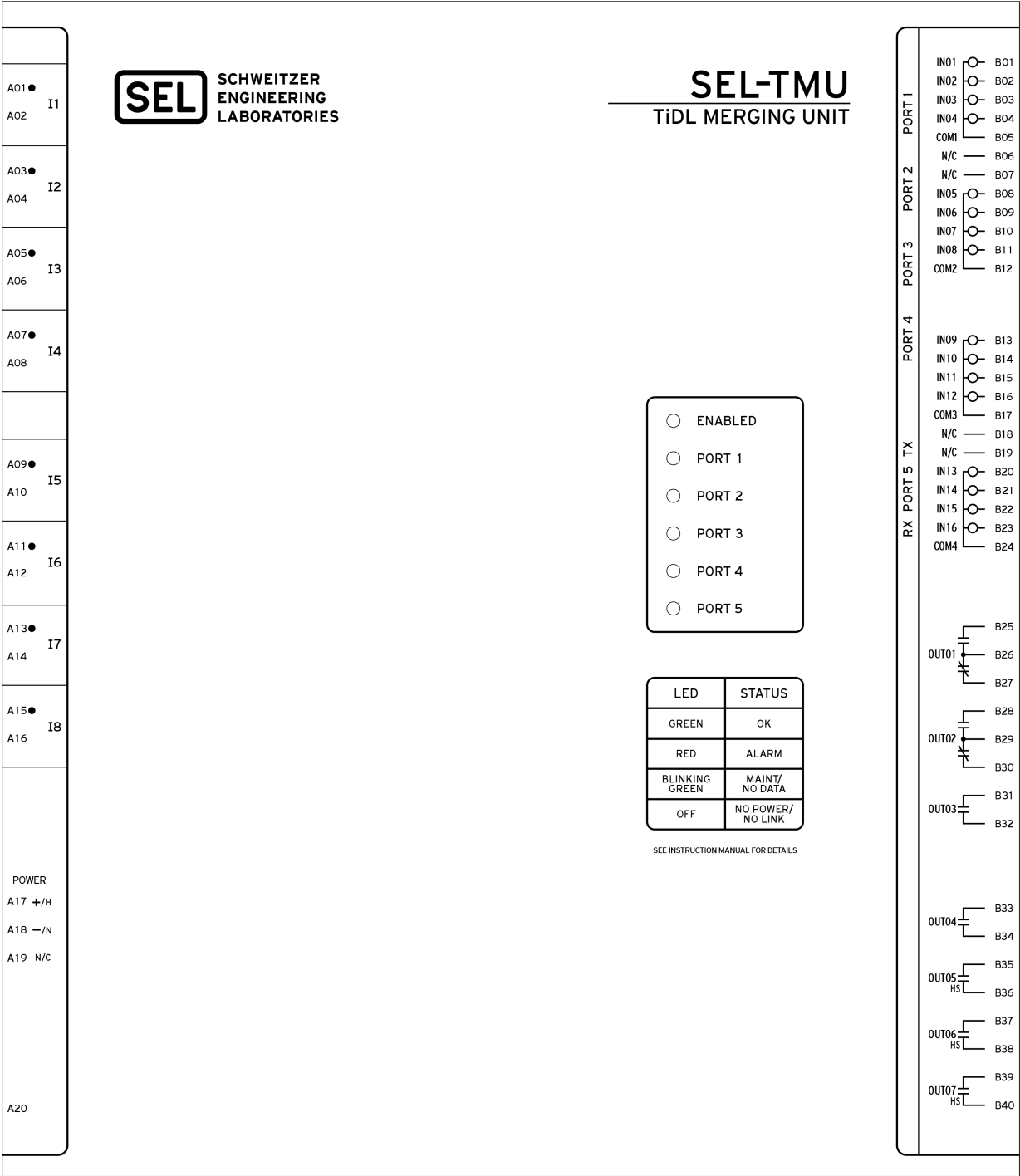


Figure 8 8CT SEL-TMU Front Panel

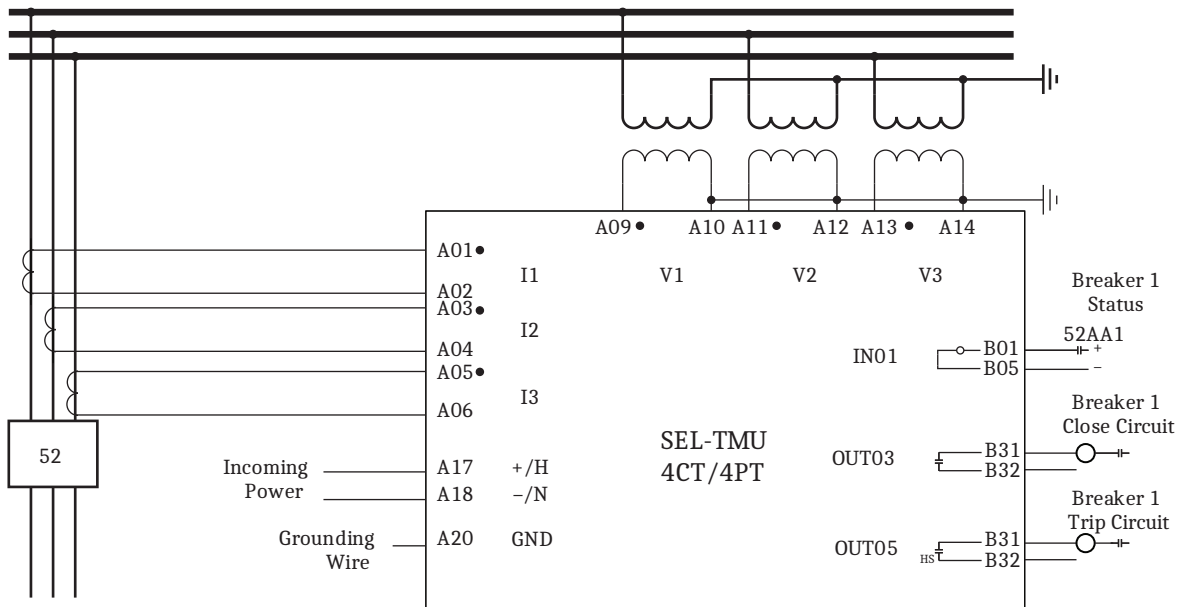


Figure 9 Typical External AC/DC Connections—4CT/4PT SEL-TMU

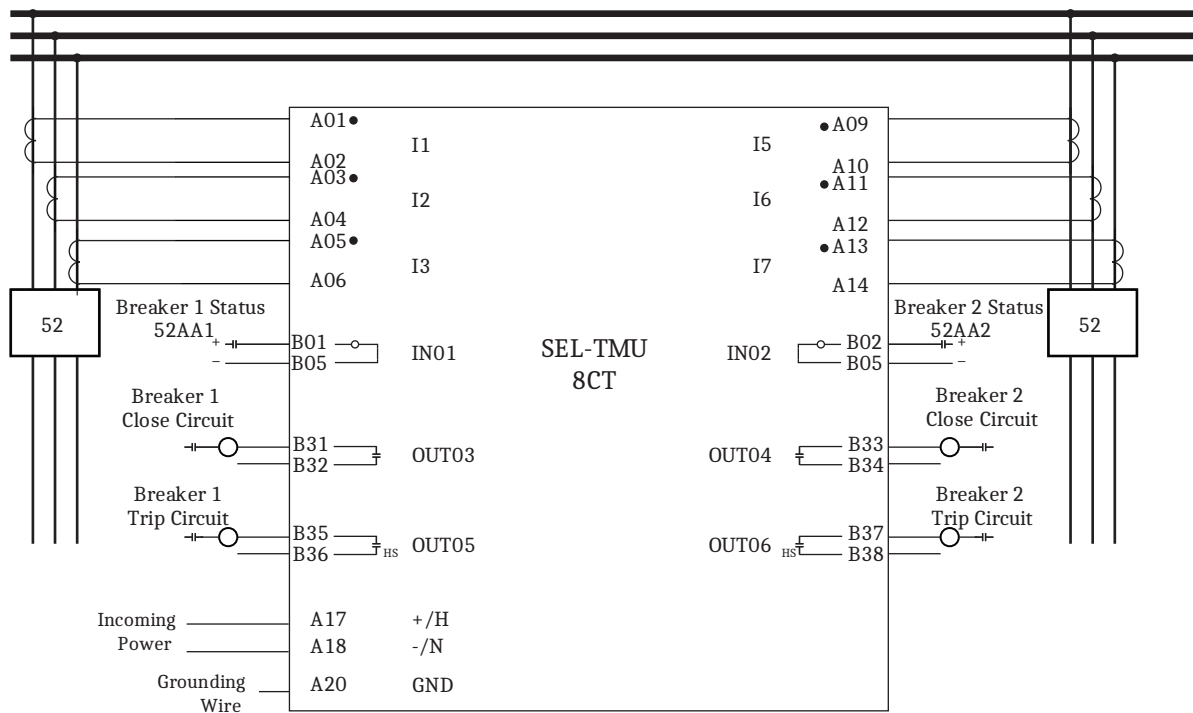


Figure 10 Typical External AC/DC Connections—8CT SEL-TMU

Testing

The SEL-TMU can be tested by creating and commissioning topology in a connected SEL TiDL relay. This section assumes a topology has been created and downloaded to a connected SEL TiDL relay. For more information on configuring and commissioning an SEL TiDL system topology, refer to an SEL TiDL relay instruction manual.

Basic Operational Topology

To test an individual SEL-TMU, configure and commission a basic topology as shown in *Figure 11*. For SEL-TMU devices that support both PT and CT inputs, configure the mapping as shown in *Figure 11(a)*. For SEL-TMU devices that support only CT inputs, configure the mapping as shown in *Figure 11(b)*. To test the remaining inputs of the SEL-TMU not used (such as V4 and I4 in *Figure 11(a)* and I7 and I8 in *Figure 11(b)*), configure and commission a new topology that includes those inputs as mapped quantities.

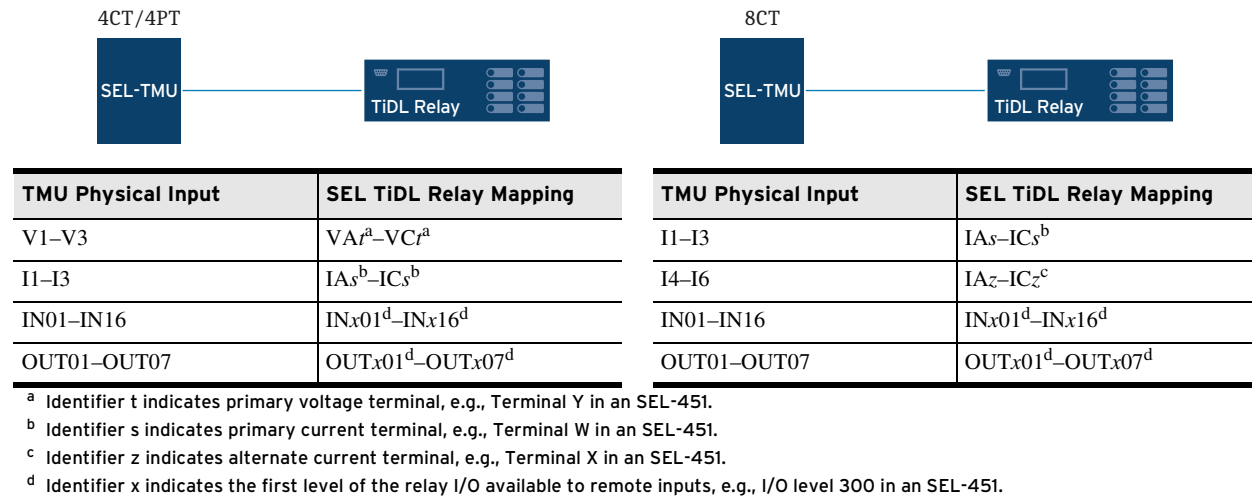


Figure 11 SEL-TMU Topologies

Once one of the topologies from *Figure 11* has been commissioned, connect a signal generator to the SEL-TMU inputs as shown in *Figure 12*.

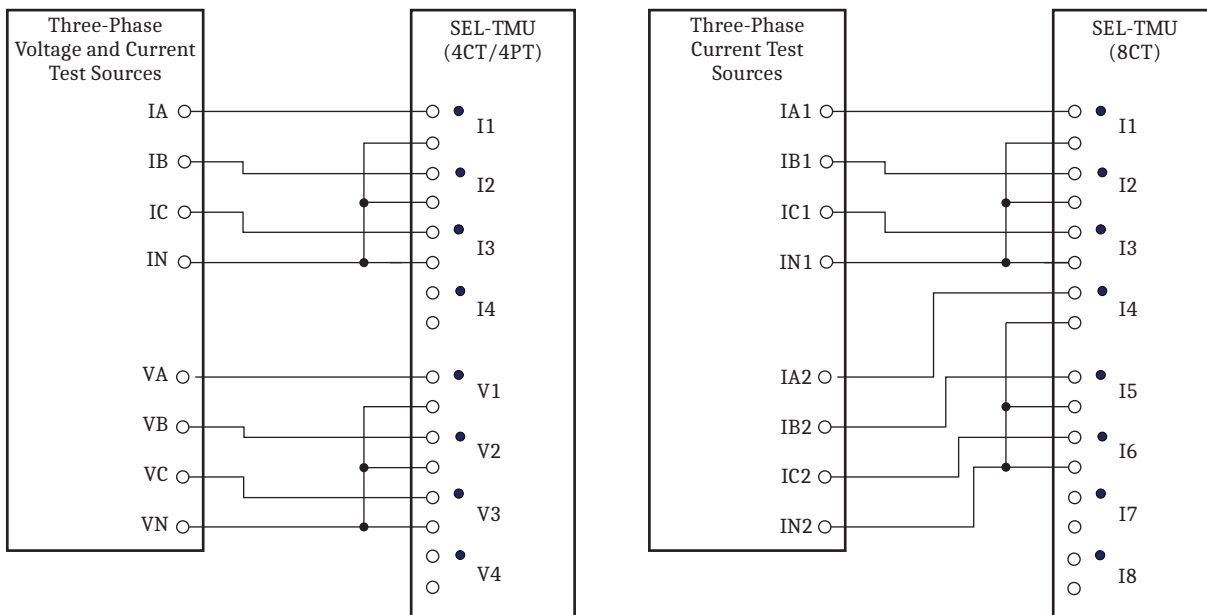


Figure 12 Test Connections for SEL-TMU

Test the SEL-TMU A/D conversion first by injecting current into the I1 terminal. Verify proper mapping and conversion within your connected SEL TiDL relay, then proceed with injecting signals into the other available terminals. Adjust your topology as needed to test all CT/PT inputs.

Binary I/O Testing

To test the binary inputs of the SEL-TMU, inject voltage up to and slightly exceeding the binary input pickup level as set in the SEL TiDL relay, and verify the proper pickup of the input in the connected SEL TiDL relay. After verifying proper pickup, decrease the injected voltage to slightly less than the expected dropout level as set in the connected relay and verify proper dropout of the input.

Test the binary outputs of the SEL-TMU by issuing output command signals from the connected SEL TiDL relay. See the instruction manual of the SEL TiDL relay for further instructions on how to assert outputs (OUT:xxx settings, **PUL** command, etc.).

Troubleshooting

The SEL-TMU provides robust self-monitoring to detect an out-of-tolerance condition within the SEL-TMU. If an out-of-tolerance condition occurs, the SEL-TMU takes appropriate action, then alerts connected relays of the observed condition.

The SEL-TMU diagnostics are designed to maximize the availability of the SEL-TMU in your TiDL system.

The following provides instructions on how to troubleshoot the SEL-TMU:

- *SEL-TMU Front-Panel LEDs* on page 17
- *Observing SEL-TMU Status* on page 18

SEL-TMU Front-Panel LEDs

The SEL-TMU front panel provides six status LEDs, as shown in *Figure 13*.

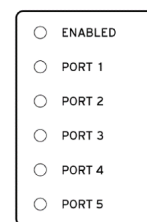


Figure 13 SEL-TMU Front-Panel LEDs

Table 4 provides an indication of the LED status and the state of the SEL-TMU.

Table 4 SEL-TMU Front-Panel LEDs and Descriptions

LED Color and State	Enabled LED	TiDL Port LED (Ports 1-4)	Serial Port (Port 5)
Solid Green	The SEL-TMU is enabled and operating properly.	The port is connected and sending and receiving data.	Reserved for future use
Blinking Green	SEL-TMU is currently upgrading.	The port is connected but not receiving data.	Reserved for future use
Solid Red	The SEL-TMU is disabled (as a result of an out-of-tolerance condition (see <i>Observing SEL-TMU Status</i> on page 18)) or is finishing upgrading, which typically takes less than 4 minutes.	The port is connected but was not able to establish communications with connected device (contact SEL Technical Support should this occur). This could be caused by incorrect SFP authentication or an internal port error.	Reserved for future use
Off	The SEL-TMU does not have power (all LEDs are off).	The port is not connected or the SEL-TMU does not have power (all LEDs off).	Expected behavior

Observing SEL-TMU Status

The SEL-TMU status is observed through a connected SEL TiDL relay.

If an out-of-tolerance condition occurs, the SEL-TMU alerts the connected SEL TiDL relays. Then the connected relays log the relevant diagnostics for the condition.

Retrieve SEL-TMU status and diagnostic information via a connected SEL TiDL relay (see the corresponding SEL TiDL relay instruction manual for instructions), then contact SEL Technical Support or your local SEL application engineer for further direction:

Tel: +1.509.338.3838
 Fax: +1.509.332.7990
 Internet: selinc.com/support
 Email: info@selinc.com

Specifications

AC Analog Inputs

General

Parameter	Value
Sampling Rate	10 kHz
Signal Bandwidth	2.5 kHz

AC Current Inputs

Parameter	Value
Rated Current (Inom)	1 A/5 A
Continuous Thermal Rating	20 Arms
One-Second Thermal Rating	500 Arms
Rated Frequency	50/60 Hz
Operational Frequency Range	40–65 Hz
Burden Rating	≤ 0.1 VA at 1 A at rated frequency
ADC Current Limit	400 Arms
ADC Resolution	24-bit

AC Voltage Inputs

Parameter	Value
Rated Voltage Range (Vnom)	57.7–250 Vrms LN
Operational Voltage Range	0–300 Vrms LN
Ten-Second Thermal Rating	600 Vrms
Rated Frequency	50/60 Hz
Operational Frequency Range	40–65 Hz
Burden Rating	≤ 0.1 VA at 120 V at rated frequency
ADC Voltage Limit	305 Vrms
ADC Resolution	16-bit

Binary Inputs

Parameter	Value
Sampling Rate	10 kHz
Rated Voltage Range	24–250 Vdc
Operational Voltage Range	0–300 Vdc
Assertion/Deassertion Threshold Range ^a	16–250 Vdc
Assertion/Deassertion Setting Threshold Accuracy	±5% of setting ^a ±2 V
Current Draw	0.5–4 mA (for threshold setting range ^a)
Burden	≤ 0.6 W (for rated voltage range)

^a Assertion/deassertion threshold settings are set in the connected TiDL relays.

Binary Outputs

General

Parameter	Value
Update Rate	≤ 2 ms
Rated Voltage Range	24–250 Vdc
Operational Voltage Range	0–300 Vdc
Mechanical Durability	10,000 no-load operations

Parameter	Value
Continuous Contact Current	5 A 4 A at 85 °C
Open State Leakage Current	≤ 30 µA

Standard Form A and Form C Binary Outputs

Parameter	Value
Operating Time (Resistive Load)	Pickup: ≤ 6 ms
	Dropout: ≤ 6 ms
Make ^{a, b} (Short Duration Contact Current)	30 A at 250 Vdc 2,000 operations
Limiting Making Capacity ^b	1000 W at 250 Vdc (L/R = 40 ms) 2000 operations
Limiting Breaking Capacity ^{a, b}	50 W (L/R = 40 ms) for rated voltage range 10,000 operations 10 operations in 4 s followed by 2 min idle
Short-Time Thermal Withstand ^d	50 A for 1 second
Contact Rating in Accordance With UL Certification	R300 ^c

^a According to IEEE C37.90-2005

^b According to IEC 60255-27:2013

^c According to UL-508

High-Speed High-Current Interrupting Binary Outputs

Parameter	Value
Operating Time (Resistive Load)	Pickup ≤ 10 µs
	Dropout ≤ 6 ms
Make ^{a, b} (Short Duration Contact Current)	30 A at 250 Vdc 2,000 operations
Limiting Making Capacity ^b	1000 W at 250 Vdc (L/R = 40 ms) 2,000 operations
Limiting Breaking Capacity ^{a, b}	1250 W for rated voltage range (L/R = 40 ms) 10,000 operations 4 operations in 1 s followed by 2 min idle
Short-Time Thermal Withstand ^a	50 A for 1 s

^a According to IEEE C37.90-2005

^b According to IEC 60255-27:2013

Power Supply

General

Parameter	Value	
Rated Voltage Range	48–250 Vdc / 100–240 Vrms	
Operational Voltage Range	38–300 Vdc / 80–264 Vrms	
Rated Frequency	50/60 Hz	
Operational Frequency Range	45–65 Hz	
Burden Rating	≤ 25 W/ 70 VA for rated voltage range	
Vdc Input Ripple	15% of applied rated dc voltage	
Interruption/Ride-Through (20 W Burden)	48 Vdc	≥ 1 s
	125 Vdc	
	250 Vdc	

Fuse

Parameter	Value
Rated Current	5.0 A
Max Rated Voltage	350 Vac / 450 Vdc
Rupture Speed	Time-lag

TiDL Communications Ports

Parameter	Value
Number of Ports	4
Protocol	T-Protocol
Supported SFP Transceivers	SEL-8103-01

SEL-8103-01

Parameter	Value
Connector Type	LC
Supported Fiber Types	OM1 (62.5/125 µm) OM3 (50/125 µm)
Wavelength	1310 nm
Link Budget	≥ 9 dB
Approximate Range	2 km

Note: The SEL-C808 Fiber-Optic Cable complies with the SEL-8103-01 Ethernet SFP requirements.

Compliance

Designed and manufactured under an ISO 9001 certified quality management system

FCC Compliance Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference in which case the user will be required to correct the interference at his own expense.

UL Listed to U.S. and Canadian safety standards
(File E212775; NRGU, NRGU7)

CE Mark

Environmental Operating Parameters

Parameter	Value
Operating Temperature	–40° to +85°C (–40° to +185°F)
Humidity	5% to 95% noncondensing
Altitude	≤ 2000 m
Weight	10 lb
IP Rating	IP4X for front, top, and back of chassis IP2X for sides (terminals) IP1X for terminal blocks
Pollution Degree	2
Overvoltage Category	III
Insulation Class	I

Measurement Accuracy**AC Current Inputs**

Parameter	Condition	Value
Magnitude Accuracy	(0.05 – 4.00) • Inom	±0.2% or ±0.002 • Inom (whichever is larger)
Phase Accuracy	(0.20 – 4.00) • Inom	±0.2°
	(0.05 – 0.20) • Inom	±1°

Note: Measurement accuracies assume 20°C temperature and one-second averaged data at tracked rated frequency.

Type Tests

EMC

Product Standards	IEC 60255-26:2013 IEEE C37.90-2005			
Test	Methodology	Level		
Emissions	CISPR 11/22/32 47 CFR Part 15B Canada ICES-001 (A) / NMB-001 (A)	Class A		
Harmonics	IEC 61000-3-2	Meets applicable limits		
Flicker	IEC 61000-3-3	Meets applicable limits		
Radiated RF Immunity	IEC 61000-4-3 IEEE C37.90.2	Frequency (MHz)	Field Strength	Modulation
		80–3000	20 V/m	AM 80% 1 kHz sine
		380/1600/1800/1850/2150/ 2600/3500/3800/5000	10 V/m	AM 80% 1kHz sine
		80/160/450/900	20 V/m	AM 80% 1 kHz sine
		900	20 V/m	Pulse Mod. 50%
Conducted RF Immunity	IEC 61000-4-6	150 kHz–80 MHz, 1 kHz 80% AM 10 Vrms		
		Spot Frequencies	27 MHz and 68 MHz	
Electrostatic Discharge	IEC 61000-4-2 IEEE C37.90.3	Contact Discharge	±2, 4, 6, 8 kV	
		Air Discharge	±2, 4, 8, 15 kV	
Electrical Fast Transient Burst	IEC 61000-4-4 IEEE C37.90.1	Port Type	Level	
		Power	±4 kV at 5 kHz	
		Input/Output	±4 kV at 5 kHz and 2.5 kHz	
		Functional Earth	±4 kV at 5 kHz	
Surge Immunity	IEC 61000-4-5	Port Type	Level	
		Power	±0.5, 1, 2 kV LL ±0.5, 1, 2, 4 kV LE	
		Input/Output	±0.5, 1, 2 kV LL ±0.5, 1, 2, 4 kV LE	
Damped Oscillatory Wave Immunity	IEC 61000-4-18 IEEE C37.90.1	Port Type	Level	
		Power	±2.5 kV common ±2.5 kV differential	
		Input	±2.5 kV common ±1 kV differential	
		Output	±2.5 kV differential	
Power Frequency Immunity	IEC 60255-26 IEC 61000-4-16	Port Type	Level	
		Binary Input	300 Vrms common 150 Vrms differential	
Power Frequency Magnetic Field Immunity	IEC 61000-4-8	100 A/m 60 seconds 1000 A/m 3 seconds		
Pulse Magnetic Field Immunity	IEC 61000-4-9	1000 A/m, Level 5		
Damped Oscillatory Magnetic Field Immunity	IEC 61000-4-16	100 A/m, Level 5		
Startup and Shutdown	IEC 60255-26	60 second ramp / 5 minute power off		

Environmental

Standard	IEC 60255-27:2014		
Test	Methodology	Level	
Cold	IEC 60255-1 IEC 60068-2-1	Test Type	Level
		Operational	Test Ad: 16 hours at -40°C
		Storage	Test Ab: 16 hours at -40°C
Dry Heat	IEC 60255-1 IEC 60068-2-2	Test Type	Level
		Operational	Test Bd: 16 hours at +85°C
		Storage	Test Bb: 16 hours at +85°C
Cyclic Temperature	IEC 60255-1 IEC 60068-2-14	Operational	Test Db: -40°C to +85°C, 5 cycles
Damp Heat	IEC 60255-1 IEC 60068-2-78 IEC 60068-2-30	Test Type	Level
		Steady State	Test Cab: 93% relative humidity, +40°C, 10 days
		Cyclic	Test Db: +25°C to +55°C, 6 cycles, (12 + 12-hour cycle), 95% relative humidity
Object Penetration	IEC 60529	Location	Level
		Front, Top, Back (Enclosure)	IP4X
		Sides (Terminals)	IP2X
		Terminal Block	IP1X
Vibration	IEC 60255-21-1	Class 2 Endurance, Class 2 Response	
Shock/Bump	IEC 60255-21-2	Test Type	Level
		Shock	Class 1 Withstand, Class 2 Response
		Bump	Class 1
Seismic	IEC 60255-21-3	Class 2 Quake Response	

Safety

Product Standards	IEC 60255-27:2014 IEEE C37.90 2005 UL-508 17th Edition		
Test	Methodology	Level	
Dielectric Strength	IEC 60255-27 IEEE C37.90 UL-508	Port Type	Level
		Power	3.6 kVdc
		Input/Output	2.5 kVrms
Impulse	IEC 60255-27 IEEE C37.90 UL-508	Port Type	Level
		Power	5 kV
		Input/Output	
Insulation Resistance	IEC 60255-27 UL-508	Meets applicable levels	
Flammability of Insulating Materials	IEC 60255-27 UL-508	Meets applicable levels	
Maximum Temperature of Parts and Materials	IEC 60255-27 UL-508	Meets applicable levels, normal use	
Protective Bonding/Continuity	IEC 60255-27 UL-508	Meets applicable levels	
Laser Safety	IEC 60825-1 21 CFR 1040.10	Meets applicable levels	

Appendix A: Manual Versions

Instruction Manual

The date code at the bottom of each page of this manual reflects the creation or revision date.

Table 5 lists the instruction manual versions and revision descriptions. The most recent instruction manual version is listed first.

Table 5 Instruction Manual Revision History

Date Code	Summary of Revisions
20230417	► Updated <i>Specifications</i> .
20210714	► Updated <i>Specifications</i> .
20210209	► Updated <i>Specifications</i> .
20201204	► Initial version.

Appendix B: SEL-TMU Upgrades

The SEL-TMU is upgraded as a part of a centrally controlled upgrade process in connected SEL TiDL relays. For further information on the centrally controlled upgrade process, see the instruction manual of the connected SEL TiDL relays.

Technical Support

We appreciate your interest in SEL products and services. If you have questions or comments, please contact us at:

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This product is covered by the standard SEL 10-year warranty. For warranty details, visit selinc.com or contact your customer service representative.

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