

# SEL-2600 RTD Module

## Instruction Manual



AC Voltage Powered Model



DC Voltage Powered Model

20200803

**SEL** SCHWEITZER ENGINEERING LABORATORIES, INC.

\*PM2600-01\*

© 2015–2020 by Schweitzer Engineering Laboratories, Inc. All rights reserved.

All brand or product names appearing in this document are the trademark or registered trademark of their respective holders. No SEL trademarks may be used without written permission. SEL products appearing in this document may be covered by U.S. and Foreign patents.

Schweitzer Engineering Laboratories, Inc. reserves all rights and benefits afforded under federal and international copyright and patent laws in its products, including without limitation software, firmware, and documentation.

The information in this document is provided for informational use only and is subject to change without notice. Schweitzer Engineering Laboratories, Inc. has approved only the English language document.

This product is covered by the standard SEL 10-year warranty. For warranty details, visit [www.selinc.com](http://www.selinc.com) or contact your customer service representative.

PM2600-01

# Table of Contents

---

List of Tables .....	iii
List of Figures .....	v
Preface .....	vii
Safety Information .....	vii
Technical Assistance .....	xi
<b>Section 1: Introduction and Specifications</b>	
Major Features and Benefits .....	1.1
Ordering Options .....	1.2
Specifications .....	1.3
<b>Section 2: Installation</b>	
Initial Checkout .....	2.1
Installation .....	2.2
<b>Section 3: Applications</b>	
Applications With SEL-300 Series Relays .....	3.1
Applications With SEL-400 Series Relays .....	3.1
Applications With SEL-700 Series Relays .....	3.2
Application With SEL-701 Motor Protection Relay .....	3.5
Application With SEL-749M Motor Protection Relay .....	3.5
Applications With SEL-2400 Series Relays .....	3.5
Applications With SEL Communications Processors .....	3.6
Data Packet Definition .....	3.10
SEL-2600 Guideform Specification .....	3.11
<b>Appendix A: Manual Versions</b>	

**This page intentionally left blank**

# List of Tables

---

Table 1.1	Product Compatibility Guide .....	1.2
Table 2.1	RTD Type and Location Worksheet .....	2.6
Table 3.1	RTD Resistance (Ohms) Versus Temperature .....	3.4
Table 3.2	SEL-2030/SEL-2032 Communications Processor Memory Map .....	3.9
Table 3.3	SEL-2600 RTD Module Data Packet Definition .....	3.10
Table A.1	Instruction Manual Revision History .....	A.1

**This page intentionally left blank**

# List of Figures

---

Figure 2.1	SEL-2600A Wiring Diagram .....	2.3
Figure 2.2	SEL-2600D Wiring Diagram .....	2.4
Figure 2.3	Dimension Diagram .....	2.6
Figure 3.1	Generator Protection With the SEL-300G .....	3.1
Figure 3.2	Transmission Line Protection With the SEL-421.....	3.2
Figure 3.3	Motor Protection With the SEL-710 .....	3.3
Figure 3.4	Motor Protection With the SEL-701 .....	3.5
Figure 3.5	Motor Protection With the SEL-749M.....	3.5
Figure 3.6	Transformer Monitor and Cooling System Control .....	3.6
Figure 3.7	Motor Protection With the SEL-501 .....	3.7
Figure 3.8	Transformer Protection With the SEL-587, SEL-387-0, SEL-387-5, SEL-387-6, or SEL-387A.....	3.7

**This page intentionally left blank**



# Preface

## Safety Information

### 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.

## 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.

	 <b>CAUTION</b> Refer to accompanying documents.	 <b>ATTENTION</b> 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

For use in Pollution Degree 3 environment.	Pour l'utilisation dans un environnement de Degré de Pollution 3.
The enclosure must have a door or cover accessible only by the use of a tool.	L'enceinte doit avoir une porte ou un couvercle accessible seulement par l'utilisation d'un outil.
Transient protection shall be provided at the power supply terminals to the equipment that is set at a level not exceeding 140% of the peak rated voltage.	La protection contre les transitoires sera fournie, au niveau des bornes d'alimentation, aux équipements qui sont réglés pour une tension ne dépassant pas 140% de la valeur nominale crête.
Ambient air temperature shall not exceed 40°C (104°F).	La température de l'air ambiant ne doit pas dépasser 50°C (122°F).
For use on a flat surface of a Type 12 enclosure.	Destiné à l'utilisation sur une surface plane d'un boîtier de Type 12.
<b>Terminal Ratings</b> <b>Wire Material</b> Use 90°C (194°F), or higher, copper conductors only.  <b>Tightening Torque</b> Power Terminal Block: 0.5–1.0 Nm (4.4–8.8 in-lb) RTD Input Terminal Block: 0.5–0.79 Nm (4.4–7.0 in-lb)	<b>Spécifications des bornes</b> <b>Type de filage</b> Utiliser seulement des conducteurs en cuivre spécifiés à 90°C (194°F), ou plus.  <b>Couple de serrage</b> Bornes d'alimentation : 0,5 à 1,0 Nm (4,4 à 8,8 in-lb) Bornes pour entrées de type RTD : 0,5 à 0,79 Nm (4,4 à 7,0 in-lb)

### Hazardous Locations Safety Marks

 <b>WARNING - EXPLOSION HAZARD</b> Open circuit before removing cover. Substitution of components may impair suitability for Class I, Division 2.	 <b>AVERTISSEMENT - DANGER D'EXPLOSION</b> Ouvrir le circuit avant de déposer le couvercle. La substitution de composants peut détériorer la conformité à Classe I, Division 2.
 <b>WARNING</b> Do not remove or replace fuse when energized.	 <b>AVERTISSEMENT</b> Ne pas retirer ou remplacer le fusible quand il est excité.
Operating Temperature Range: –40°C to +85°C (–40°F to +185°F)	Plage de température de fonctionnement : –40°C à +85°C (–40°F à +185°F)
Hazardous Locations Operating Temperature Range: –40°C to +40°C (–40°F to +104°F) for the SEL-2600A model –40°C to +85°C (–40°F to +185°F) for the SEL-2600D model	Emplacements Plage de température de fonctionnement d'emplacements dangereux : –40°C à +40°C (–40°F à +104°F) pour le modèle SEL-2600A –40°C à +85°C (–40°F à +185°F) pour le modèle SEL-2600D
These devices shall be mounted in an ATEX certified enclosure with a minimum ingress protection of at least IP54 as defined in EN 60079-0.	Ces dispositifs doivent être montés dans un boîtier certifié ATEX avec un minimum de protection d'entrée d'au moins IP54 tel que défini dans la norme EN 60079-0.

## Hazardous Locations Approvals

The SEL-2600 is UL certified for hazardous locations to Canadian and U.S. standards. In North America, the device is approved for Class I, Division 2, Groups A, B, C, D, and T4 in the –40°C to +40°C temperature range for the SEL-2600A model and –40°C to +85°C for the SEL-2600D model.

The SEL-2600 shall be installed in an indoor or outdoor (extended) tool-accessible enclosure that provides a degree of protection to personnel against access to hazardous parts. In either environment, the relay shall be protected from direct sunlight, precipitation, and full wind pressure.

The compliance labels for the SEL-2600A and SEL-2600D are located on the bottom of the device.

To comply with the requirements of the European ATEX standard for hazardous locations, the SEL-2600 shall be installed in an ATEX certified enclosure with a tool-removable door or cover that provides a degree of protection not less than IP 54, in accordance with EN 60079-0. The enclosure should be certified to these requirements or be tested for compliance as part of the complete assembly. The enclosure must be marked  
“WARNING—do not open when an explosive atmosphere is present.”

#### Other Safety Marks (Sheet 1 of 2)

<p><b>⚠ DANGER</b> Disconnect or de-energize all external connections before opening this device. Contact with hazardous voltages and currents inside this device can cause electrical shock resulting in injury or death.</p>	<p><b>⚠ DANGER</b> Débrancher tous les raccordements externes avant d'ouvrir cet appareil. Tout contact avec des tensions ou courants internes à l'appareil peut causer un choc électrique pouvant entraîner des blessures ou la mort.</p>
<p><b>⚠ DANGER</b> Contact with instrument terminals may cause electrical shock which can result in injury or death.</p>	<p><b>⚠ DANGER</b> Tout contact avec les bornes de raccordement de l'appareil peut causer un choc électrique pouvant entraîner des blessures ou la mort.</p>
<p><b>⚠ WARNING</b> 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.</p>	<p><b>⚠ AVERTISSEMENT</b> Seules des personnes qualifiées peuvent travailler sur cet appareil. Si vous n'êtes pas qualifiés pour ce travail, vous pourriez vous blesser avec d'autres personnes ou endommager l'équipement.</p>
<p><b>⚠ CAUTION</b> Use of this equipment in a manner other than specified in this manual can impair operator safety safeguards provided by this equipment.</p>	<p><b>⚠ ATTENTION</b> 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.</p>
<p><b>⚠ CAUTION</b> Class 1 Laser Product. Looking into optical connections, fiber-ends, or bulkhead connections can result in hazardous radiation exposure.</p>	<p><b>⚠ ATTENTION</b> Produit Diode électroluminescente de Classe 1. Regarder vers les connecteurs optiques, les extrémités des fibres ou les connecteurs de cloison peut entraîner une exposition à des rayonnements dangereux.</p>
<p><b>⚠ CAUTION</b> Do not connect external voltages to the contact input. Permanent damage to the product or external equipment can result from connecting external voltages to a contact input because the contact input is internally wetted.</p>	<p><b>⚠ ATTENTION</b> Ne pas raccorder de tensions externes sur les bornes des entrées de contact. Parce que les contacts sont trempés au mercure des dommages permanents peuvent résulter pour le relais ou l'équipement externe à la suite du raccordement d'une tension externe à une entrée de contact du relais.</p>
<p><b>⚠ WARNING</b> During installation, maintenance, or testing of the optical ports, use only test equipment qualified for Class 1 laser products.</p>	<p><b>⚠ AVERTISSEMENT</b> 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.</p>
<p><b>⚠ WARNING</b> Overtightening the mounting nuts may permanently damage the relay chassis.</p>	<p><b>⚠ AVERTISSEMENT</b> Une pression excessive sur les écrous de montage peut endommager de façon permanente le châssis du relais.</p>
<p><b>⚠ CAUTION</b> Equipment components are sensitive to electrostatic discharge (ESD). Undetectable permanent damage can result if you do not use proper ESD procedures. Ground yourself, your work surface, and this equipment before removing any cover from this equipment. If your facility is not equipped to work with these components, contact SEL about returning this device and related SEL equipment for service.</p>	<p><b>⚠ ATTENTION</b> Les composants de cet équipement sont sensibles aux décharges électrostatiques (DES). Des dommages permanents non-décelables peuvent résulter de l'absence de précautions contre les DES. Raccordez-vous correctement à la terre, ainsi que la surface de travail et l'appareil avant d'en retirer un panneau. Si vous n'êtes pas équipés pour travailler avec ce type de composants, contacter SEL afin de retourner l'appareil pour un service en usine.</p>
<p><b>⚠ CAUTION</b> Looking into optical connections, fiber ends, or bulkhead connections can result in hazardous radiation exposure.</p>	<p><b>⚠ ATTENTION</b> Regarder vers les connecteurs optiques, les extrémités des fibres ou les connecteurs de cloison peut entraîner une exposition à des rayonnements dangereux.</p>

## Other Safety Marks (Sheet 2 of 2)

<b>CAUTION</b> Use of controls or adjustments, or performance of procedures other than those specified herein, may result in hazardous radiation exposure.	<b>ATTENTION</b> L'utilisation de commandes ou de réglages, ou l'application de tests de fonctionnement différents de ceux décrits ci-après peuvent entraîner l'exposition à des radiations dangereuses.
<b>CAUTION</b> Do not connect power to the relay until you have completed these procedures and receive instruction to apply power. Equipment damage can result otherwise.	<b>ATTENTION</b> 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.

## LED Emitter

The following table shows *Tx* LED information specific to the SEL-2600.

### SEL-2600 LED Information

<b>CAUTION</b> Looking into optical connections, fiber ends, or bulkhead connections can result in hazardous radiation exposure.
<b>CAUTION</b> Use of controls, adjustments, or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Item	SEL-2600nn0x	SEL-2600nn1x
Mode	Multimode	Multimode
Wavelength	650 nm	820 nm
Source	LED	LED
Connector type	V-Pin	ST
Typical output power	−12 dBm	−16 dBm

### LED Safety Warnings and Precautions

- Do not look into the end of an optical cable connected to an optical output.
- Do not look into the fiber ports/connectors.
- Do not perform any procedures or adjustments that are not described in this manual.
- During installation, maintenance, or testing of the optical ports, only use equipment classified as Class 1 laser products.

## Environmental Conditions and Voltage Information

The following table lists important environmental and voltage information.

Condition	Range/Description
Indoor/outdoor use	Indoor
Altitude <sup>a</sup>	To 2000 m
Temperature	
IEC Performance Rating (per IEC/EN 60068-2-1 and IEC/EN 60068-2-2)	−40° to +85°C
Relative humidity	5% to 95%
Main supply voltage fluctuations	±10% of nominal voltage
Overvoltage	Category II
Pollution	Degree 3
Atmospheric pressure	80 to 110 kPa

<sup>a</sup> Consult with the factory for derating specifications for higher altitude applications.

## Wire Sizes and Insulation

Wire sizes for grounding (earthing), current, voltage, and contact connections are dictated by the terminal blocks and expected load currents. You can use the following table as a guide in selecting wire sizes.

Connection Type	Wire Size		Insulation Voltage
	Minimum	Maximum	
Grounding (Earthing)	18 AWG (0.8 mm <sup>2</sup> )	14 AWG (2.1 mm <sup>2</sup> )	300 V min
Power	18 AWG (0.8 mm <sup>2</sup> )	14 AWG (2.1 mm <sup>2</sup> )	300 V min
Contact I/O <sup>a</sup>	18 AWG (0.8 mm <sup>2</sup> )	14 AWG (2.1 mm <sup>2</sup> )	300 V min
RTD <sup>b</sup>	28 AWG (0.08 mm <sup>2</sup> )	16 AWG (1.30 mm <sup>2</sup> )	300 V min

<sup>a</sup> Input cables (non-fiber) lengths assumed to be <10 m.

<sup>b</sup> See *RTD Wiring* for maximum RTD lead lengths.

## RTD Wiring

The following table shows the maximum cable lengths for the RTD connections.

RTD Lead AWG	Maximum Length (meters)
28	116 m
26	184 m
24	290 m
22	455 m
20	730 m
18	1155 m
16	1848 m

**NOTE:** RTD inputs are not internally protected for electrical surges (IEC 60255-22-1 and IEC 60255-22-5). External protection is recommended if surge protection is necessary.

## Field Serviceability

The SEL-2600 does not have any field-serviceable parts. Return a faulty or failed device to the factory for repair or replacement.

## Technical Assistance

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

Schweitzer Engineering Laboratories, Inc.  
2350 NE Hopkins Court  
Pullman, WA 99163-5603 U.S.A.  
Tel: +1.509.332.1890  
Fax: +1.509.332.7990  
Internet: [www.selinc.com](http://www.selinc.com)  
Email: [info@selinc.com](mailto:info@selinc.com)

**This page intentionally left blank**

# Section 1

## Introduction and Specifications

---

Use the SEL-2600 RTD (resistance temperature detector) Module to transmit 12 RTD-based temperature measurements and a single input contact status as far as 500 meters with V-pin connectors or 1000 meters with ST® connectors using inexpensive fiber-optic cable.

The SEL-2600 provides superior RTD noise immunity (as high as 1 Vac rms, 50 Hz or greater). The SEL-2600 RTD Module comes in two variations:

- AC powered SEL-2600A
- DC powered SEL-2600D

## Major Features and Benefits

---

- Selectable fiber-optic connection model options support V-pin or ST connectors.
- Fiber-optic link eliminates expensive cable pulls.
- Improved design provides superior RTD noise immunity.
- LEDs indicate device status, transmit status, and contact input status.
- Measures as many as 12 RTD temperatures plus one contact input with no settings. The device supports the following RTD types:
  - 100-ohm platinum
  - 120-ohm nickel
  - 100-ohm nickel
  - 10-ohm copper
- Power from 120 Vac or 240 Vac (SEL-2600A) or 125 Vdc (SEL-2600D).

**Table 1.1 Product Compatibility Guide**

SEL-2600 Connected to the Fiber-Optic Port on the Relay		SEL-2600 Connected to the EIA-232 <sup>a</sup> or EIA-485 <sup>b</sup> Port on the Relay
V-Pin Connector Option	ST Connector Option	Both V-Pin and ST Connector Options
SEL-701 Motor Protection Relay	SEL-700G Generator Protection Relay SEL-710 Motor Protection Relay SEL-710-5 Motor Protection Relay SEL-749M Motor Protection Relay SEL-751 Feeder Protection Relay SEL-751A Feeder Protection Relay SEL-787 Transformer Protection Relay SEL-787-2, -3, -4 Transformer Protection Relay SEL-2411 Programmable Automation Controller SEL-2414 Transformer Monitor	SEL-300G Multifunction Generator Relay SEL-352-2, -3 Breaker Failure Relay SEL-387A Current Differential and Overcurrent Relay SEL-387-5, -6 Current Differential and Overcurrent Relay SEL-400G Advanced Generator Protection System SEL-411L Advanced Line Differential Protection, Automation, and Control System SEL-421 Protection, Automation, and Control System SEL-451 Protection, Automation, and Control System SEL-487B Bus Differential and Breaker Failure Relay SEL-487E Transformer Protection Relay SEL-487V Capacitor Protection and Control System SEL-2030 or SEL-2032 Communications Processor SEL-3530 Real-Time Automation Controller (RTAC)

<sup>a</sup> Requires SEL-2812M or SEL-2814 for ST connectors and SEL-2800M Fiber-Optic Transceiver for V-pin connectors.

<sup>b</sup> Requires SEL-2820 V-Pin Transceiver for V-pin connectors and SEL-2824 Fiber-Optic Transceiver or SEL-9220 Fiber-Optic Adapter (SEL-300 series relays only) for ST connectors.

## Ordering Options

The SEL-2600 can be ordered in two versions based on the power supply selection.

- 120/240 Vac powered SEL-2600A
- 125 Vdc powered SEL-2600D

The SEL-2600 also offers two connector choices for the fiber-optic output port: a V-pin connector with standard 3 m (9.8 ft) 200 µm fiber-optic cable (SEL part number C805Z010VVX0003) and an ST connector with standard 5 m (16.4 ft) Simplex 62.5/200 µm fiber-optic cable (SEL part number C807Z010SSX0005). Cables of different lengths can be ordered separately as mentioned in the Model Option Table.

Complete ordering information is not provided in this instruction manual. See the latest SEL-2600 Model Option Table at [www.selinc.com](http://www.selinc.com), under Support, Product Literature, Ordering Information (MOTs).



# Specifications

## Compliance

Designed and manufactured under an ISO 9001 certified quality management system


47 CFR 15B, Class A

**NOTE:** 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 to radio communications. Operation of this equipment in a residential area is likely to 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 (QUYX, QUYY7)

UL certified for Hazardous Locations to Canadian and U.S. standards

ATEX certificate number: DEMKO 15 ATEX 1588X

Ex marking string:  II 3 G Ex nA IIC T4 Gc  
EN 60079-0:2012 + A11:2013,  
EN 60079-15:2010

CE Mark

RCM Mark

**NOTE:** Where so marked, ATEX and UL Hazardous Location Certification tests are applicable to rated supply specifications only and do not apply to the absolute operating ranges, continuous thermal, or short circuit duration specifications.

## General

### 12 RTD Inputs

Measuring Range:	−50° to +250°C
Accuracy:	±2°C
RTD Open-Circuit Detection:	>250°C
RTD Short-Circuit Detection:	<−50°C
RTD Types:	PT100, NI100, NI120, CU10
RTD Lead Resistance:	25 ohm max. per lead
Lead Length:	<10 m to meet IEC 60255-22-1 and IEC 60255-22-5
Update Rate:	<3 s
Noise Immunity on RTD Inputs:	1.4 Vac <sub>peak</sub> ≥50 Hz

### Contact Input

One dry contact input (15 Vdc max).

Use for local speed switch or other monitoring.

### Power Supply

SEL-2600A	
120 Vac:	±20%
240 Vac:	±20%
50/60 Hz:	±5%
AC Burden:	5 VA max
Voltage Dropout:	<40 V within 1 minute of power removal
Rated Insulation Level:	300 Vac
Rated Impulse Voltage:	4000 V
Inrush Current:	<50 A

Rated:	500 mA, 250 V
Interruptions:	100 ms @ 120/240 Vac
SEL-2600D	
Nominal Supply Voltage:	125 Vdc ±10%
Power Consumption:	<5 W
Interruptions:	200 ms @ 125 Vdc

### Fuse Ratings

#### SEL-2600D Power Supply Fuse

Rating:	2.0 A
Maximum Rated Voltage:	300 Vdc, 250 Vac
Breaking Capacity:	1500 A at 250 Vac
Type:	Time-lag T

#### SEL-2600A Power Supply Fuse

Rating:	0.5 A
Maximum Rated Voltage:	250 Vac
Breaking Capacity:	35 A at 250 Vac
Type:	Time-lag T

### Communications Port (Fiber-Optic, Transmit Only)

Binary data packet contains temperatures and self-test results.

Sent approximately every 0.6 seconds (maximum 0.75 seconds) at 2400 bps.

CRC-16 data security.

### Fiber-Optic Transmit Port

Ordering Options	1	2
Mode	Multi	Multi
Wavelength (nm)	650	820
Fiber Size	200 µm	62.5/200 µm
Approximate Range	500 m	1000 m
Source	LED	LED
Connector Type	V-pin	ST
Min TX Pwr. (dBm)	−31	−20
Max TX Pwr. (dBm)	−18.5	−12.6

LED: Class 1 Laser complies with EN 60825-1:1994 + A1 + A2

### Operating Temperature

IEC Performance Rating: −40° to +85°C (−40° to +185°F)  
(per IEC/EN 60068-2-1 and IEC/EN 60068-2-2)

**NOTE:** Not applicable to UL applications.

### Operating Environment

Insulation Class:	I
Pollution Degree:	3
Overvoltage Category:	II
Atmospheric Pressure:	80–110 kPa
Relative Humidity:	5%–95%, noncondensing
Maximum Altitude Without Derating (Consult the Factory for Higher Altitude Derating):	2000 m

### Dimensions

112.3 mm (4.45 in) x 241.3 mm (9.5 in) x 53.2 mm (2.06 in)

### Weight

2.7 kg (6.0 lb)

### Terminal Connections

#### Power Terminal Block

Minimum:	0.5 Nm (4.4 in-lb)
Maximum:	1.0 Nm (8.8 in-lb)

#### RTD Input Terminal Block

Minimum:	0.5 Nm (4.4 in-lb)
Maximum:	0.79 Nm (7.0 in-lb)

## Type Tests

### Environmental Tests

Enclosure Protection Class:	IEC 60529 IP20
Cold:	IEC 60068-2-1:2007 IEC 60255-27:2013, Section 10.6.1.2 IEC 60255-27:2013, Section 10.6.1.4 –40°C, 16 hours
Dry Heat:	IEC 60068-2-2:2007 IEC 60255-27:2013, Section 10.6.1.1 IEC 60255-27:2013, Section 10.6.1.3 85°C, 16 hours
Damp Heat, Steady State:	IEC 60068-2-78:2001 IEC 60255-27:2013, Section 10.6.1.5 40°C, 93% relative humidity, 10 days
Damp Heat, Cyclic:	IEC 60068-2-30:2001 IEC 60255-27:2013, Section 10.6.1.6 25° to 55°C, 6 cycles, relative humidity
Change of Temperature:	IEC 60068-2-14:2009 IEC 60255-1:2010, Section 6.12.3.5 –40° to 85°C, ramp rate 1°C/min, 5 cycles
Conducted Emissions:	IEC 60255-26:2013 Class B FCC 47 CFR Part 15.107 Class B ICES-003 Issue 6 EN 55011:2009 + A1:2010 Class B EN 55022:2010 + AC:2011 Class B EN 55032:2012 + AC:2013 Class B CISPR 11:2009 + A1:2010 Class B CISPR 22:2008 Class B CISPR 32:2015 Class B
Radiated Emissions:	IEC 60255-26:2013 Class B FCC 47 CFR Part 15.109 Class B ICES-003 Issue 6 EN 55011:2009 + A1:2010 Class B EN 55022:2010 + AC:2011 Class B EN 55032:2012 + AC:2013 Class B CISPR 11:2009 + A1:2010 Class B CISPR 22:2008 Class B CISPR 32:2015 Class B

### Dielectric Strength and Impulse Tests

Dielectric:	IEC 60255-27:2013, Section 10.6.4.3 IEEE C37.90-2005 2800 Vdc on power supply 500 Vac on contact input (not applicable to RTD inputs)
Impulse:	IEC 60255-27:2013, Section 10.6.4.2 IEEE C37.90:2005 0.5 J, 5000 V on power supply 0.5 J, 1000 V on contact input (not applicable to RTD inputs)

### RFI and Interference Tests

ESD:	IEC 61000-4-2:2008 IEC 60255-26:2013, Section 7.2.3 IEEE C37.90.3:2001
Radiated RF Immunity:	IEC 61000-4-3:2010 IEC 60255-26:2013, Section 7.2.4 20 V/m IEEE C37.90.2-2004 20 V/m
Fast Transient, Burst Immunity:	IEC 61000-4-4:2012 IEC 60255-26:2013, Section 7.2.5 Severity Level 4 4 kV, 5 kHz at power supply, RTD, and contact input port IEEE C37.90.1-2002 2500 V oscillatory 4000 V transient
Surge Immunity: <sup>a</sup>	IEC 61000-4-5:2005 IEC 60255-26:2013, Section 7.2.7 Power Supply and Contact Input 1 kV line-to-line 2 kV line-to-earth
Surge Withstand Capability Immunity:	EN 61000-4-18:2010 IEC 60255-26:2013, Section 7.2.6 Severity Level: Power supply and contact input 2.5 kV peak common mode 1.0 kV peak differential mode IEEE C37.90.1-2002 Severity Level: 2.5 kV oscillatory 4 kV fast transient
Conducted RF Immunity:	IEC 61000-4-6:2008 IEC 60255-26:2013, Section 7.2.8
Magnetic Field Immunity:	IEC 61000-4-8:2009 IEC 60255-26:2013, Section 7.2.10 Severity Level: 1000 A/m for 3 seconds 100 A/m for 1 minute; 50/60 Hz
Power Supply Immunity:	IEC 61000-4-11:2004 IEC 61000-4-17:1999 IEC 61000-4-29:2000 IEC 60255-26:2013, Section 7.2.11 IEC 60255-26:2013, Section 7.2.12 IEC 60255-26:2013, Section 7.2.13

### Vibration and Shock Tests

Vibration Resistance:	IEC 60255-21-1:1998 IEC 60255-27:2013, Section 10.6.2.1 Endurance: Class 2 Response: Class 2
Shock Resistance:	IEC 60255-21-2:1998 IEC 60255-27:2013, Section 10.6.2.2 IEC 60255-27:2013, Section 10.6.2.3 Withstand: Class 1 Response: Class 2 Bump: Class 1
Seismic (Quake Response):	IEC 60255-21-3:1993 IEC 60255-27:2013, Section 10.6.2.4 Response: Class 2

<sup>a</sup> RTD cables (non-fiber) lengths assumed to be <3 m.

# Section 2

## Installation

---

### Initial Checkout

---

#### CAUTION

Class 1 Laser Product. Looking into optical connections, fiber ends, or bulkhead connections can result in hazardous radiation exposure.

**IMPORTANT:** If internal fuses are blown and require replacement, return the equipment to the manufacturer. These components are not intended to be serviced in the field.

Before installing the SEL-2600, perform an initial checkout to ensure successful power up using the steps outlined below.

Step 1. Connect Terminal **26** to an appropriate ground.

Step 2. **For the SEL-2600A:**

Apply line power to the SEL-2600A at one of the following terminal combinations:

- 120 Vac—Terminal **23** is hot and Terminal **24** is neutral
- 240 Vac—Terminal **23** is hot and Terminal **25** is neutral

**For the SEL-2600D:**

Apply 125 Vdc power to the SEL-2600D as follows:

- Positive (+) connection to Terminal **24**
- Negative (–) connection to Terminal **25**

The SEL-2600 will turn on and perform internal diagnostics. The module is ready when the green **ENABLED** LED illuminates (allow as many as 25 s maximum).

Step 3. Verify that the red **TX** LED pulses approximately every 0.6 s (less than 0.75 s maximum).

Each pulse corresponds to the transmission of RTD data, device status, and contact input status.

Step 4. Connect Terminal **20** to Terminal **21** to test the internally wetted contact input.

The red **INPUT** LED illuminates when the contact input is electrically shorted.

The unit is now ready for installation.

# Installation

---

## Physical Location

Proper placement of the SEL-2600 helps make certain that you receive years of trouble-free operation.

The SEL-2600 is EN 61010-1 certified at Installation/Overvoltage Category II and Pollution Degree 3. This allows mounting of the relay in a sheltered indoor environment that does not exceed the temperature and humidity ratings for the relay. The SEL-2600 is required to be mounted in an indoor or outdoor (extended) locked enclosure that provides a degree of protection to personnel against access to hazardous parts. In either environment, the relay shall be protected from direct sunlight, precipitation, and full wind pressure.

You can place the relay in extreme temperature and humidity locations. (See *Operating Temperature* and *Operating Environment* in the *Specifications*.) For EN 61010-1 certification, the SEL-2600 rating is 2000 m (6562 ft) above mean sea level.

To comply with the requirements of the European ATEX standard for hazardous locations, the SEL-2600 shall be installed in an ATEX-certified enclosure with a tool-removable door or cover that provides a degree of protection not less than IP54, in accordance with EN 60079-0. The enclosure shall be limited to the surrounding air temperature range of  $-40^{\circ}\text{C} \leq T_a \leq +40^{\circ}\text{C}$ . The enclosure should be certified to these requirements or be tested for compliance as part of the complete assembly. The enclosure must be marked “WARNING—Do not open when an explosive atmosphere is present.” In North America, the relay is approved for Hazardous Locations Class I, Division 2, Groups A, B, C, and D, and temperature class T3C with a maximum surrounding air temperature of  $40^{\circ}\text{C}$ .

## Grounding

Verify that the power source is turned OFF (locked out) before making connections. Connect the grounding terminal screw located on the bottom left of the unit, next to Terminal 26, to the rack frame ground or main station ground for proper safety and performance. SEL recommends that you use  $3.30\text{ mm}^2$  (12 AWG) or heavier wire less than 2 m (6.6 ft) in length for this connection. Make the ground connection before making the power connections.

SEL recommends that you use wire with sufficient rating for 300 V minimum insulation, and greater than  $90^{\circ}\text{C}$  thermal capability.

## Power Connections

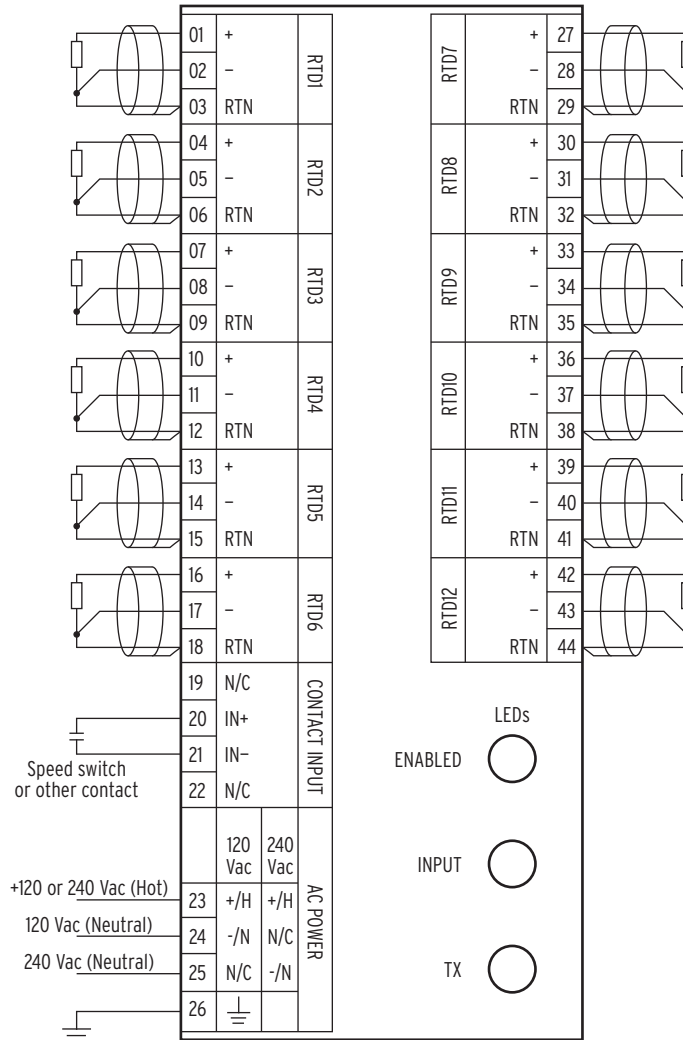
The power terminals are isolated from the chassis ground. SEL recommends that you use  $1.30\text{ mm}^2$  (16 AWG) size or heavier wire (as thick as 12 AWG) to connect to the power terminals. SEL further recommends that you use wire with sufficient rating for 300 V minimum insulation, and greater than  $90^{\circ}\text{C}$  thermal capability.

For compliance with EN 60947-1 and EN 60947-3, place a suitable external switch, circuit breaker, or overcurrent device (fuse) in the power leads for the SEL-2600. This device must be able to isolate both hot and neutral power leads for the SEL-2600A and should interrupt both positive and negative power leads for the SEL-2600D. The maximum current rating for the device should be 20 A.

Provide appropriate protection to power supply terminals and exposed length of wire for protection against electrical shock.

Operational power is internally fused with a power supply fuse. See *Specifications on page 1.3* for power supply and fuse ratings. Be sure to use fuses that comply with IEC 60127-2.

## Wiring Diagrams

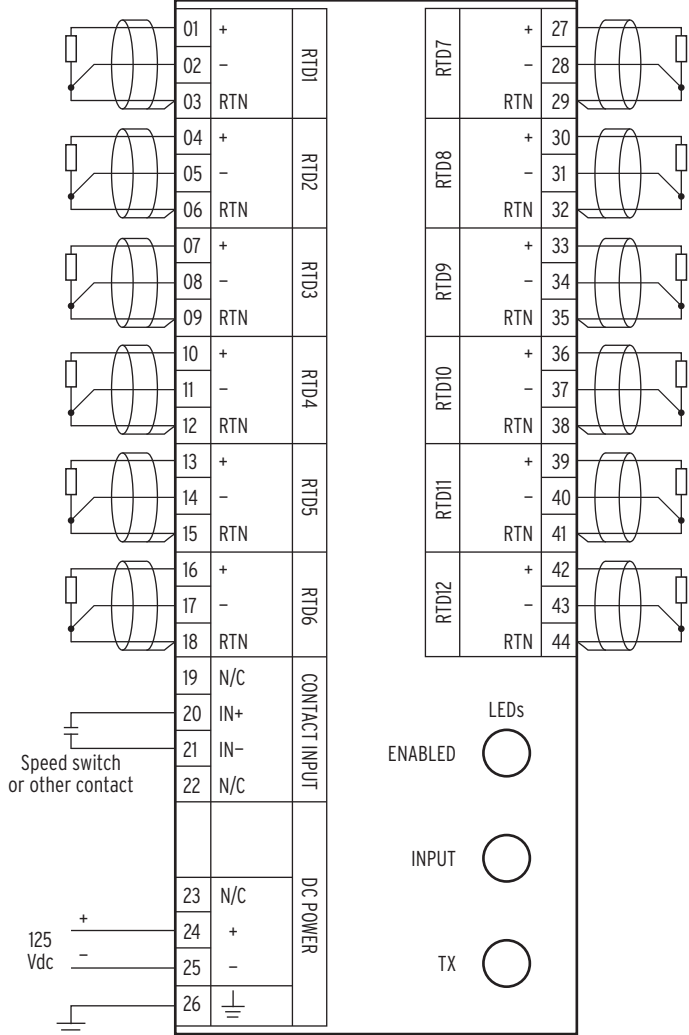


**Note 1:** RTN terminals for all 12 RTDs are internally connected to chassis ground.

**Note 2:** Fiber-Optic TX Port (not shown in figure) is available in V-pin or ST connector options (refer to the SEL-2600 Model Option Table).

**Note 3:** N = Neutral, N/C = No Connection, RTN = Return

**Figure 2.1 SEL-2600A Wiring Diagram**



- Note 1:** RTN terminals for all 12 RTDs are internally connected to chassis ground.
- Note 2:** Fiber-Optic TX Port (not shown in figure) is available in V-pin or ST connector options (refer to the SEL-2600 Model Option Table).
- Note 3:** N = Neutral, N/C = No Connection, RTN = Return

Figure 2.2 SEL-2600D Wiring Diagram

Installation Steps

**CAUTION**  
Use of this equipment in a manner other than specified in this manual can impair operator safety safeguards provided by this equipment.

- Step 1. Locate an appropriate mounting panel or enclosure near the protected device.
- Step 2. Drill four mounting holes (see Figure 2.3).
- Step 3. Secure the SEL-2600 using the four bolts and locknuts provided.
- Step 4. Ground the SEL-2600 by connecting Terminal 26 to an appropriate electrical ground.

Follow local requirements and practices, making sure the ground conductor is at least as large as the power conductors.

- Step 5. Connect as many as 12 RTDs to the SEL-2600 terminal blocks (see Figure 2.2).

The SEL-2600 supports shielded three-lead RTDs, providing terminals for +, -, and RTN (return) leads. The return lead provides a means for lead-resistance compensation. For best

lead-resistance compensation, all three leads should be the same length and wire gauge. Maximum lead resistance is 25 ohms.

Use 3.30 mm<sup>2</sup> (12 AWG) to 0.08 mm<sup>2</sup> (28 AWG) wire gauge for the leads. SEL recommends that you use Belden 8771 or similar cable. SEL also recommends that you use wire with sufficient rating for 300 V minimum insulation, and greater than 90°C thermal capability. The cable shield should be connected to ground at the SEL-2600 (use the **RTN** terminal for shield grounding).

- a. Performance to all specifications is guaranteed only when using shielded RTD cables (twisted leads) no longer than 10 meters.
- b. While RTD cables longer than 10 meters can be used, conformance to IEC 60255-22-1 and IEC 60255-22-5 is no longer ensured.

This product is not intended to accept externally applied voltages or transients >5 V on the RTD terminal block contacts and is intended only for Overvoltage Category II. Therefore, the RTD installation should accommodate for suitable isolation from such voltages at the tip/measuring point and use properly designed RTDs that include a suitable isolation effort at the RTD probe itself.

### CAUTION

Do not connect external voltages to the contact input. Permanent damage to the product or external equipment can result from connecting external voltages to a contact input because the contact input is internally wetted.

Step 6. Record the type and location of each RTD in *Table 2.1*.

Step 7. Connect a dry contact to the SEL-2600 contact input Terminals **20** and **21**, as appropriate. The contact is internally wetted at 8 Vdc.

Step 8. Connect the SEL-2600 to a protective relay.

**If using a SEL-2600A**, connect ac line power via one of the following terminal combinations:

- a. 120 Vac—Terminal **23** is hot and Terminal **24** is neutral
- b. 240 Vac—Terminal **23** is hot and Terminal **25** is neutral

**If using a SEL-2600D**, connect 125 Vdc power as follows:

- a. Positive (+) connection to Terminal **24**
- b. Negative (–) connection to Terminal **25**

The green **ENABLED** LED illuminates when power is applied and the internal diagnostics are complete (allow as many as 25 seconds maximum).

Step 9. Verify that the SEL-2600 is operating properly by ensuring the following:

- a. The green **ENABLED** LED is illuminated.
- b. The red **TX** LED pulses approximately once every 0.6 seconds (less than 0.75 seconds maximum).
- c. The protective relay receives valid RTD measurements.
- d. The red **INPUT** LED illuminates when the SEL-2600 contact input is electrically shorted (connect Terminal **20** to Terminal **21**).

Table 2.1 RTD Type and Location Worksheet

RTD Input	RTD Location	RTD Type
RTD1		
RTD2		
RTD3		
RTD4		
RTD5		
RTD6		
RTD7		
RTD8		
RTD9		
RTD10		
RTD11		
RTD12		

Mechanical Diagram

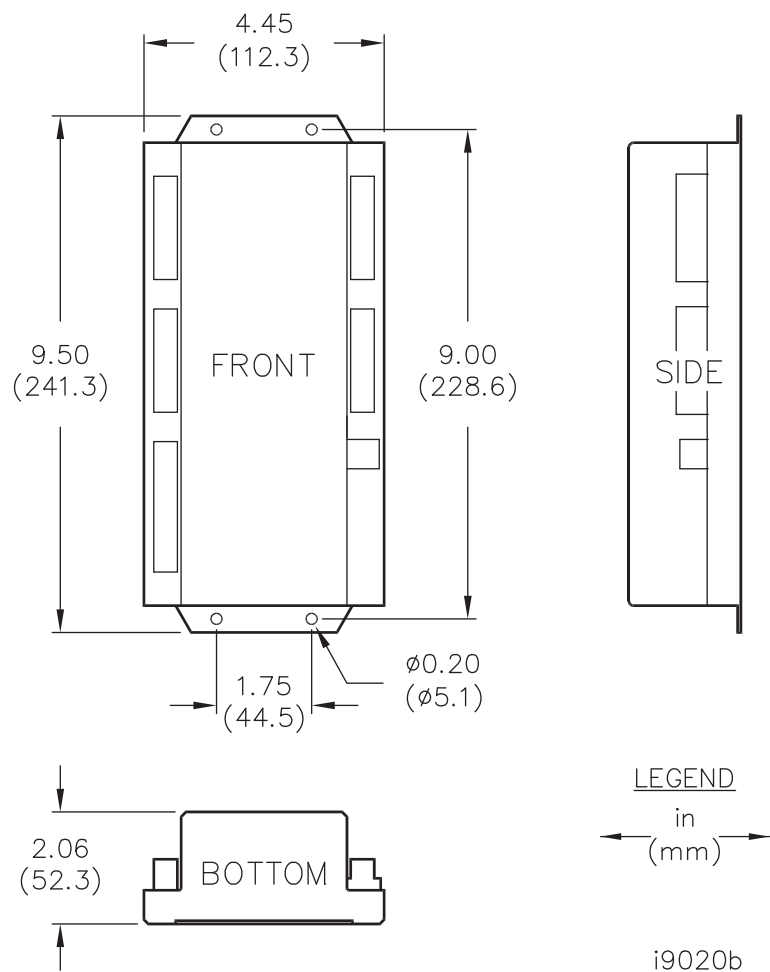


Figure 2.3 Dimension Diagram



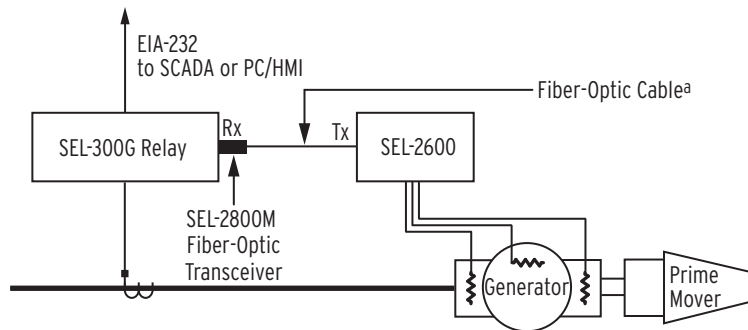
# Section 3

## Applications

### Applications With SEL-300 Series Relays

The SEL-300G, SEL-352, SEL-387A, and SEL-387 are referred to as SEL-300 series relays and have an optional RTD-based thermal protection feature that uses the SEL-2600 to acquire thermal data for alarm and trip functions. SEL-300 series relays communicate with the SEL-2600 over the serial port and hence can use both V-pin and ST® connector options. The SEL-300 series relays can be connected to the SEL-2600 on the EIA-232 port via the SEL-2812M or SEL-2814M Fiber-Optic Transceiver for ST connectors, and SEL-2800M Fiber-Optic Transceiver for V-pin connectors and on the EIA-485 port via the SEL-2820 V-Pin Transceiver for V-pin connectors and SEL-2824 Fiber-Optic Transceiver or SEL-9220 Fiber-Optic Adapter for ST connectors.

A typical application using the SEL-300G follows. Similar connections can be applied for other SEL-300 series relays. Connect the SEL-2600 to the SEL-300G as shown in *Figure 3.1*. Set and test the SEL-300G as directed in the *SEL-300G Multifunction Generator Relay Instruction Manual*.



<sup>a</sup> Refer to the Model Option Table for cable choices.

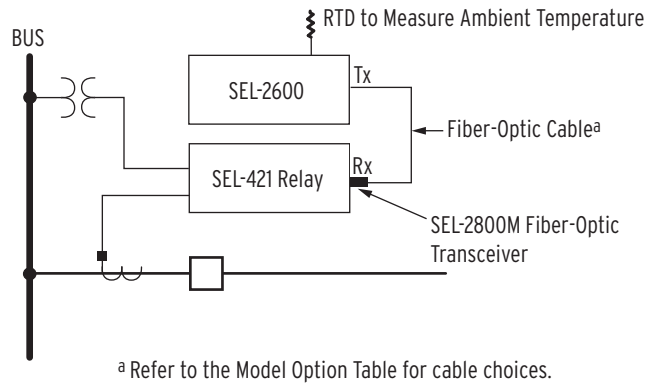
**Figure 3.1 Generator Protection With the SEL-300G**

### Applications With SEL-400 Series Relays

The SEL-400G, SEL-411L, SEL-421, SEL-451, SEL-487B, SEL-487E, and SEL-487V are referred to as SEL-400 series relays. The SEL-400 series relays interface directly with the SEL-2600 to acquire as many as 12 RTD temperature values. The relays use the RTD values in free-form SELOGIC® applications. SEL-400 series relays communicate with the SEL-2600 over the serial port and hence can use both V-pin and ST connector options. The SEL-400 series relays can be connected to the SEL-2600 on the EIA-232 port via the SEL-2812M or SEL-2814M Fiber-Optic Transceiver for ST connectors, and SEL-2800M Fiber-Optic Transceiver for V-pin connectors

and on the EIA-485 port via the SEL-2820 V-Pin Transceiver for V-pin connectors and SEL-2824 Fiber-Optic Transceiver for ST connectors.

A typical application using the SEL-421 follows. Similar connections can be applied for the other SEL-400 series relays. Connect the SEL-2600 to the SEL-421 as shown in *Figure 3.2*. Set and test the SEL-421 as directed in the *SEL-421 Reference Manual*.



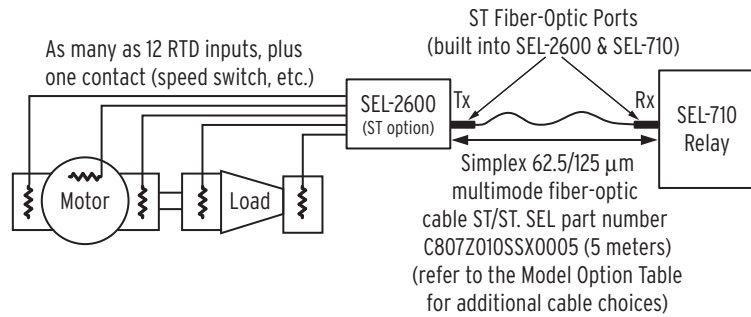
**Figure 3.2 Transmission Line Protection With the SEL-421**

## Applications With SEL-700 Series Relays

The SEL-700G, SEL-710, SEL-710-5, SEL-751, SEL-751A, SEL-787, and SEL-787-2, -3, -4 are referred to in this subsection as SEL-700 series relays. SEL-700 series relays provide protection for transformers, feeders, motors, and generators. Combining the SEL-2600 (ST connectors option) and the SEL-700 series relays provides remote RTD-based thermal protection.

All SEL-700 series relays connect to the SEL-2600 (ST connectors option) on the fiber-optic port via Simplex 62.5/200  $\mu\text{m}$  multimode fiber-optic cable ST/ST with SEL part number C807Z010SSXxxx (refer to the Model Option Table for cable choices). The SEL-700G also supports the SEL-2600 RTD Module on the EIA-232 port using the SEL-2812M or SEL-2814M Fiber-Optic Transceiver for ST connectors, and SEL-2800 Fiber-Optic Transceiver for V-pin connectors and on the EIA-485 port using the SEL-2820 V-Pin Transceiver for V-pin connectors and SEL-2824 Fiber-Optic Transceiver for ST connectors.

A typical application using the SEL-710 follows. Similar connections can be applied for other SEL-700 series relays.



**Figure 3.3 Motor Protection With the SEL-710**

- Step 1. Connect the SEL-2600 (ST connector option) to the SEL-710 using a 62.5/200  $\mu$ m fiber-optic cable with ST connectors (the supplied C807Z010SSX0005 or equivalent) between the SEL-2600 fiber-optic TX output and the SEL-710 fiber-optic RX input.

The SEL-710 and SEL-2600 (ST connector option) use 820 nm rated, ST connector-based fiber-optic ports.

- Step 2. Set the SEL-710 to accept the RTD temperature data packets (see *Data Packet Definition*) sent by the SEL-2600.
- Set RTD ENABLE (E49RTD) equal to Y. This enables the use of the SEL-2600 data.
  - Set the RTD Location and RTD Type settings based on the information you recorded in *Table 2.1*.
  - Set the RTD Alarm and RTD Trip Temperature settings as required for your application.
  - Repeat *Step b* and *Step c* for each RTD input used.

You can use any of the following methods to enter the settings.

- Relay front-panel menus:  
Set / Show > RELAY > RTD Settings
- Personal computer connected to a relay serial port running ACSELERATOR QuickSet® SEL-5030 Software.
- Personal computer connected to a relay serial port using a terminal emulation software package and ASCII commands.

Refer to the *SEL-710 Motor Protection Relay Instruction Manual* for more details regarding calculating and entering settings.

- Step 3. After accepting the relay settings, verify correct RTD temperature measurement using one of the following methods.
- Relay front-panel menus:  
Meter > Thermal
  - Personal computer connected to a relay serial port running ACSELERATOR QuickSet.
  - Personal computer connected to a relay serial port using a terminal emulation software package and the **METER T** command.

**NOTE:** RTD curves in SEL products are based on the DIN/IEC 60751 standard.

The relay indicates the temperatures of each connected, healthy RTD. If the relay reports that an RTD is open or shorted, or if the temperature reading is wrong, verify the wiring at the SEL-2600. Also verify that the RTD type connected to an input matches the RTD Type setting.

**Table 3.1 RTD Resistance (Ohms) Versus Temperature**

Temp (°C)	100 Platinum	120 Nickel	100 Nickel	10 Copper
–50.00	80.31	86.17	74.30	7.10
–40.00	84.27	92.76	79.10	7.49
–30.00	88.22	99.41	84.20	7.88
–20.00	92.16	106.15	89.30	8.26
–10.00	96.09	113.00	94.60	8.65
0.00	100.00	120.00	100.00	9.04
10.00	103.90	127.17	105.60	9.42
20.00	107.79	134.52	111.20	9.81
30.00	111.67	142.06	117.10	10.19
40.00	115.54	149.79	123.00	10.58
50.00	119.39	157.74	129.10	10.97
60.00	123.34	165.90	135.30	11.35
70.00	127.07	174.25	141.70	11.74
80.00	130.89	182.84	148.30	12.12
90.00	134.70	191.64	154.90	12.51
100.00	138.50	200.64	161.80	12.90
110.00	142.29	209.85	168.80	13.28
120.00	146.06	219.29	176.00	13.67
130.00	149.82	228.96	183.30	14.06
140.00	153.58	238.85	190.90	14.44
150.00	157.32	248.95	198.70	14.83
160.00	161.05	259.30	206.60	15.22
170.00	164.77	269.91	214.80	15.61
180.00	168.47	280.77	223.20	16.00
190.00	172.17	291.96	231.80	16.39
200.00	175.85	303.46	240.70	16.78
210.00	179.15	315.31	249.80	17.17
220.00	183.17	327.54	259.20	17.56
230.00	186.82	340.14	268.90	17.95
240.00	190.45	353.14	278.90	18.34
250.00	194.08	366.53	289.10	18.73

## Application With SEL-701 Motor Protection Relay

Combining the SEL-2600 (V-pin option) and the SEL-701 enhances the motor protection by adding remote RTD-based thermal protection. Set and test the SEL-701 as directed in the *SEL-701 Motor Protection Relay Instruction Manual*.

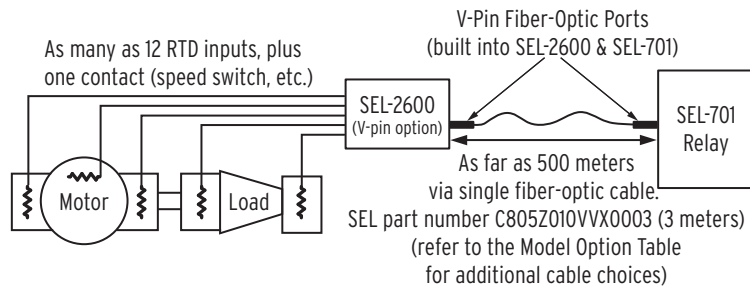


Figure 3.4 Motor Protection With the SEL-701

## Application With SEL-749M Motor Protection Relay

Combining the SEL-2600 (ST connector option) and the SEL-749M enhances the motor protection by adding remote RTD-based thermal protection. Set and test the SEL-749M as directed in the *SEL-749M Motor Protection Relay Instruction Manual*.

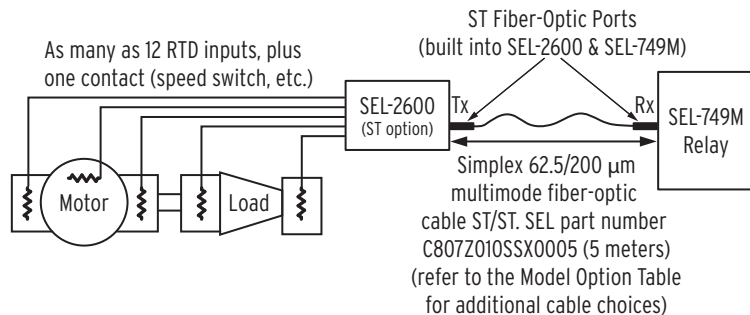


Figure 3.5 Motor Protection With the SEL-749M

## Applications With SEL-2400 Series Relays

The SEL-2411 and SEL-2440 interface directly with the SEL-2600 to acquire as many as 12 RTD temperature measurements. You can use this temperature information for transformer thermal monitoring, including hot-spot temperature, if the transformer supports a thermowell for an RTD sensor. SEL-2400 series relays communicate with the SEL-2600 over the fiber-optic serial port with ST connectors.

A typical application using the SEL-2411 follows. Similar connections can be applied for the SEL-2440 relay as well. Connect the SEL-2600 to the SEL-2411 as shown in *Figure 3.6*. Set and test the SEL-2411 as directed in the *SEL-2411 Programmable Automation Controller Instruction Manual*.

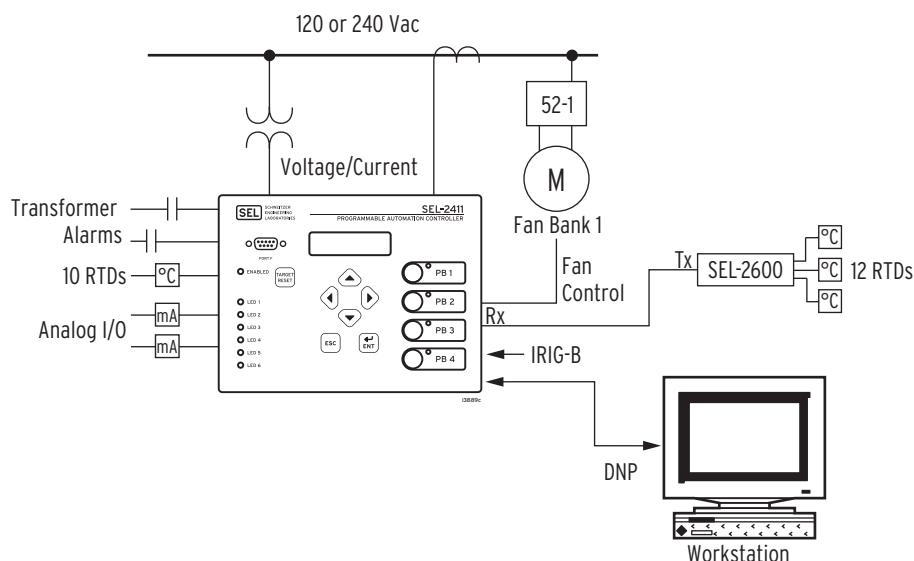


Figure 3.6 Transformer Monitor and Cooling System Control

## Applications With SEL Communications Processors

Use the SEL-2600 in combination with an SEL communications processor to enhance many protection and monitoring applications. The communications processor monitors temperature data from the SEL-2600, performs threshold comparisons, and sends control commands to a protective relay. SEL communications processors can communicate with the SEL-2600 over the serial port and hence can use both V-pin and ST connector options.

The applications shown in *Figure 3.7* and *Figure 3.8* are representative of the numerous possible configurations using the SEL-2600 and an SEL communications processor. Contact SEL for help in applying these products in other configurations.

Program an SEL communications processor to perform four automated steps:

- Step 1. Receive temperature data from the SEL-2600.
- Step 2. Store the temperature data in memory.
- Step 3. Perform temperature threshold comparisons.
- Step 4. Issue control commands to a protective relay based on the temperature comparisons.

The following sections describe how to configure an SEL communications processor to perform the four automated steps shown previously, assuming that the SEL-2600 is connected to Serial Port 4 of an SEL communications processor. Refer to your SEL communications processor instruction manual for further information on programming concepts.

### Receive Temperature Data

Connect the SEL-2600 (V-pin option) to an SEL communications processor using an SEL-2800M Fiber-Optic Transceiver and 200  $\mu\text{m}$  fiber-optic cable C805Z010VVX0003, or equivalent. Set the port settings of an SEL communications processor as shown.

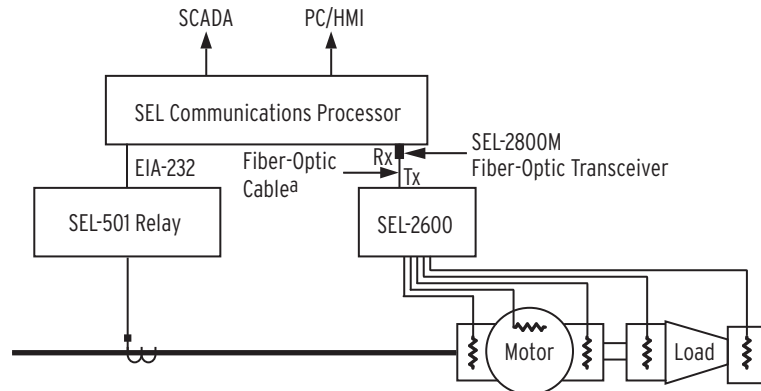
```

*>>SET P 4 <Enter>

DEVICE = S <Enter>
CONFIG = N <Enter>
PORTID = SEL-2600 RTD Module <Enter>
BAUD = 2400 <Enter>
DATABIT = 8 <Enter>
STOPBIT = 1 <Enter>
PARITY = N <Enter>
RTS_CTS = N <Enter>
XON_XOFF = N <Enter>
TIMEOUT = OFF <Enter>

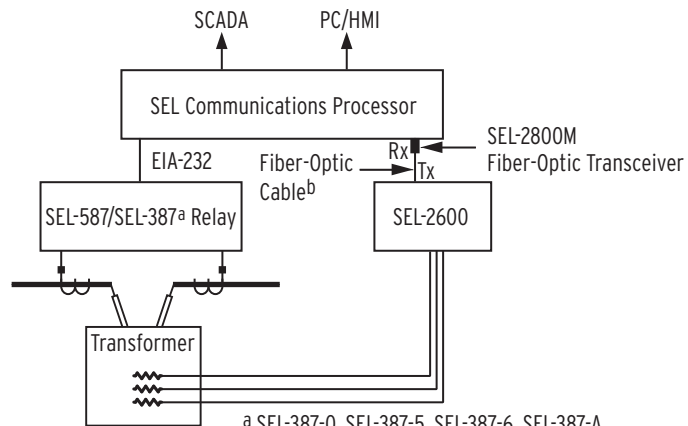
*>>

```



<sup>a</sup> Refer to the Model Option Table for cable choices.

**Figure 3.7 Motor Protection With the SEL-501**



<sup>a</sup> SEL-387-0, SEL-387-5, SEL-387-6, SEL-387-A.

<sup>b</sup> Refer to the Model Option Table for cable choices.

**Figure 3.8 Transformer Protection With the SEL-587, SEL-387-0, SEL-387-5, SEL-387-6, or SEL-387A**

## Store Temperature Data in SEL Communications Processor Memory

Use the **SET A** command to reserve memory.

```

*>>SET A 4 <Enter>

AUTOBUF = N <Enter>
STARTUP = "" <Enter>
SEND_OPER = N <Enter>
REC_SER = N <Enter>
MSG_CNT = 0 <Enter>
ARCH_EN = N <Enter>
USER = 54 <Enter>

*>>

```

## Perform Temperature Threshold Comparisons

The USER setting reserves a data region with 54 registers. Each register is 2 bytes for a total length of 108 bytes. This data region holds the received data packet and mathematical equations for threshold comparisons.

An SEL communications processor automatically moves the data section of each received data packet (see *Table 3.3*) into the reserved USER data region at the addresses shown in *Table 3.2*.

The SEL-2600 data packet includes temperature information for each of the four types of RTDs. To access the correct temperature, use the memory map location associated with the correct RTD type.

Data from the USER region can be accessed using an absolute address or in the form *n:USER:offset* where *n* is the port number and *offset* is the value shown in the offset column of *Table 3.2*. For example, access the RTD 2, 10-ohm copper data using the absolute address F80Ah or the offset form 4:USER:0Ah. The examples in the remainder of this section use the offset form.

The following example communications processor settings compare the measured temperature of RTD 2 (10-ohm copper) against a threshold of 28°C. If the measured temperature is valid (i.e., the RTD is not shorted or open) and is higher than the threshold, Bit 0 of register 035H is set equal to 1. Serial Port 4 is again assumed.

```
*>>SET M 4 <Enter>

1 033h = 28                #Store temp threshold <Enter>
2 034h = 4:USER:033h      #Get the threshold <Enter>
3 034h -= 4:USER:0Ah      #Subtract the RTD temp <Enter>
4 035h:0 = 4:USER:034h:15 #Get sign bit of result <Enter>
5 035h:0 *= !4:USER:0Ah:15 #Test bit 15 of temp <Enter>
6 035h:0 *= !4:USER:0Ah:14 #Test bit 14 of temp <Enter>

*>>
```

The text following the pound (#) symbols are comments and are not required to set the SEL communications processor.

- **Line 1:** Stores the temperature threshold in register 033h.
- **Line 2:** Copies the threshold to register 034h in preparation for Line 3.
- **Line 3:** Subtracts the measured RTD temperature from the threshold and stores the result in register 034h. If the result is negative, the measured RTD temperature is higher than the threshold and Bit 15 (the sign bit) of 034h is set.
- **Line 4:** Copies the sign bit (Bit 15) of 034h into Bit 0 of 035h.
- **Line 5:** Clears Bit 0 of 35h if RTD is shorted.
- **Line 6:** Clears Bit 0 of 35h if RTD is open.

This logic can be expanded to operate on additional RTDs. Use the **SET A** command to reserve additional registers for mathematical equations.

```
*>>SET A USER 4 <Enter>

USER    = 57
```



Use the **SET M** command to add the equations. The following settings show how to add RTD 12, 100-ohm platinum (4:USER:02Fh) at a threshold of 31°C.

```
*>>SET M 4 <Enter>

7 036h = 31 #Store temp threshold <Enter>
8 037h = 4:USER:036h #Get the threshold <Enter>
9 037h -= 4:USER:02Fh #Subtract the RTD temp <Enter>
10 038h:0 = 4:USER:037h:15 #Get sign bit of result <Enter>
11 038h:0 *= !4:USER:02Fh:15 #Test bit 15 of temp <Enter>
12 038h:0 *= !4:USER:02Fh:14 #Test bit 14 of temp <Enter>

*>>
```

**Table 3.2 SEL-2030/SEL-2032 Communications Processor Memory Map**

Address (hex)	Offset	Data Description
F800h–F801h	0–01h	Milliseconds since device turned on
F802h	02h	Device status
F803h	03h	RTD 1, 100-ohm platinum
F804h	04h	RTD 1, 100-ohm nickel
F805h	05h	RTD 1, 120-ohm nickel
F806h	06h	RTD 1, 10-ohm copper
F807h	07h	RTD 2, 100-ohm platinum
F808h	08h	RTD 2, 100-ohm nickel
F809h	09h	RTD 2, 120-ohm nickel
F80Ah	0Ah	RTD 2, 10-ohm copper
•		
•		
(this 4-register sequence is repeated for RTD 3 through RTD11)		
•		
•		
F82Fh	2Fh	RTD 12, 100-ohm platinum
F830h	30h	RTD 12, 100-ohm nickel
F831h	31h	RTD 12, 120-ohm nickel
F832h	32h	RTD 12, 10-ohm copper
F833h–F835h	33h–35h	Storage for mathematical functions

## Issue Control Commands to Relay

Connect an SEL communications processor to the protective relay. Establish communications as outlined in the SEL communications processor and the protective relay instruction manuals.

Use the **SET P** command to set AUTO\_CONFIG equal to Y. This enables automatic control capabilities for the serial port connected to the relay. Use the **SET A** command to set SEND\_OPER equal to Y. This enables Fast Operate commands based on logic bit transitions. Use the **SET L** command to control four breakers using Fast Operate commands based on the result of a single temperature comparison.

The following example settings assume the relay is connected to an SEL communications processor Serial Port 10, and the SEL-2600 is connected to Serial Port 4.

```
*->>SET L 10 <Enter>

SBR1 = 4:USER:35h:0 #If above threshold open breaker 1 <Enter>
CBR1 = 0 <Enter>
SBR2 = 4:USER:35h:0 #If above threshold open breaker 2 <Enter>
CBR2 = 0 <Enter>
SBR3 = 4:USER:35h:0 #If above threshold open breaker 3 <Enter>
CBR3 = 0 <Enter>
SBR4 = 4:USER:35h:0 #If above threshold open breaker 4 <Enter>
CBR4 = 0 <Enter>

*>>
```

The example can be modified to control each breaker based on separate temperature thresholds. *Perform Temperature Threshold Comparisons* shows how to program an SEL communications processor for multiple temperature comparisons. Use the comparisons along with the following settings to control Breaker 1 and Breaker 2.

```
SBR1 = 4:USER:35h:0 #If RTD 2 > 28 degrees C open breaker 1 <Enter>
CBR1 = 0 <Enter>
SBR2 = 4:USER:38h:0 #If RTD 12 > 31 degrees C open breaker 2 <Enter>
CBR2 = 0 <Enter>
```

Refer to the specific device instruction manual for more information on Fast Operate commands, wiring, and configuration.

## Data Packet Definition

The SEL-2600 sends a binary data packet approximately every 0.6 seconds (0.75 seconds maximum). The packet contains data for all four supported RTD types, so no settings are required in the SEL-2600. With the SEL-2600 (V-pin option) and the SEL-2800M Fiber-Optic Transceiver, any EIA-232 device can be configured to process the binary data packet contents shown in *Table 3.3*. The ST connectors option is also available using an SEL-2812M or SEL-2814M transceiver.

**Table 3.3 SEL-2600 RTD Module Data Packet Definition (Sheet 1 of 2)**

Data Value	Data Size	Description
A546h	2 bytes	Beginning of message code
74h	1 byte	Message length (116 bytes)
0000000000h	5 bytes	Routing value (0)
00h	1 byte	Status byte
12h	1 byte	Function code
00h	1 byte	Sequence byte
00h	1 byte	Pad byte
xxxxxxx	4 bytes	Milliseconds since SEL-2600 turned on or clock rollover (86,400,000 ms/5265C00h)

**Table 3.3 SEL-2600 RTD Module Data Packet Definition (Sheet 2 of 2)**

Data Value	Data Size	Description
xx	2 bytes	Device status (bitmap)  Bit 0: Power Supply Status (0 = okay; 1 = fail)  Bit 1: RTD Module Status (0 = okay; 1 = fail)  Bit 2: Watchdog Timer Status (0 = okay; 1 = fail)  Bit 3: 8 V Power Supply Status (0 = okay; 1 = fail)  Bit 4: 5 V Power Supply Status (0 = okay; 1 = fail)  Bit 5: -5 V Power Supply Status (0 = okay; 1 = fail)  Bits 6–14: Unused, Zero  Bit 15: Contact Input State (0 = deasserted; 1 = asserted)
xxxx	96 bytes <sup>a</sup>	Temperature data (°C)  Word One: PT100 temperature Word Two: NI100 temperature Word Three: NI120 temperature Word Four: CU10 temperature  Use only the appropriate temperature for the type of RTD connected to each input.  If an RTD circuit is open, the error code is 7FFh; if the circuit is shorted, the error code is 8000h. For approximately the first 20 seconds (less than 25 seconds maximum) after applying power, the module sends the 7FF0h error code.
yy	2 bytes	CRC-16 data block check code

<sup>a</sup> 2 bytes per word • 4 words per RTD • 12 RTDs = 96 bytes.

## SEL-2600 Guideform Specification

RTD (Resistance Temperature Detector) monitoring shall be provided by a microprocessor-based module with the following characteristics.

- The module shall be capable of acquiring RTD data from as many as 12 RTDs.
- The module shall accept input from any of four different types of three-wire RTDs (100-ohm platinum, 120-ohm nickel, 100-ohm nickel, and 10-ohm copper) on every RTD input terminal.
- The module shall accept a single contact input.
- The module shall require no configuration settings.
- The module shall perform internal self-tests on the power supply and RTD inputs.

- The module shall transmit over fiber optics all measured RTD values, input contact status, and self-test status at less than 750 ms intervals over a distance of as far as 500 meters for the V-pin connectors option and 1000 meters for the ST connectors option.
- The module shall transmit valid RTD data within 25 seconds after turning on.
- The module shall secure data communications using CRC-16 (Cyclical Redundancy Check) error detection.
- The module shall be equipped with a fiber-optic port (V-pin option or ST connectors option).
- The module shall use LEDs (light emitting diodes) to indicate device self-test status, input contact status, and fiber port transmit status.
- The module shall be capable of operating within specifications over a temperature range of  $-40^{\circ}$  to  $+85^{\circ}\text{C}$  ( $-40^{\circ}$  to  $+185^{\circ}\text{F}$ ).
- The module shall be powered by 120 Vac or 240 Vac for the ac powered model or 125 Vdc for the dc powered model.
- The module shall mount to a flat surface and have dimensions not exceeding 241.3 mm x 112.3 mm x 52.3 mm (9.5 in x 4.45 in x 2.06 in).
- The module shall be UL certified for the U.S. and Canada, including Class I, Division 2 hazardous locations applications, CE, RCM, and ATEX.

## Service and Support

- **Reliability.** The vendor shall supply the actual mean time between failures (MTBF) for the device upon request.
- **Manufacturer.** The device shall be manufactured in the U.S.A.
- **Conformal Coating.** The device shall have conformal coating to protect the circuit boards from harsh environments.
- **Warranty.** The device shall include a ten-year, no-questions-asked warranty for all material and workmanship defects. In addition, the warranty shall cover accidental customer-induced damage.

# Appendix A

## Manual Versions

The date code at the bottom of each page of this manual reflects the creation or revision date. *Table A.1* lists the instruction manual versions and revision descriptions. The most recent instruction manual version is listed first

**Table A.1 Instruction Manual Revision History**

Revision Date	Summary of Revisions
20200803	<p><b>Preface</b></p> <ul style="list-style-type: none"> <li>➤ Updated <i>Hazardous Locations Approvals</i> including removing product compliance labels.</li> <li>➤ Updated <i>Safety Marks</i> and removed <i>Product Labels</i>.</li> <li>➤ Added <i>LED Emitter, Environmental Conditions and Voltage Information, Wire Size and Insulation, RTD Wiring, and Field Serviceability</i>.</li> </ul> <p><b>Section 1</b></p> <ul style="list-style-type: none"> <li>➤ Updated <i>Table 1.1: Product Compatibility Guide</i>.</li> <li>➤ Updated <i>Specifications</i>.</li> </ul> <p><b>Section 2</b></p> <ul style="list-style-type: none"> <li>➤ Updated <i>Physical Location</i>.</li> <li>➤ Updated <i>Figure 2.1: SEL-2600A Wiring Diagram</i> and <i>Figure 2.2: SEL-2600D Wiring Diagram</i>.</li> </ul>
20160330	<p><b>Preface</b></p> <ul style="list-style-type: none"> <li>➤ Updated the product compliance labels in <i>Hazardous Locations Approvals</i> to add the ATEX marking.</li> </ul> <p><b>Section 1</b></p> <ul style="list-style-type: none"> <li>➤ Updated the product compliance information in <i>Specifications</i>.</li> </ul> <p><b>Section 2</b></p> <ul style="list-style-type: none"> <li>➤ Updated the wire sizes that can be used on the terminal blocks of the SEL-2600 RTD module.</li> </ul>
20150925	<p><b>Preface</b></p> <ul style="list-style-type: none"> <li>➤ Updated the product compliance labels in <i>Hazardous Locations Approvals</i> to add the CSA mark for Class I, Division 2 hazardous locations.</li> </ul> <p><b>Section 1</b></p> <ul style="list-style-type: none"> <li>➤ Updated the product compliance information in <i>Specifications</i>.</li> </ul>
20150406	<p>➤ Initial version.</p> <p>NOTE: This version of the manual has combined the SEL-2600A (20050303) and SEL-2600D (20061024) manuals and updated the information to cover both models of the SEL-2600 RTD Module.</p> <p><b>Preface</b></p> <ul style="list-style-type: none"> <li>➤ Added <i>Safety Information, Product Labels, and Technical Assistance</i>.</li> </ul> <p><b>Section 1</b></p> <ul style="list-style-type: none"> <li>➤ Updated <i>Major Features and Benefits</i>.</li> <li>➤ Added <i>Ordering Options</i>.</li> <li>➤ Added <i>Table 1.1: Product Compatibility Guide</i>.</li> <li>➤ Updated <i>Specifications</i>.</li> </ul> <p><b>Section 2</b></p> <ul style="list-style-type: none"> <li>➤ Updated <i>Initial Checkout</i>.</li> </ul> <p><b>Section 3</b></p> <ul style="list-style-type: none"> <li>➤ Reordered relay series applications and updated descriptions and drawings.</li> <li>➤ Updated <i>SEL-2600 Guideform Specification</i>.</li> </ul>

**This page intentionally left blank**





**SCHWEITZER ENGINEERING LABORATORIES, INC.**

2350 NE Hopkins Court • Pullman, WA 99163-5603 USA

Tel: +1.509.332.1890 • Fax: +1.509.332.7990

[www.selinc.com](http://www.selinc.com) • [info@selinc.com](mailto:info@selinc.com)