

Quick-Start Installation and User's Guide

SEL SCHWEITZER ENGINEERING LABORATORIES, INC.



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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. Note: The 24 Vdc battery inside the SEL-351RS Kestrel Recloser Control enclosure is excluded from the product warranty.

PM351RS-02

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Preface

About This Quick-Start Installation and User's Guide

This SEL-351RS Kestrel® Recloser Control Quick-Start Installation and User's Guide helps you install, communicate with and set the SEL-351RS Kestrel in its EZ (“easy”) mode of operation. Refer to *Section 13: Testing and Troubleshooting* in the SEL-351RS Kestrel Recloser Control Instruction Manual for testing instructions. The EZ mode performs traditional recloser control functions and operations.

When using the SEL-351RS Kestrel as a traditional line recloser control, it is only necessary to access the EZ Level (Access Level E) Settings. See the SEL-351RS Kestrel Recloser Control Instruction Manual for complete information regarding the full functionality of the SEL-351RS Kestrel.

This *Quick-Start Installation and User's Guide* includes the following:

- *Preface*
- *Section 1: Installation*
- *Section 2: Getting Started With Communications*
- *Section 3: Front-Panel Interface*
- *Section 4: EZ Settings*
- *Section 5: Battery*
- *Section 6: Specifications*
- *Appendix A: Quick-Start Guide Change Information*

Safety Information

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.

 DANGER Contact with instrument terminals may cause electric 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 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 avec d'autres personnes ou endommager l'équipement.
 WARNING Before installing, operating, maintaining, or testing this equipment, carefully read and understand the contents of this guide. Improper installation, handling, or maintenance can result in death, severe personal injury, and/or equipment damage.	
 WARNING This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply may result in death, severe personal injury, and/or equipment damage.	
 CAUTION The SEL-351RS Kestrel contains devices sensitive to Electrostatic Discharge (ESD). When working on the relay module with cover removed, work surfaces and personnel must be properly grounded or equipment damage may result.	
 CAUTION Do not connect this control to an energized recloser until all control settings have been properly programmed and verified. Refer to the Settings section of this guide for programming procedures. Failure to comply can result in control and recloser misoperation, equipment damage, and personal injury.	

Conventions

Typographic Conventions

The instructions in this manual indicate these options with specific font and formatting attributes. The following table lists these conventions.

Example	Description
STATUS	Commands, command options, and command variables typed at a command line interface on a PC.
<i>n</i> SHO <i>n</i>	Variables determined based on an application (in bold if part of a command).
<Enter>	Single keystroke on a PC keyboard.
<Ctrl+D>	Multiple/combination keystroke on a PC keyboard.
Start > Settings	PC software dialog boxes and menu selections. The > character indicates submenus.
CLOSE	Recloser control front-panel pushbuttons.
ENABLE	Recloser control front- or side-panel labels.
RELAY RESPONSE MAIN > METER	Recloser control front-panel LCD menus. The > character indicates submenus.
Are you sure?	Recloser control responses visible on the PC screen.

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Section 1

Installation

Overview

This section provides:

- Hardware overview
- Installation steps
- Recloser connection details

Compatibility

The SEL-351RS Kestrel® Single-Phase Recloser Control is compatible with the following:

- G&W Viper-SP single-phase recloser (manufactured by G&W Electric Company)
- ABB Elastimold MVR single-phase recloser (manufactured by Thomas & Betts Corporation)

Hardware Overview

The SEL-351RS Kestrel installation consists of three major pieces:

- Enclosure
- Control Module
- Battery

These pieces are shown in *Figure 1.1* and *Figure 1.2* and are described in the following text.



Figure 1.1 SEL-351RS Kestrel Front View With Lift-to-Open Enclosure



Figure 1.2 SEL-351RS Kestrel Front View With Swing-Open Enclosure

Enclosures

The SEL-351RS Kestrel can be ordered with either of the two enclosures shown in *Figure 1.1* and *Figure 1.2*. Both options are painted aluminum enclosures. Both enclosures are NEMA 3R rated and provides space for mounting of the control module, battery, and accessories (e.g., radio).

Opening enclosure doors provides fast and easy access to the front-panel HMI. The lift-to-open enclosure provides easy access to wiring and fuses. The swing open enclosure has a swing panel that opens for access to wiring and fuses.

Both enclosures also provide a front-door document holder.

At the rear of each enclosure (near the mounting bracket), a small screened, louvered vent is installed for the venting of battery gasses.

Mounting Accessories

Lift-to-Open Enclosure

ACCESSORY PANEL You can mount an accessory panel on the standoffs on the inside of the door on the lift-to-open enclosure (see Figure 1.3). The accessory panel is not provided by SEL.

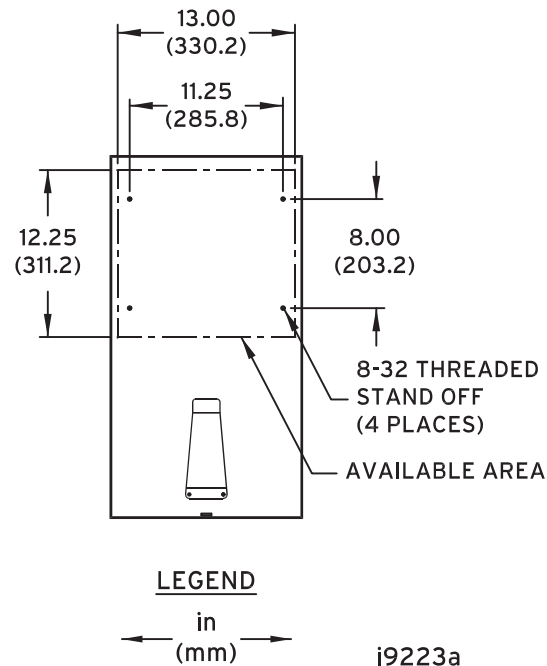


Figure 1.3 Recommended Dimensions and Drill Plan for User-Supplied Accessory Panel (Lift-To-Open Enclosure)

The user-supplied accessory panel mounts atop the stand-offs indicated in Figure 1.3. Not including accessory panel thickness, the depth available between the stand-offs and the front-panel of the SEL-351RS Kestrel module (with the enclosure door fully closed) is 3 inches (77 mm).

The left-hand inside panel of the enclosure has two pairs of stand-offs to mount the SEL-2401 Satellite-Synchronized Clock or the cabinet heater. These devices come with their own mounting hardware.

Swing Open Enclosure

ACCESSORY PANEL You can mount an accessory panel on the back panel studs of the SEL 351RS enclosure (see Figure 1.4). The accessory panel is not provided by SEL.

FIFTH THREADED STUD

The 1/4" long threaded stud located at the center-right in Figure 1.4 does not necessarily have to be secured to the accessory panel, but has to be allowed for in installation. This stud is used in other applications separate from the SEL-351RS Kestrel.

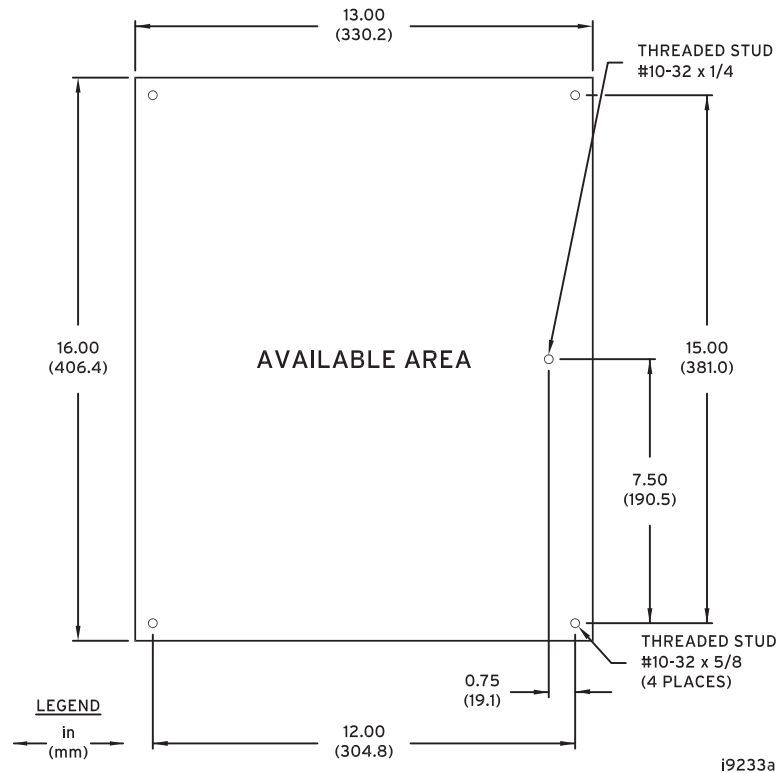


Figure 1.4 Recommended Dimensions and Drill Plan for User-Supplied Accessory Panel (Swing Open Enclosure)

Accessory mounting is facilitated by four mounting studs protruding from the back panel of the SEL-351RS Kestrel swing panel enclosure. The location of these mounting studs relative to one another is shown with the locations of the 1/4-inch diameter holes in the recommended accessory panel in *Figure 1.4*.

Mounting stud details: #10-32; 5/8-inch (15.9 mm) length.

Refer to *Figure 1.2*. When the swing panel is closed, the distance between the back panel of the SEL 351RS relay module and the back panel of the SEL 351RS enclosure is 2.75 inches (69.8 mm). This does not include space taken up by mounting an accessory panel onto the mounting studs, which subtracts from the 2.75-inch dimension.

The swing to open enclosure provides spaces for all the accessories listed for the lift-to-open enclosure in *Lift-to-Open Enclosure* on page 1.3. Additionally, there is space for a cabinet heater, the SEL-3031 Serial Radio Transceiver, or the SEL-2725 Five-Port Ethernet Switch.

Control Module

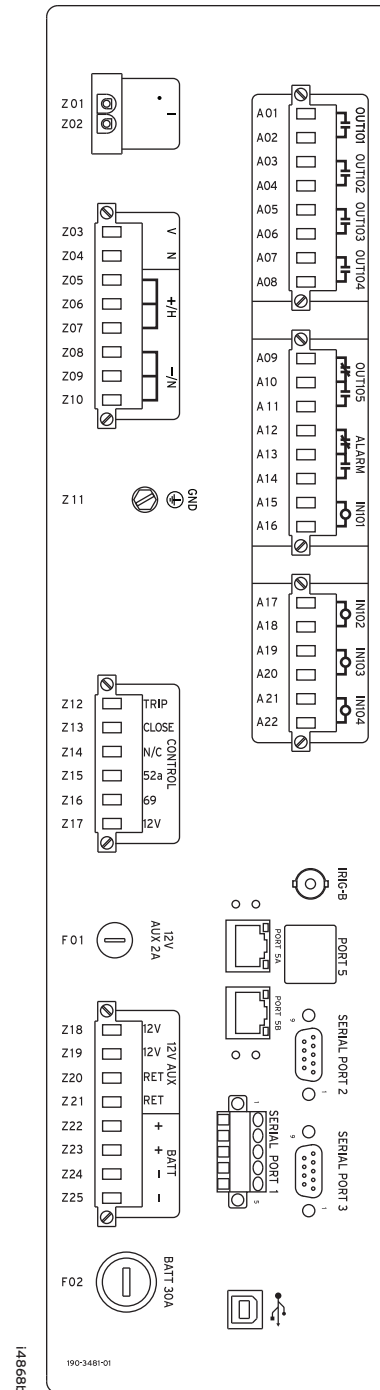


Figure 1.5 SEL-351RS Kestrel Side Panel

The control module side-panel (*Figure 1.5*) shows:

- Inputs and outputs; see *Extra Connections* on page 1.16
- Power supply; see *Power Connections* on page 1.13
- Current input; see *Recloser Connection Details* on page 1.18
- Voltage input; see *Changing the CT Tap* on page 1.13
- TRIP/CLOSE outputs and status inputs; see *Connect the Control Cable* on page 1.15

- +12V auxiliary supply; see *Extra Connections on page 1.16*
- Battery connections; see *Battery Installation and Connection on page 1.11*
- Fuses; see *Battery and Fuse Replacement on page 1.17*

These connections are discussed throughout the rest of this section. For communication connections and features see *Section 2: Getting Started With Communications*.

Battery

See *Battery Installation and Connection on page 1.11* and *Battery and Fuse Replacement on page 1.17* for more information on battery service and characteristics.

No Enclosure Option

The SEL-351RS Kestrel can be ordered from SEL without an enclosure. This option might be used where the control will be installed in a substation environment or where a custom enclosure will be used. An SEL-351RS Kestrel ordered with no enclosure consists of:

- Control Module
- Wiring Harnesses

See *Installation Steps on page 1.7* and *Recloser Connection Details on page 1.18* for details on wiring the recloser control. See *Figure 1.6* for dimensions of the SEL-351RS Kestrel control module.

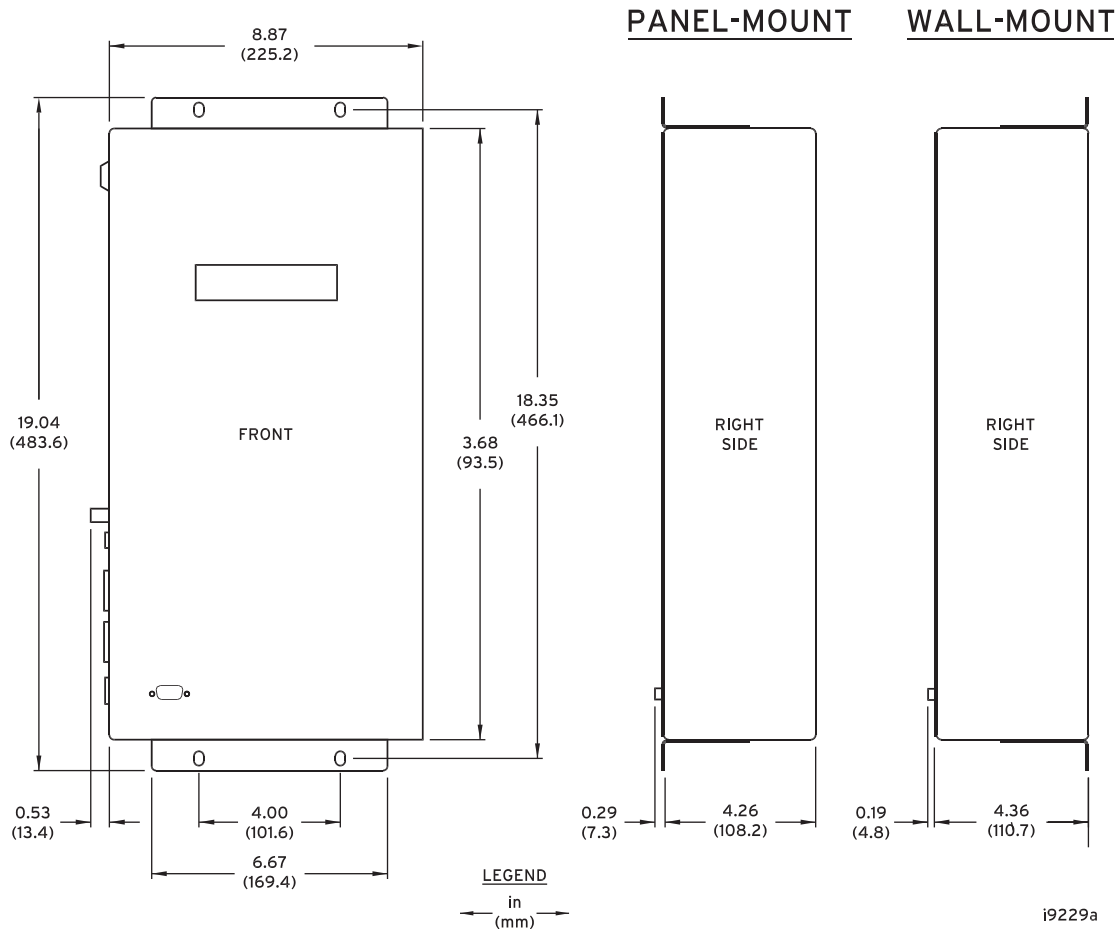


Figure 1.6 SEL-351RS Kestrel Control Module Dimensions

Installation Steps

Lift-To-Open Enclosure Mounting

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.

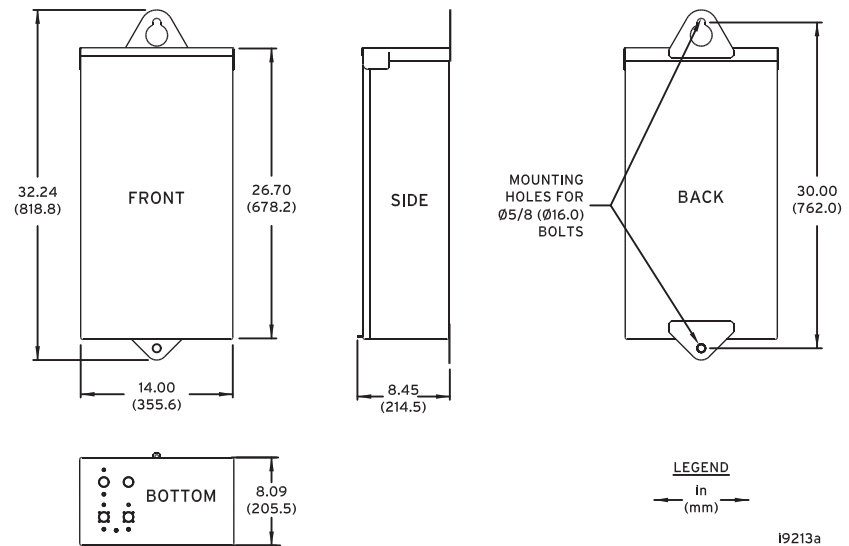


Figure 1.7 SEL-351RS Kestrel Enclosure Dimensions and Mounting Drill Plan (Lift-To-Open Enclosure)

⚠ WARNING

Take proper precautions to prevent personal injury or equipment damage when lifting and mounting the SEL-351RS Kestrel. Make sure doors are latched closed. Secure lifting attachments to the lifting holes. Lift slowly. Do not transport the SEL-351RS Kestrel with the battery inside the enclosure.

⚠ DANGER

If the recloser is energized while the control cable is disconnected from the recloser control, the CT secondaries in the control cable may generate dangerously high voltages. Do not come in contact with the pins or pin sockets in the control cable. Contact with high voltage can cause serious injury or death.

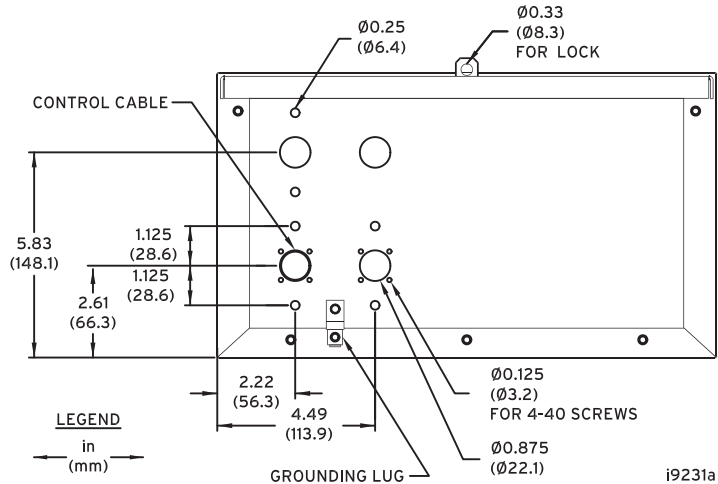


Figure 1.8 Connector Panel at Bottom of Enclosure (Lift-To-Open Enclosure)

Mounting Bolts/Washers: SEL does not provide the 5/8-inch mounting bolt/washer assemblies required for mounting the SEL-351RS Kestrel. The top mounting hole on the enclosure is 2 inches in diameter, so any washer used with the top mounting bolt must be less than 2 inches in diameter.

- Step 1. Lift slowly.
- Step 2. Slip the top mounting hole/keyway over the top mounting bolt/washer assembly.
- Step 3. Rest the unit on the bolt, settled in the keyway slot.
- Step 4. Secure the bottom mounting bracket with another mounting bolt/washer assembly.
- Step 5. Secure both top and bottom mounting bolt/washer assemblies.

The unit weighs (fully-featured) 11.34 kg (25 lb.), without the battery. Battery weights are given in *Table 5.2*.

Swing Open Enclosure Mounting

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.

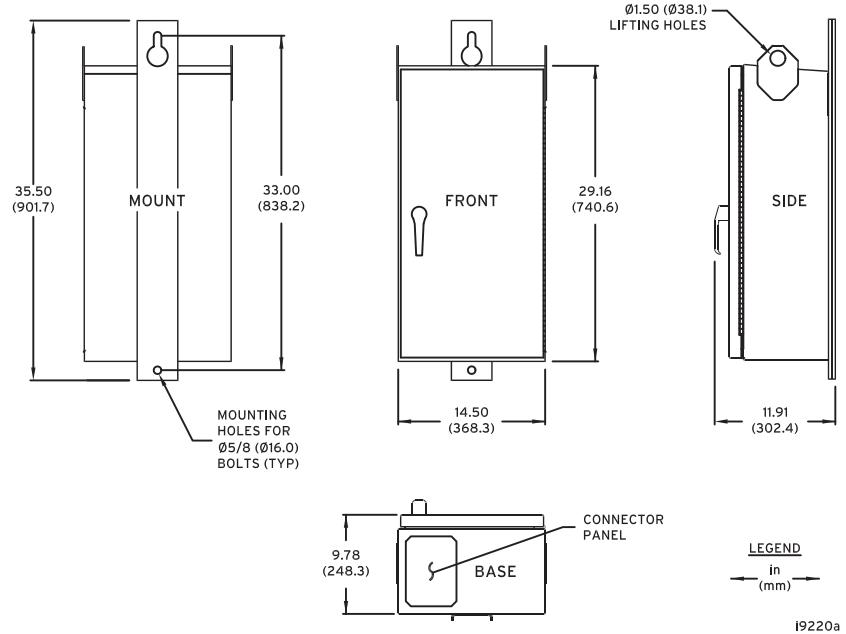


Figure 1.9 SEL-351RS Kestrel Enclosure Dimensions and Mounting Drill Plan (Swing Open Enclosure)

WARNING

Take proper precautions to prevent personal injury or equipment damage when lifting and mounting the SEL-351RS Kestrel. Make sure doors are latched closed. Secure lifting attachments to the lifting holes. Lift slowly. Do not transport the SEL-351RS Kestrel with the battery inside the enclosure.

DANGER

If the recloser is energized while the control cable is disconnected from the recloser control, the CT secondaries in the control cable may generate dangerously high voltages. Do not come in contact with the pins or pin sockets in the control cable. Contact with high voltage can cause serious injury or death.

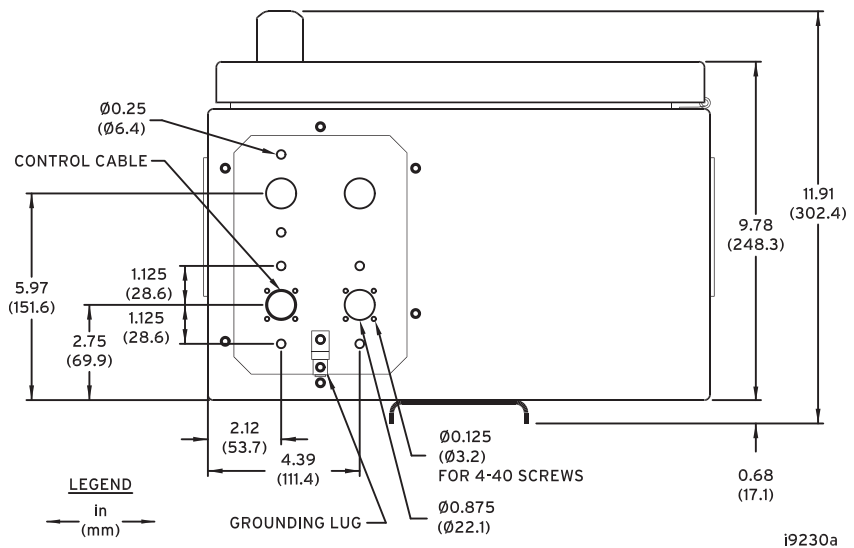


Figure 1.10 Connector Panel at Bottom of Enclosure (Swing Open Enclosure)

Mounting Bolts/Washers: SEL does not provide the 5/8-inch mounting bolt/washer assemblies required for mounting the SEL-351RS Kestrel. The top mounting hole on the enclosure is 2 inches in diameter, so any washer used with the top mounting bolt must be less than 2 inches in diameter.

The SEL-351RS Kestrel has one 1.5 inch diameter lifting-hole on each side of the enclosure.

- Step 1. Secure lifting attachments to the lifting holes.
- Step 2. Lift slowly.
- Step 3. Slip the top mounting hole/keyway over the top mounting bolt/washer assembly.

- Step 4. Rest the unit on the bolt, settled in the keyway slot.
- Step 5. Secure the bottom mounting bracket with another mounting bottom bolt/washer assembly.
- Step 6. Secure both top and bottom mounting bolt/washer assemblies.

The unit weighs 17.8 kg (≤ 40 lb.), without the battery. Battery weights are given in *Table 5.2*.

Control Grounding

IMPORTANT: All devices interfacing to the SEL-351RS Kestrel Recloser Control must be connected to the same pole ground. Figure 1.11 shows a suggested method of making these connections.

IMPORTANT: All connections to the SEL-351RS Kestrel Recloser Control must be routed in close proximity to and parallel to their corresponding ground paths for adequate surge protection. The connections and their ground paths should be approximately equal in length. Use applicable IEEE and IEC grounding standards. Follow the proceeding recommendations to reduce high potentials from surges that can damage equipment.

IMPORTANT: All external control wiring brought into the SEL-351RS Kestrel Recloser Control enclosure should be protected within shielded cables. Ground these cable shields inside the enclosure at the hex head bolt (#10-32, stainless steel) that protrudes through the floor of the enclosure.

ENCLOSURE OPENINGS

No openings into the SEL-351RS Kestrel enclosure should be left uncovered with the exception of the vented hole plugs provided by SEL. Any conduit or other wire entry must be properly sealed.

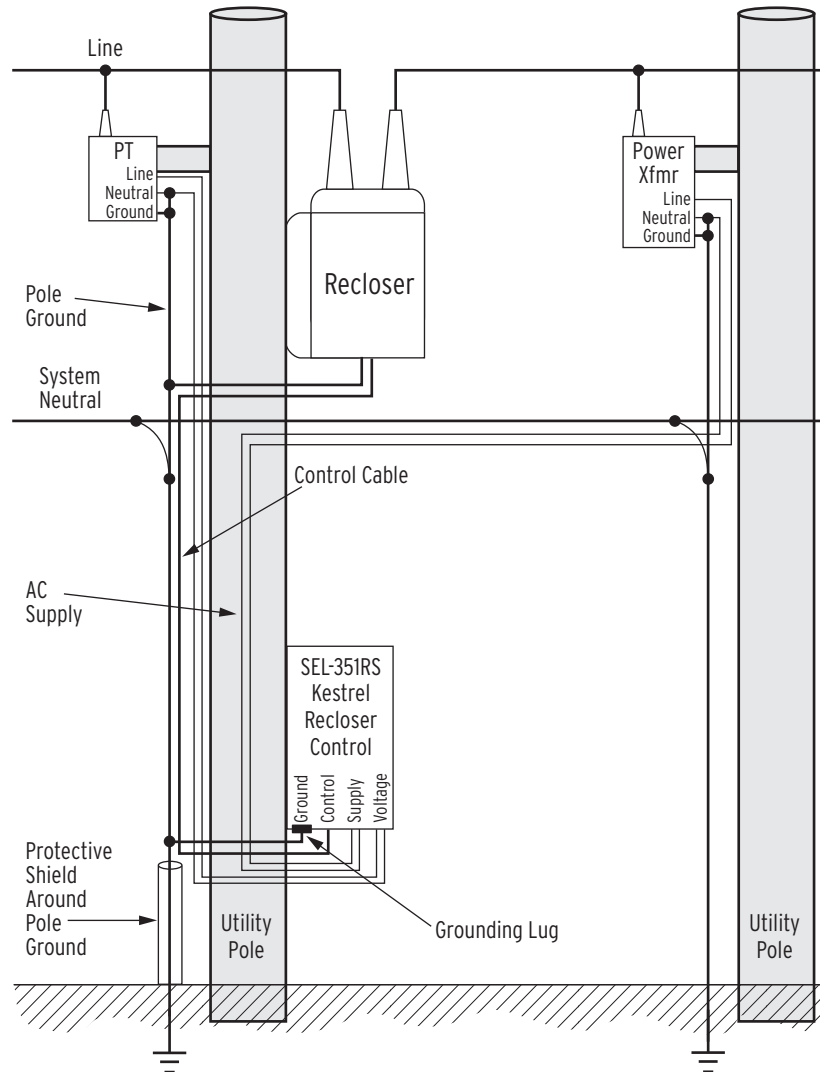


Figure 1.11 SEL-351RS Kestrel Recloser Control Customer Ground Connection to Required System Grounding

- Step 1. Connect the pole ground to the grounding lug on the bottom of the recloser control enclosure as shown in *Figure 1.11*.

The grounding lug accommodates No. 10 through No. 4 conductors (solid or stranded). A protective shield around the pole ground is suggested to help prevent physical damage to the ground wire.

Step 2. Ground all devices interfacing to the recloser control at the same pole ground.

Devices include: recloser, power transformer, potential transformers/voltage transducers, and SCADA equipment. Even devices on adjacent poles with their own pole ground (e.g., power transformer) must still connect to the pole ground for the recloser control.

Step 3. Route the control cable in close proximity to and parallel with the recloser ground.

Step 4. Route ac supply voltage and PT (potential transformer) voltage connections in parallel with their transformer ground paths.

Step 5. Ground shielding for additional control wiring connections.

Step 6. Make these ground connections to the hex head bolt, mentioned in *Step 1*, that protrudes through the floor of the enclosure.

Step 7. Bring all other points that require grounding (e.g., a radio) inside the SEL-351RS Kestrel enclosure to the hex head bolt and make the connections secure.

Note that the control module is grounded at this protruding hex head bolt.

Step 8. When installing the recloser control and recloser, include the following according to the manufacturers' recommendations:

- Protection of the recloser and the power transformer with lightning arresters.
- Grounding of the recloser head and tank.
- Grounding of the power transformer tank.
- Grounding of the control cabinet.

Battery Installation and Connection

CAUTION

Disconnect the battery from the relay module (using the Quick Disconnect) before disconnecting the battery terminals and removing the battery. Connect the Quick Disconnect last when installing the battery.

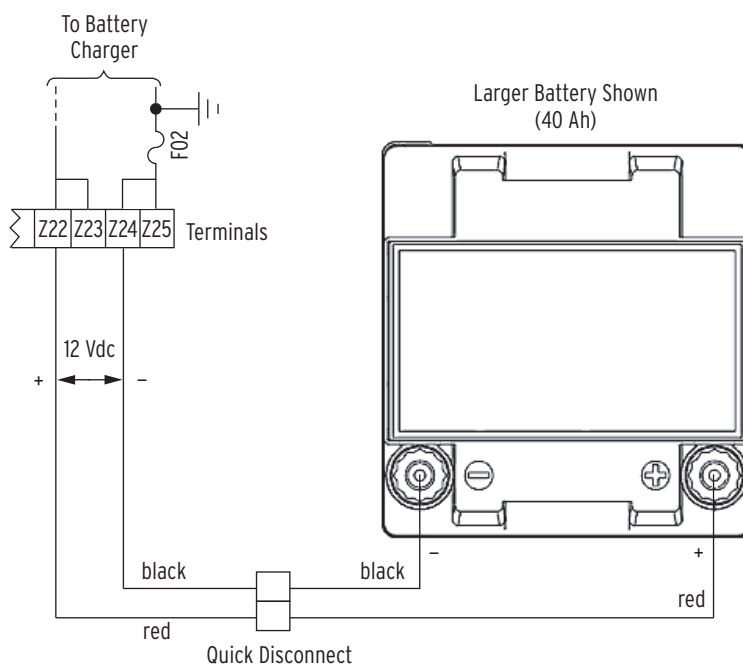


Figure 1.12 Battery Wiring Harness Connections (Shown Connected to Relay Module)

- Step 1. Follow any manufacturer installation recommendations and warnings for the battery.
- Step 2. If the Quick Disconnect of the battery wiring harness is not already unplugged (pulled apart into its two separate mating pieces), unplug it.
- The battery harness should now be in two separate pieces.
- Step 3. Connect the appropriate half of the battery wiring harness (the Quick Disconnect still unplugged) to terminals Z22 and Z24 on the SEL-351RS Kestrel relay module (see *Figure 1.12*).
- Connect the red wire to terminal Z22 (BATT +).
 - Connect the black wire to terminal Z24 (BATT -).
- Step 4. Connect the other half of the battery wiring harness (the Quick Disconnect still unplugged) to the 12 V battery terminals (see *Figure 1.12*).
- Connect the red wire to the positive (+) battery terminal.
 - Connect the black wire to the negative (-) battery terminal.

Make sure that this half of the battery wiring harness is oriented correctly on the battery for the eventual reconnection of the Quick Disconnect after the battery is put back inside the enclosure.

- Step 5. Unbuckle and move the side-release buckle strap so that the raised battery platform is clear.
- The strap should already be fitted underneath the slots provided on the raised platform.
- Step 6. Set the 12 V battery on the raised battery platform, with the battery terminals up and the battery wiring harness oriented correctly.
- Step 7. Fasten and secure the side-release buckle strap over the battery, keeping the battery terminals clear.
- Step 8. Plug in the Quick Disconnect of the battery wiring harness (joining together its two separate mating pieces), making the battery wiring harness one continuous piece again.

The battery is now fully connected to the SEL-351RS Kestrel relay module.

WARNING

Do not transport the SEL-351RS Kestrel with the battery inside the enclosure.

Wake Up

With the battery installed, press the front-panel **WAKE UP** pushbutton to energize the SEL-351RS Kestrel.

If the unit turns on, the **ENABLED** LED illuminates and the **BATTERY PROBLEM** LED remains extinguished.

If the unit does not turn on, check the following items:

- Battery condition.
- Battery fuse (panel-mount fuse **F02** on the side panel of the control module, next to **Z22** through **Z25** connections). See *Figure 1.12* and *Table 1.1*.

Note that application of 120/220 Vac or 125/250 Vdc voltage always energizes the SEL-351RS Kestrel.

Power Connections

The SEL-351RS Kestrel operates on the following power supply voltages:

- 120/220 Vac
- 125/250 Vdc

Figure 1.13 shows the simplest 120 Vac power connection. Note that fuse protection is provided internally and is not user replaceable.

NOTE: When 120/220 Vac or 125/250 Vdc power is correctly connected to the SEL-351RS, the front-panel **AC SUPPLY** LED illuminates. If it is still extinguished, check connections and contact factory for assistance.

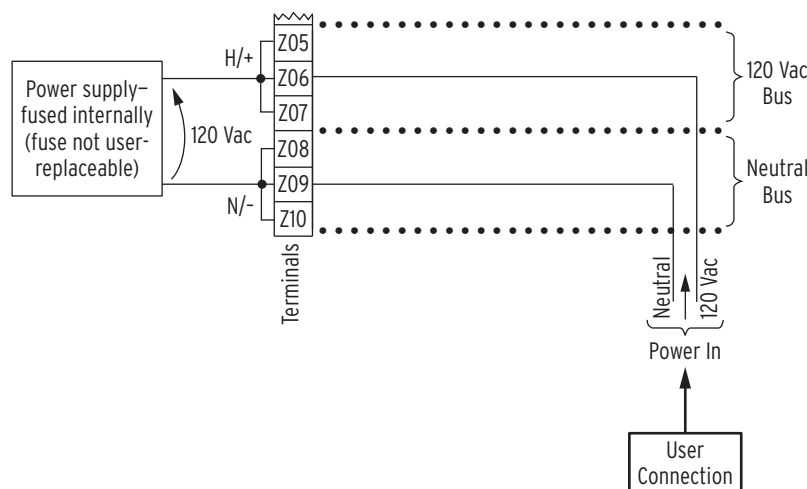


Figure 1.13 120 Vac Power Connection

Optional Convenience Outlet Connections

CAUTION

When ordered with the optional convenience outlet, the incoming power to the SEL-351RS Kestrel is routed directly to the convenience outlet. This voltage could be 120/220 Vac or 125/250 Vdc. Ensure that any device to be connected to this outlet is compatible with the voltage that is being supplied to the SEL-351RS Kestrel.

The SEL-351RS Kestrel can be ordered with an optional fused convenience outlet in conjunction with the swing-open enclosure. In this configuration, incoming power will land on a terminal block mounted on the back panel of the enclosure before being routed to the SEL-351RS Kestrel and the convenience outlet (see Figure 1.14).

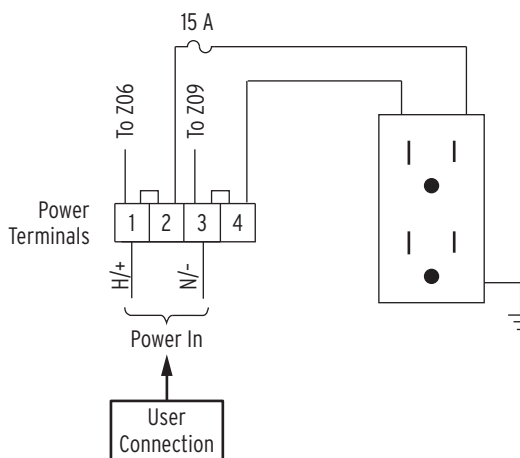


Figure 1.14 Incoming Power With Convenience Outlet Ordering Option

Changing the CT Tap

From the factory, the High CT Tap is connected to current inputs Z01 and Z02 via a uniquely keyed two-pin connector, as seen in Figure 1.18. The Low CT Tap connector is keyed the same but is not connected (N/C) to anything. From the factory, the unconnected Low CT Tap connector is covered with a protective boot.

If a change is made from the High CT Tap to the Low CT Tap, the secondary current into the SEL-351RS Kestrel Recloser control will double in magnitude for the same primary current. Thus, settings especially need to be changed before making such a CT tap transition so that tripping on load does not occur.

To operate from a different CT tap, perform the following steps (refer to *Figure 1.18*):

- Step 1. Disconnect the presently connected CT tap from current inputs Z01 and Z02.
- Step 2. Change the settings in any settings group that may possibly be used.
 - For all setting groups with EZ settings enabled:
Change EZ setting: CT Ratio.
 - For all setting groups with EZ settings not enabled:
Change Group setting: CTR and all overcurrent element pickup settings.

Example: If CT tap is changed from 1000:1 to 500:1, change existing pickup setting 51P1P=1A secondary to 51P1P=2A secondary, as the secondary current will double in magnitude for the same primary current.
- Step 3. Connect the previously identified, unconnected CT tap to current inputs Z01 and Z02.
- Step 4. Install the protective boot on the newly disconnected CT tap connector.
- Step 5. Check metering to verify load.

Phase Voltage Connection

PT (Potential Transformer) Connection

The SEL-351RS Kestrel has one voltage input V/N (terminals Z03 and Z04). Refer to *120/220 Vac Power Supply Voltage as Voltage Input* if PT is not available.

See *Settings for Voltage Input Configuration* in *Section 9: Settings* of the SEL-351RS Kestrel Recloser Control Instruction Manual for more details.

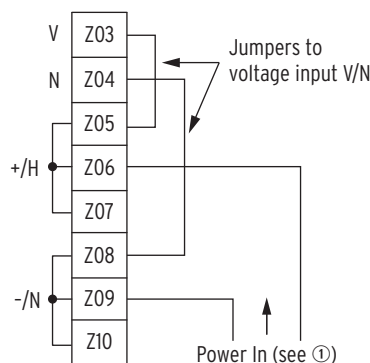
See *Voltage Connection for Metering* and *Phantom Metering for Different Phase Voltage Connection* in *Section 8: Metering and Monitoring* and *Settings for Voltage Input Configuration* in *Section 9: Settings* of the SEL-351RS Kestrel Recloser Control Instruction Manual for more details.



Figure 1.15 Phase Voltage Connection

120/220 Vac Power Supply Voltage as Voltage Input

Install jumpers to bring 120/220 Vac to voltage input V/N when sensing voltage is not brought separately to the SEL-351RS Kestrel unit (see *Figure 1.16*).



① Figure 1.13

Figure 1.16 Install Jumpers from 120/220 Vac Power Bus to Voltage Input V

Verify Settings/Set Date and Time

CAUTION

Do not connect the SEL-351RS Kestrel to an energized recloser until all control settings have been properly programmed and verified. Failure to comply can result in control and recloser misoperation, equipment damage, and personal injury.

Note that this step presumes that the factory-set **ALTERNATE SETTINGS** operator control is operative.

- Step 1. If the alternate settings are not going to be used, copy the main settings (Settings Group 1) to the alternate settings (Settings Group 2) with the **COPY** command (i.e., **COP 1 2**).

The settings in both settings groups will then be the same. If the **ALTERNATE SETTINGS** operator control pushbutton is accidentally pressed (switching the active settings group), the SEL-351RS Kestrel still operates on the same settings. Refer to *Factory EZ Settings on page 4.3* for more information on main and alternate settings.

- Step 2. Set the date and time with the **DATE** and **TIME** commands (**DAT** and **TIM**, respectively).

Connect the Control Cable

DANGER

If the recloser is energized while the control cable is disconnected from the recloser control, the CT secondaries in the control cable may generate dangerously high voltages. Do not come in contact with the pins or pin sockets in the control cable. Contact with high voltage can cause serious injury or death.

Note that the control cable carries the current signal, among other signals, between the recloser and the SEL-351RS Kestrel.

Connect the 10-pin recloser control cable to the control cable receptacle at the bottom of the SEL-351RS enclosure (see *Figure 1.8* and *Figure 1.10*). *Table 1.1* gives the pin descriptions for the control cable.

Table 1.1 Control Cable Receptacle Pin Descriptions

A	Monitored Auxiliary Contact (52a)	F	Current Return (Low CT tap) ^{a, b}
B	Monitored 69 Contact	G	Recloser Ground
C	Terminal Current, I (High CT tap) ^a	H	+12 Vdc (Whetting Voltage) for monitoring recloser status
D	Current Return (High CT tap) ^a	J	Trip
E	Terminal Current, I (Low CT tap) ^{a, b}	K	Close

^a See Figure 1.18 and accompanying text for explanation on high and low CT taps

^b Only applicable for G&W Viper-SP single-phase recloser.

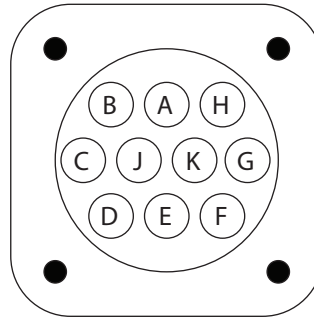


Figure 1.17 Control Cable Receptacle Pinouts (view from inside enclosure)

Metering Check

- Step 1. Press the front-panel **METER** pushbutton and select the **INST** (instantaneous metering) option.
- Step 2. Scroll through the instantaneous (fundamental) metering values (primary), checking current **I** magnitude and angle for expected values. If values are not expected, suspect a wiring problem or setting problem.
- Step 3. Do similar checks for the voltage connection with the instantaneous metering screens. If voltage **V** shows an abnormally high voltage level, suspect a wiring problem or setting problem.

Extra Connections

Connect extra I/O, and auxiliary 12 Vdc power as needed in the application.

Extra Inputs/Outputs

Optoisolated inputs IN102–IN104 and output contacts OUT101–OUT104 are an ordering option. Output contacts OUT105 and ALARM and optoisolated input IN101 are standard. In *Figure 1.5*, notice that the output contact types are:

- Form A (normally open): **OUT101–OUT104**
- Form C (normally closed/normally open): **OUT105** and **ALARM**

Ratings for the optoisolated inputs and output contacts are found in *Section 6: Specifications*. The connectors for the optoisolated inputs and output contacts accept wire size AWG 24 to 12. Strip the wires to 0.31 inch (8 mm) and install with a small slotted-tip screwdriver.

+12 Vdc Auxiliary Power Supply

A +12 Vdc auxiliary power supply rated for 13 W continuous is a standard feature. Use this supply to power radios, or other accessories installed in the cabinet. Two +12 Vdc and two return terminal screws are provided for convenience. Fuse F01 protects this +12 Vdc auxiliary power supply (fuse F01 is in-line with Z18 and Z19; see *Table 1.2*).

Relay Module Main Board Jumpers and Clock Battery

- The SEL-351RS Kestrel has features that very infrequently (if at all) need to be set or changed. These features are:
- Access and breaker control jumpers
 - Serial port voltage jumpers
 - Clock battery

See *Section 2: Additional Installation Details* in the SEL-351RS Kestrel Recloser Control Instruction Manual to access the jumpers and clock battery.

Battery and Fuse Replacement

See *Battery Replacement on page 5.3* for details on battery replacement.

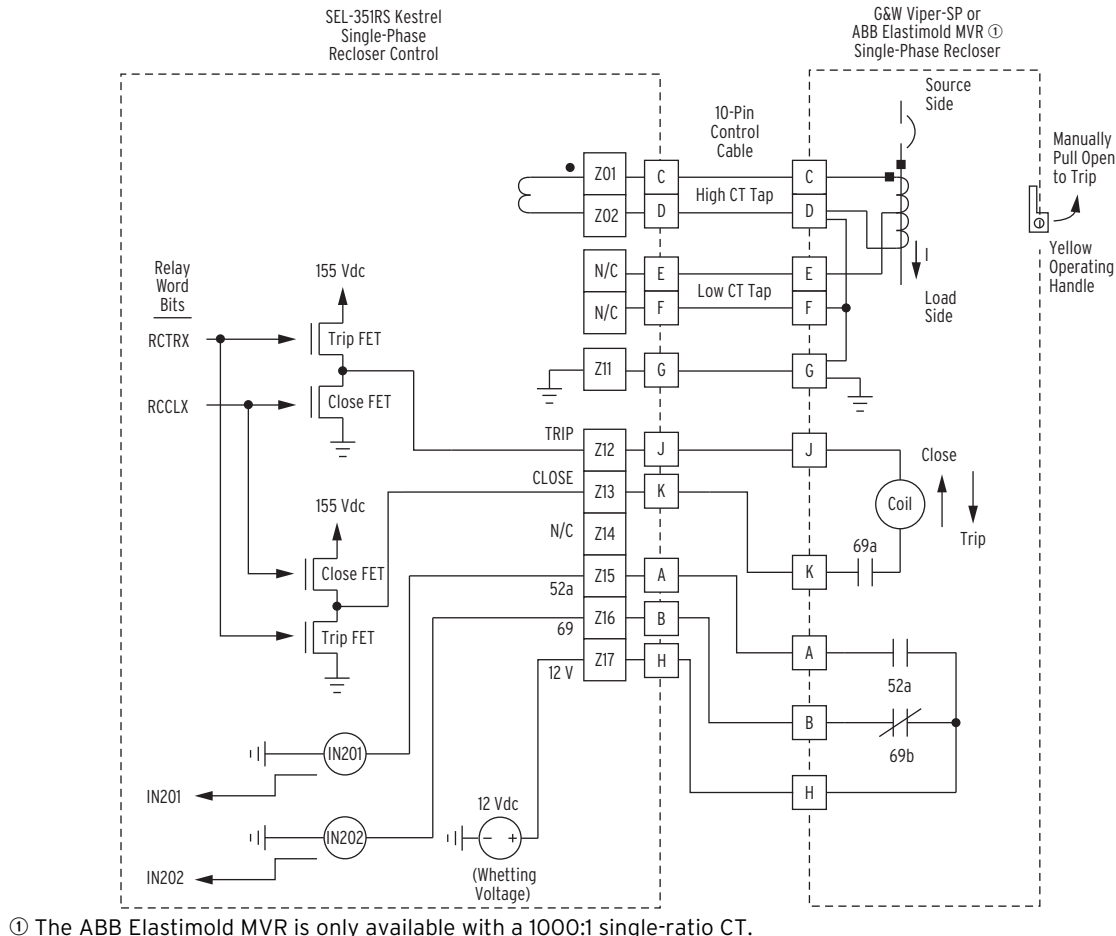
See *Figure 1.5* for fuse positions F01–F02 on the side panel of the relay module.

Table 1.2 Replacement Fuses for the SEL-351RS Kestrel Recloser Control

Fuse Location	Ampere Rating	Dimensions	Manufacturer	Catalog Numbers	Purpose
Side panel-mounted fuse holder F01	2 A	0.25 x 1.25" (6.4 x 31.8 mm)	Littelfuse Bussman	313002 MDL-2	Protect accessible 12 Vdc auxiliary power supply.
Side panel-mounted fuse holder F02	30 A	0.25 x 1.25" (6.4 x 31.8 mm)	Littelfuse Bussman	314030 ABC-30	Protect battery and charger circuitry from inadvertent short.
Swing-open panel-mounted fuse holder ^a	15 A	0.25 x 1.25" (6.4 x 31.8 mm)	Littelfuse Bussman	314015 BK/ABC-15	Protect convenience outlet for overload or line-to-line short circuits (10 A load limit).

^a Convenience outlet ordering option.

Recloser Connection Details



① The ABB Elastimold MVR is only available with a 1000:1 single-ratio CT.

Figure 1.18 Control Cable Connections Between SEL-351RS Kestrel and G&W Viper-SP or ABB Elastimold MVR Single-Phase Recloser

The G&W Viper-SP is equipped with a multi-ratio CT with either 1000/500:1 CT taps or 400/200:1 CT taps. When the recloser is ordered with 1000/500:1 CT taps, then High CT Tap = 1000:1 and Low CT Tap = 500:1. Similarly, when the recloser is ordered with 400/200:1 CT taps, then High CT Tap = 400:1 and Low CT Tap = 200:1.

Factory wiring connects the highest of the available CT taps (1000:1 or 400:1) to current inputs Z01 and Z02. For more sensitivity, change the CT connection to the Low CT Tap (500:1 or 200:1; see *Changing the CT Tap*).

⚠ DANGER

Do not come in contact with the pins of the control cable. High voltages may be present when the recloser is energized.

The ABB Elastimold MVR is equipped with a 1000:1 single-ratio CT.

Change current transformer polarity with Global EZ setting Current Transformer Polarity or Global setting CTPOL, designating forward or reverse power flow.

Figure 1.18 shows the factory wiring for trip/close circuit connections between the SEL-351RS Kestrel and the G&W Viper-SP or ABB Elastimold MVR single-phase recloser.

Relay Word Bit RCTR (Trip) turns on the Trip FETs connected to terminals Z13 and Z12, causing current to flow in the Trip direction.

Relay Word Bit RCCLX (Close) turns on the Close FETs connected to terminals Z13 and Z12, causing current to flow in the Close direction.

The 69a contact in the trip/close circuit opens and stays open when the external yellow operating handle on the recloser is pulled to the lock-open position. With contact 69a open, there is no way to close the recloser until the yellow operating handle is reset.

Input IN202 monitors the status of the yellow operating handle. The 69b contact closes when the yellow operating handle goes to the lock-open position. Input IN202 is used in SELOGIC control equation setting 79DTL (drive-to-lockout).

Input IN201 monitors the 52a recloser status.

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Section 2

Getting Started With Communications

Overview

Topics covered in this section:

- Establishing communications with serial and USB ports
- Communications port pinouts
- Communications cables
- Commands
- Access levels
- Password protection

Refer to *Section 10: Communications* in the SEL-351RS Kestrel Recloser Control Instruction Manual for detailed information on all the communications available in the SEL-351RS Kestrel® Recloser Control.

Establishing Communications With Serial and USB Ports

This part of this section shows how to establish local communications with the control using serial and USB ports only. Refer to the SEL-351RS Kestrel Recloser Control Instruction Manual for instructions on establishing communications with other ports.

Establishing Communications Using a Serial Port

Use the front serial port and any terminal emulation program or the ACCELERATOR QuickSet® SEL-5030 Software to begin communicating with the recloser control. Connect an SEL C234A cable between the control and a personal computer. The factory default communications parameters for the serial port are:

- Baud Rate = 9600
- Data Bits = 8
- Parity = N
- Stop Bits = 1

Press the **<Enter>** key, and the SEL-351RS Kestrel will respond with a = prompt, which indicates that Level 0 access is established—see *Table 2.7*.

Establishing Communications Using the USB Port

USB Port Overview

The USB port has no settings, and is faster than the serial ports, especially for operations requiring transport of large blocks of data such as long event reports or firmware upgrades.

Each time you connect a recloser control to your PC USB port, Windows determines if a driver has already been installed and is ready for use. There are three possibilities:

1. Connect a PC for the first time to a recloser control USB port.

Windows launches the **Found New Hardware Wizard**. The wizard guides you through the USB driver installation process and creates a new virtual COM port (e.g., COM 4).

See *Detailed Instructions for USB Port Driver Installation* on page 2.3 before connecting the recloser control to your PC USB port.

2. Reconnect a PC to a recloser control USB port using a different physical USB port on a PC (i.e., same PC, different physical USB port on the PC).

Windows launches the **Found New Hardware Wizard**. Select **Install the software automatically (Recommended)** and click **Next**. Windows locates the required INF file and driver, and creates a new virtual COM port (e.g., COM 5).

Windows creates a new virtual COM port (e.g., COM 6, COM 7) each time you connect a recloser control to a physical USB port that has not previously been connected to a recloser control. The virtual COM port number remains associated with the same physical USB port until you uninstall the driver.

3. Reconnect a PC to a recloser control USB port using a physical USB port on the PC that has already been connected to a recloser control (i.e., same PC, same physical USB port on the PC).

Windows recognizes that the driver is already installed, and creates the same virtual COM port created the first time you connected a recloser control to that particular physical USB port (e.g., COM 4). No action is required on your part.

The USB driver exposes normal communications port settings to the personal computer operating system, such as baud rate, parity, etc. to maintain compatibility with many PC applications. Changing these settings in the PC does not change how the recloser control USB port operates. You can use a PC terminal emulator program or dedicated software to connect to the SEL-351RS Kestrel via USB port. The USB port offers a subset of the functionality of a standard serial port—see *Table 10.6* in the SEL-351RS Kestrel Recloser Control Instruction Manual for details.

USB uses a connection based protocol. Under certain circumstances, such as power cycling the recloser control, the USB connection may be terminated. If the USB connection is terminated it may be necessary to reconnect to the recloser control using the PC application software, or disconnect and then reconnect the USB connector at either the PC or the recloser control.

ACSELERATOR QuickSet is more tolerant to unexpected USB device disconnections than most other PC applications. While using ACSELERATOR QuickSet, it is possible to disconnect the USB cable from one recloser control and move it to another recloser control without the need to restart the application, reselect the COM port, or even disconnect and reconnect at the application level.

Detailed Instructions for USB Port Driver Installation

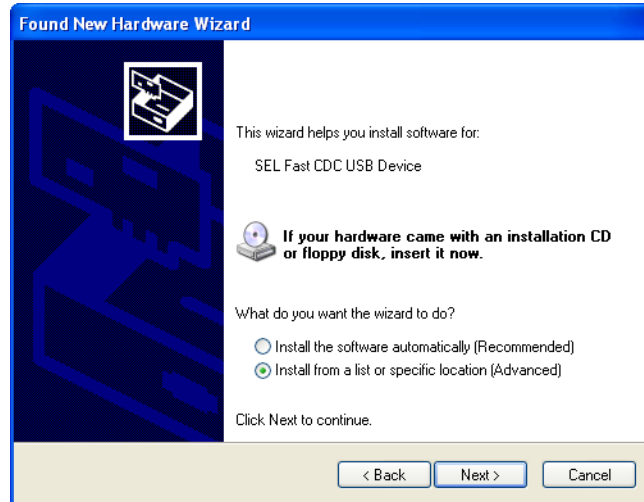
The following detailed instructions for USB driver installation are specifically for the Windows XP operating system. Some steps may be different and some screens may be changed for other Windows operating systems.

- Step 1. Retrieve the USB driver file “SEL Fast CDC USB Device.INF” from the SEL-351RS Kestrel product page on the SEL website (selinc.com) or from the ACSELERATOR QuickSet SEL-5030 Installation CD. Place the INF file in any convenient directory, such as C:\SEL\Drivers\Control_USB.
- Step 2. Connect the recloser control to your PC with SEL Cable C664, or any standard A to B USB cable. Your PC will recognize that a new device has been connected, and will start the **Found New Hardware Wizard**. Select **No, not this time** and click **Next**. Some Windows XP systems will skip this screen and go to the screen shown in *Step 3*. Click **Next**.

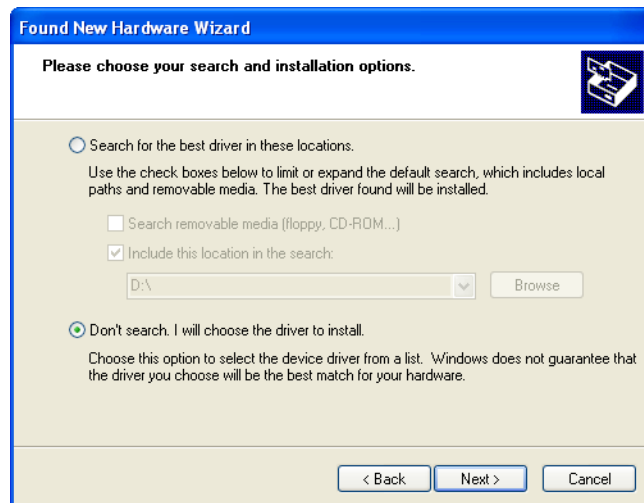
NOTE: The SEL-351RS Kestrel USB driver is different than the driver used for SEL EIA-232 serial to USB converter cable C662, and is different from the driver used for the SEL-2440 Discrete Programmable Automation Controller.



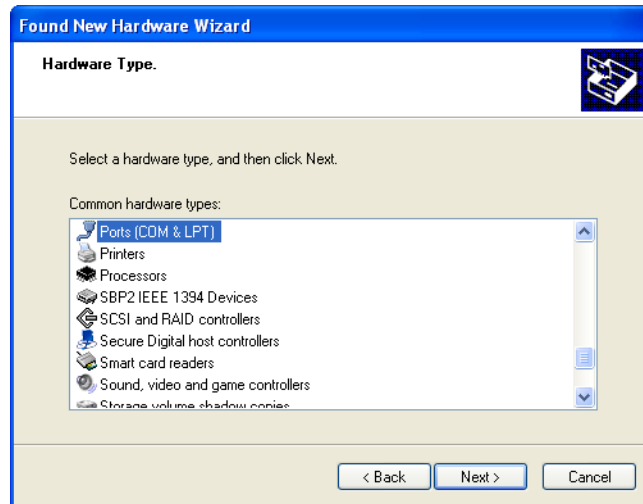
Step 3. Select **Install from a list or specific location (Advanced)**. Click **Next**.



Step 4. Select **Don't search. I will choose the driver to install**. Click **Next**.



- Step 5. If prompted for a hardware type select **Ports (COM & LPT)** and click **Next**. Some Windows XP systems will skip this screen and go to the next screen.

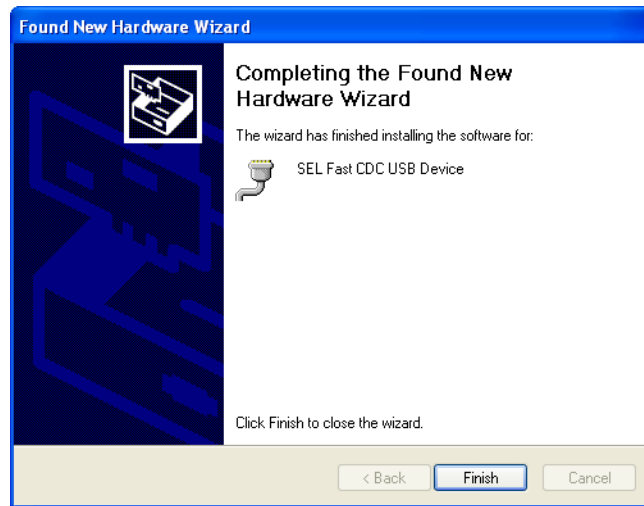


- Step 6. If necessary, use the **Have Disk** button and direct the wizard to the folder containing the INF file you copied to your local drive in *Step 1*. After you locate the INF file, the **Found New Hardware Wizard** will return to the screen shown below. Verify the selected **Model** is **SEL Fast USB CDC Device**. Click **Next**.

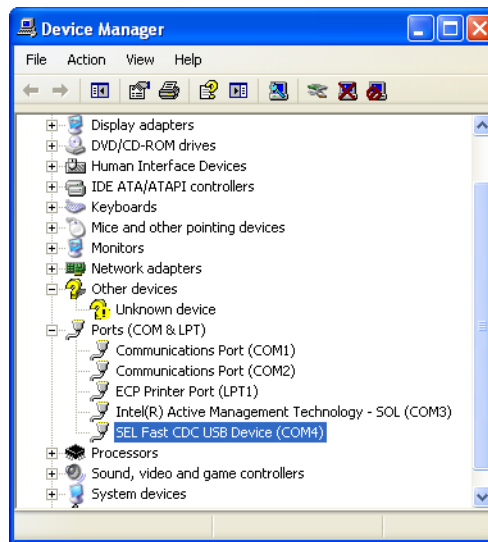


- Step 7. If Windows warns that the driver has not passed Windows Logo testing, verify that the name **SEL Fast CDC USB Device** matches the Model selected in *Step 6*, and then click **Continue Anyway**.
- Step 8. Wait while the wizard installs the driver software.

Step 9. Click **Finish** to finish the installation process.



The USB port driver is now installed, and a new virtual COM port (e.g., COM 4) is ready for use. To see what virtual COM port has been created, launch any communications program that allows selection of a COM port, and view the available ports, or go to the Windows Device Manager and inspect the available COM ports as shown below. Use Device Manager to verify which virtual COM port is associated with a particular physical USB port. Device Manager updates the available COM ports each time a cable is inserted or removed.



To test the USB port and the newly installed driver follow these steps:

- Step 1. Launch ACSELERATOR QuickSet, and select **Communications > Parameters** from the menu, or click the **Communications Parameters** icon from the opening screen. See *Section 3: PC Software* in the SEL-351RS Kestrel Recloser Control Instruction Manual for more information on ACSELERATOR QuickSet. Select the new COM port created by the driver installation process, e.g., COM 4 in the screen capture. Ignore other settings like parity and baud rate. They

have no effect on how the USB port operates, and are only presented to the operating system to retain compatibility with certain applications.

- Step 2. Select **Communications > Terminal** from the menu, or click the terminal icon on the tool bar. Log into the recloser control normally. The USB port should work similarly to an EIA-232 port, only much faster. See *Table 10.6* in the SEL-351RS Kestrel Recloser Control Instruction Manual for a list of features available from the USB port.

Communications Port Pinouts

Hardware Handshaking

All EIA-232 serial ports support RTS/CTS hardware handshaking. RTS/CTS handshaking is not supported on the EIA-485 Serial Port 1.

To enable hardware handshaking, use the **SET P** command (or front-panel **SET** pushbutton) to set **RTSCTS = Y**. Disable hardware handshaking by setting **RTSCTS = N**.

- If **RTSCTS = N**, the control permanently asserts the RTS line.
- If **RTSCTS = Y**, the control deasserts RTS when it is unable to receive characters.
- If **RTSCTS = Y**, the control does not send characters until the CTS input is asserted.

Figure 2.1 and *Table 2.1* through *Table 2.3* show the functions of the pins and terminals of the serial ports.

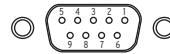


Figure 2.1 DB-9 Connector Pinout (Female) for EIA-232 Serial Ports

Table 2.1 EIA-232 Pinout Functions

Pin	Port 2	Port 3	Port F
1	N/C or +5 Vdc ^a	N/C or +5 Vdc ^a	N/C
2	RXD	RXD	RXD
3	TXD	TXD	TXD
4	+IRIG-B	N/C	N/C
5, 9	GND	GND	GND
6	-IRIG-B	N/C	N/C
7	RTS	RTS	RTS
8	CTS	CTS	CTS

^a See EIA-232 Serial Port Voltage Jumpers in Section 2: Additional Installation Details of the SEL-351RS Kestrel Recloser Control Instruction Manual.

Table 2.2 Terminal Functions for EIA-485 Serial Port 1

Terminal	Function
1	+TX
2	–TX
3	+RX
4	–RX
5	SHIELD

Table 2.3 Serial Communications Port Pin Function Definitions

Pin Function	Definition
N/C	No Connection
+5 Vdc (0.5 A combined limit)	5 Vdc Power Connection
RXD, RX	Receive Data
TXD, TX	Transmit Data
IRIG-B	IRIG-B Time-Code Input
GND	Ground
SHIELD	Shielded Ground
RTS	Request To Send
CTS	Clear To Send
DCD	Data Carrier Detect
DTR	Data Terminal Ready
DSR	Data Set Ready

Communications Cables

Table 2.4 SEL Communications Cable Guide (Sheet 1 of 2)

NOTE: Listing of devices not manufactured by SEL in Table 2.4 is for the convenience of our customers. SEL does not specifically endorse or recommend such products, nor does SEL guarantee proper operation of those products, or the correctness of connections over which SEL has no control.

SEL-351RS Kestrel Port	Connect To Device (gender refers to the device)	SEL Cable
All EIA-232 ports	Laptop PC, 9-Pin Mate (DTE)	C234A
All EIA-232 ports	PC, 25-Pin Male (DTE)	C227A
All EIA-232 ports	PC, USB	C662
All EIA-232 ports	SEL Communications Processor or SEL-2100 Without IRIG	C272A
Serial Port 2	SEL Communications Processor or SEL-2100 With IRIG	C273A
All EIA-232 ports	SEL-PRTU	C231
All EIA-232 ports	SEL-DTA2	C272A
Serial Port 2 and Serial Port 3 ^a	StarComm® Modem, 5 Vdc Powered	C220
All EIA-232 ports	Standard Modem, 25-Pin Female (DCE)	C222
All EIA-232 ports	RFL-9660	C345A
USB Port	PC, USB	C664
Ethernet	PC or Switch (Ethernet RJ45, straight-through)	C627

Table 2.4 SEL Communications Cable Guide (Sheet 2 of 2)

SEL-351RS Kestrel Port	Connect To Device (gender refers to the device)	SEL Cable
Ethernet	PC or Switch (Ethernet RJ45, crossover)	C628
Ethernet	PC or Switch (Ethernet LC Fiber-Optic)	C807

^a A corresponding main board jumper must be installed to power the StarComm Modem with +5 Vdc (0.5 A limit) from the SEL-351RS Kestrel. See Figure 2.2 in the SEL-351RS Kestrel Recloser Control Instruction Manual.

Refer to *Section 10: Communications* in the SEL-351RS Kestrel Recloser Control Instruction Manual for cable diagrams.

Commands

Commands, passwords, or settings you type appear in bold/uppercase: **SH0**. Computer keys you press appear in bold/brackets: **<Enter>**.

The following commands are available for use with the SEL-351RS Kestrel. Much of the information available from the commands is also available via the front-panel pushbuttons (see *Pushbutton Primary Functions on page 3.4*).

The commands are shown in uppercase letters, but they can also be entered using lowercase letters.

Table 2.5 ASCII Command Summary (Sheet 1 of 4)

Access Level	Prompt	ASCII Command	Command Description	Corresponding Front-Panel Pushbutton
1	=>	2AC	Go to Access Level 2	
0	=	ACC	Go to Access Level 1	
1	=>	BAC	Go to Access Level B	
1	=>	BNA	Displays information useful for autoconfiguration of data gathering equipment	
1	=>	BRE	Breaker monitor data	OTHER
B	==>	BRE R	Reset breaker/recloser contact wear and trip operation counters.	OTHER
B	==>	BRE W	Preload breaker/recloser contact wear and trip operation counters.	OTHER
E	==>	BTT	Display latest battery discharge test results and time remaining until next discharge test.	
E	==>	BTT NOW	Force battery discharge test	OTHER
2	==>	CAL	Go to Access Level C	
0	=	CAS	Displays information useful for autoconfiguration of data gathering equipment	
1	=>	CEV	Compressed event reports	
1	=>	CHI	Compressed history reports	
B	==>	CLO	Close breaker	
1	=>	COM	MIRRORED BITS communications statistics	
B	==>	CON n	Control remote bit <i>n</i> (<i>n</i> = 1–16)	

Table 2.5 ASCII Command Summary (Sheet 2 of 4)

Access Level	Prompt	ASCII Command	Command Description	Corresponding Front-Panel Pushbutton
2	=>>	COP <i>m n</i>	Copy setting Group <i>m</i> to Group <i>n</i>	
1	=>	COU	Display SELOGIC® counter values	
1	=>	CST	Compressed status report	
1	=>	DAT	Show date	OTHER
1	=>	DAT <i>m/d/y</i>	Enter date in this format if Date Format setting DATE_F = MDY	OTHER
1	=>	DAT <i>y/m/d</i>	Enter date in this format if Date Format setting DATE_F = YMD	OTHER
1	=>	DNA	Displays information useful for autoconfiguration of data gathering equipment	
1	=>	ETH	Displays information about Ethernet port(s)	
1	=>	EVE <i>n</i>	Show event report number <i>n</i> with 1/4 cycle resolution	
1	=>	EVE C <i>n</i>	Show compressed event report number <i>n</i> for use with SEL-5601 Analytic Assistant	
1	=>	EVE L <i>n</i>	Show event report number <i>n</i> with 1/16 cycle resolution	
1	=>	EVE R <i>n</i>	Show raw event report number <i>n</i> with 1/16 cycle resolution	
0	=	EXI	Terminate Telnet session	
0	=	EZA	Go to Access Level E (EZ)	
1	=>	FIL	List or read available files	
2	=>>	FIL WRI	Write file	
1	=>	GOO	Display GOOSE transmit and receive information	
1	=>	GRO	Display active setting group number	GROUP
B	=>>	GRO <i>n</i>	Change active setting group to Group <i>n</i>	GROUP
1	=>	HIS <i>n</i>	Show summary of <i>n</i> latest event reports	EVENTS
1	=>	HIS C	Clear the summary and corresponding event reports	
0	=	ID	Display configuration information about the relay	
2	=>>	L_D	Prepares the relay to receive new firmware	
1	=>	LDP	Load profile report	
2	=>>	LOO	Loopback	
1	=>	MAC	Display Ethernet port MAC address	
1	=>	MET <i>k</i>	Display instantaneous metering data. Enter <i>k</i> for repeat count.	METER

Table 2.5 ASCII Command Summary (Sheet 3 of 4)

Access Level	Prompt	ASCII Command	Command Description	Corresponding Front-Panel Pushbutton
1	=>	MET D	Display demand and peak demand data	METER
1	=>	MET E	Display energy metering data	METER
1	=>	MET M	Display maximum/minimum metering data	METER
1	=>	MET RD	Reset demand metering data	METER
1	=>	MET RE	Reset energy metering data	METER
1	=>	MET RM	Reset maximum/minimum metering data	METER
1	=>	MET RP	Reset peak demand metering data	METER
B	==>	OPE	Open breaker	
2	=>>	PAS 1	Change Access Level 1 password	SET
2	=>>	PAS E	Change Access Level E password	SET
2	=>>	PAS B	Change Access Level B password	SET
2	=>>	PAS 2	Change Access Level 2 password	SET
2	=>>	PAR	Change the device part number. Use only under direction from SEL.	
B	==>	PUL	Pulse output contact	CNTRL
2	=>>	R_S	Restore factory default settings. Only available under certain conditions.	
0	=>	QUI	Return to Access Level 0	
1	=>	SER <i>n</i>	Show the latest <i>n</i> rows in the Sequential Events Recorder (SER) event report	
1	=>	SER <i>m n</i>	Show rows <i>m</i> through <i>n</i> in the Sequential Events Recorder (SER) event report	
1	=>	SER d1	Show rows in the Sequential Events Recorder (SER) event report from date d1	
1	=>	SER d1 d2	Show rows in the Sequential Events Recorder (SER) event report from date d1 to d2	
1	=>	SER C	Clear SER records from nonvolatile memory	
2	=>>	SET <i>n</i>	Change settings for Group <i>n</i>	SET
2	=>>	SET L <i>n</i>	Change SELOGIC control equation settings for Group <i>n</i>	
2	=>>	SET EZ <i>n</i>	Change EZ settings for Group <i>n</i>	SET
2	=>>	SET FZ	Change FZ settings (Global EZ settings)	SET
2	=>>	SET G	Change Global settings	SET
2	=>>	SET P <i>n</i>	Change Port <i>n</i> settings	SET

Table 2.5 ASCII Command Summary (Sheet 4 of 4)

Access Level	Prompt	ASCII Command	Command Description	Corresponding Front-Panel Pushbutton
2	=>>	SET R	Change Sequential Events Recorder (SER) settings	SET
2	=>>	SET T	Change text label settings	
1	=>	SHO <i>n</i>	Show settings for Group <i>n</i>	
1	=>	SHO L <i>n</i>	Show SELOGIC control equation settings for Group <i>n</i>	
1	=>	SHO EZ <i>n</i>	Show EZ settings for Group <i>n</i>	
1	=>	SHO FZ	Show FZ settings (Global EZ settings)	
1	=>	SHO G	Show Global settings	
1	=>	SHO P <i>n</i>	Show Port <i>n</i> settings	
1	=>	SHO R	Show Sequential Events Recorder (SER) settings	
1	=>	SHO T	Show text label settings	
1	=>	SNS	Displays information useful for autoconfiguration of data gathering equipment	STATUS
1	=>	SSI	Voltage Sag/Swell/Interruption Report	
1	=>	STA	Relay self-test status	
2	=>>	STA C	Clear self-test status and restart relay	OTHER
1	=>	TAR <i>n k</i>	Display Relay Word row. If <i>n</i> = 0 through 59, display row <i>n</i> . If <i>n</i> is an element (e.g., 50P1), display the row containing element <i>n</i> . Enter <i>k</i> for repeat count.	
1	=>	TAR R	Reset the front-panel tripping targets	TARGET RESET
B	=>>	TES DB	Force protocol binary and analog values. Used for protocol testing.	OTHER
1	=>	TIM	View/change time	
1	=>	TRI	Trigger an event report	
2	=>>	VEC	Displays information useful to the factory in troubleshooting	
1	=>	VER	Show relay configuration and firmware version	

Event Reports

NOTE: The event report length is selectable: 15, 30, or 60 cycles. More options are available to customize event reports.

Refer to the SEL-351RS Kestrel Recloser Control Instruction Manual for more event information.

Event reports are automatically triggered at the beginning of a fault and when the SEL-351RS Kestrel issues a trip. Event report length is 15 cycles (factory default). The latest hundred 15-cycle event reports are stored in nonvolatile memory.

To obtain event report information, use the **EVE** command. There are numerous options that allow you to customize event information. For descriptions and examples of all options, refer to the SEL-351RS Kestrel Recloser Control Instruction Manual. The general command format is:

EVE [*n A D*]

The parameters in brackets [] are optional. *Table 2.6* defines the parameters [*n A D*] that can be issued with the **EVE** command to customize the report format.

Table 2.6 Event Report Parameters

Parameter	Description
<i>n</i>	Choose event number (1–100). Defaults to 1 if not specified.
A	Specifies that the analog section of the event is to be displayed (current, voltage, frequency, contact outputs, and optoisolated inputs).
D	Specifies that the digital section (Protection and Control Elements) of the event is to be displayed.

Summary event information can be viewed at the control front-panel LCD using the front-panel pushbuttons. Press the **EVENTS** pushbutton (primary function) and the appropriate left/right and up/down pushbuttons (secondary function) to view event information.

If no parameters are issued with the **EVE** command, you will automatically receive both the analog (A) and digital (D) sections of the event report.

Access Levels and Password Protection

PASSWORDS REQUIRED WITH FRONT- PANEL PUSHBUTTONS?

See Pushbutton Primary Functions on page 3.4.

WARNING

This device is shipped with default passwords. Default passwords should be changed to private passwords at installation. Failure to change each default password to a private password may allow unauthorized access. SEL shall not be responsible for any damage resulting from unauthorized access.

Issue commands to the SEL-351RS Kestrel to view metering values, change recloser control settings, obtain event information, etc. The commands can be accessed only from the corresponding access level as shown in *Table 2.5*, but a higher access level can access the serial port commands in a lower access level.

Access Level 0 (the lowest access level)

Access Level 1

Access Level E (EZ access level)

Access Level B

Access Level 2 (the highest access level)

As a security measure, entry to a particular access level (except Access Level 0) requires a unique password. This allows the user to set up a password system to deny unqualified or unauthorized personnel access to higher levels.

The SEL-351RS Kestrel ships from the factory with default passwords (see *Table 2.7*). Make sure that password information is stored for future reference in the event that it is lost or forgotten.

Table 2.7 Access Level, Summary Information

Access Level	Access Command	Prompt	Factory Default Password	Description of Access Level Command Privileges
0		=		Signifies that serial communications are established. The only operation available here is go to Access Level 1 or Access Level E.
1	ACC	=>	OTTER	Primarily allows you to only look at information (i.e., metering, settings), not change it.
E	EZA	=+>	DAKOTA	Primarily allows the user to change the EZ group settings and global EZ settings.
B	BAC	==>	EDITH	Primarily allows the user to operate output contacts or change the active setting group.
2	2AC	=>>	TAIL	Unlimited access to relay settings, parameters, and output contacts.

Change Passwords

LOST OR FORGOTTEN PASSWORD?

When passwords are lost or forgotten, you can set new passwords by putting the main board Access jumper in place. See Section 2: Additional Installation Details in the SEL-351RS Kestrel Recloser Control Instruction Manual.

WANT TO OPERATE WITHOUT PASSWORDS?

See Figure 2.2 in the SEL-351RS Kestrel Recloser Control Instruction Manual.

The **PAS** command allows you to change existing passwords at Access Level 2. To change passwords, enter **PAS x**, where *x* is the access level password being changed. The relay will prompt for the old password, new password, and a confirmation of the new password as follows:

```
=>>PAS 1 <Enter>

Old Password: *****

New Password: *****
Confirm New Password: *****

Password Changed
=>>
```

Passwords may include as many as 12 characters. Valid characters are listed in Table 2.8.

Record the new password in a safe place for future reference. Passwords cannot be viewed from the recloser control.

Table 2.8 Valid Password Characters

Alpha	A B C D E F G H I J K L M N O P Q R S T U V W X Y Z a b c d e f g h i j k l m n o p q r s t u v w x y z
Numeric	0 1 2 3 4 5 6 7 8 9
Special	! " # \$ % & ' () * + , - . / : ; < = > ? @ [\] ^ _ ` ~

Upper- and lowercase letters are treated as different characters. Strong passwords consist of the maximum allowable characters, with at least one special character, number, lowercase letter, and uppercase letter. Strong passwords do not include a name, date, acronym, or word. The recloser control may issue a weak password warning if the new password can be strengthened.

Examples of valid, distinct passwords include:
SDFdfa098&^# &*LKJoi09873 m,nYIO689&(*)

Section 3

Front-Panel Interface

Topics covered in this section:

- Status and Trip Target LEDs
- Pushbuttons
- Operator Controls

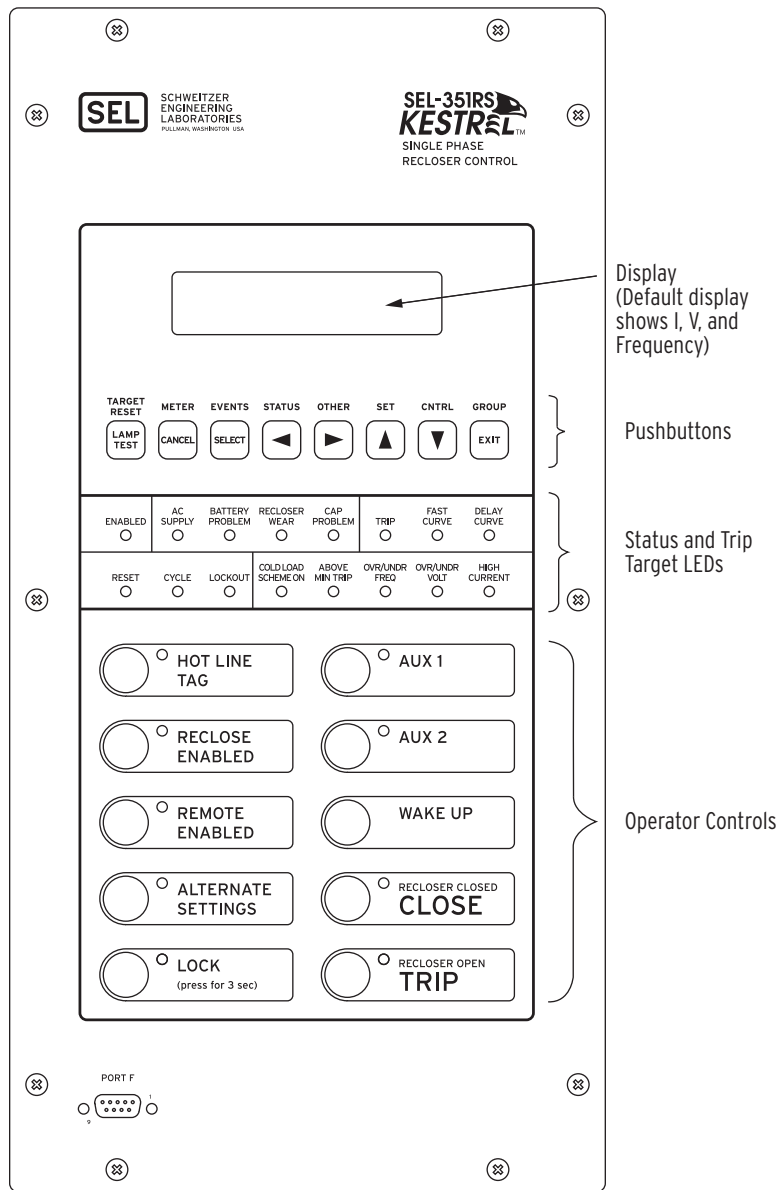


Figure 3.1 SEL-351RS Kestrel Front-Panel Interface

USER-CONFIGURABLE LABELS

The SEL-351RS Kestrel® Recloser Control comes standard with user-configurable labels. Figure 3.2 shows the SEL-351RS Kestrel with default labels. The dashed lines in Figure 3.2 indicate the areas for user-configurable labels.

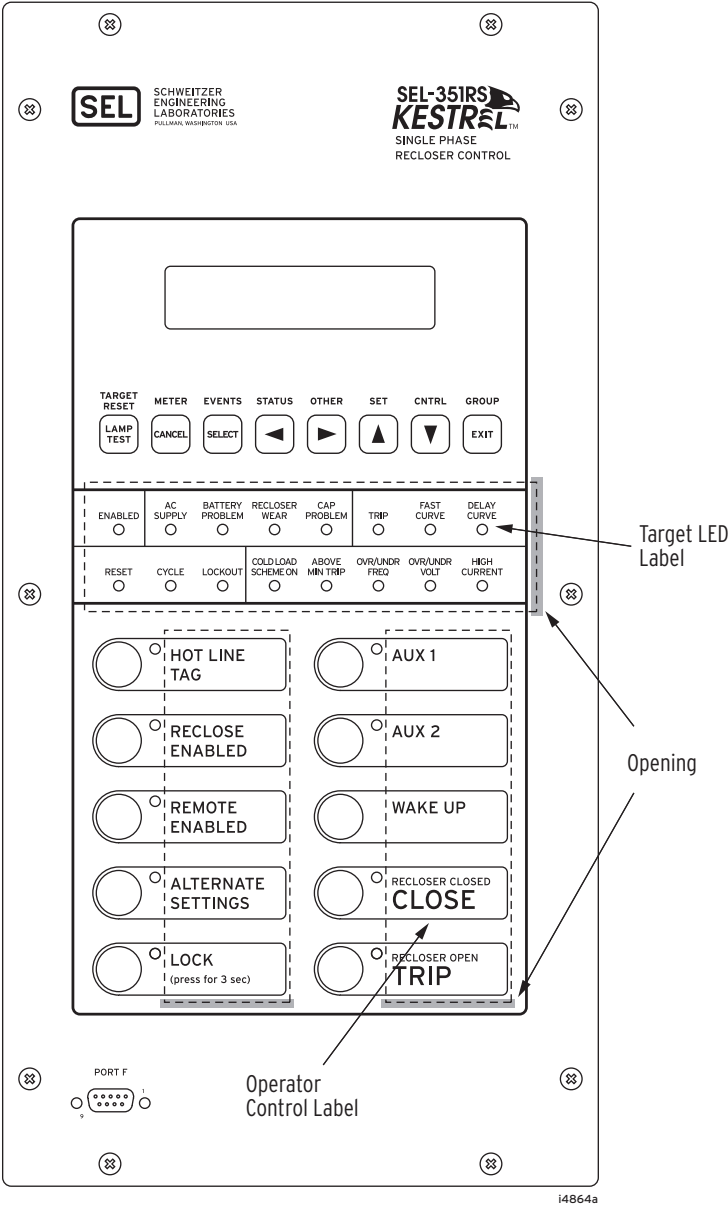


Figure 3.2 SEL-351RS Kestrel Front-Panel Interface Configurable Labels

Status and Trip Target LEDs

Most of the status and trip target LEDs and operator controls can change function (if desired by the user) by programming at a higher logic level (see the SEL-351RS Kestrel Recloser Control Instruction Manual). This subsection discusses each function as shipped from the factory and inscribed on the front panel.

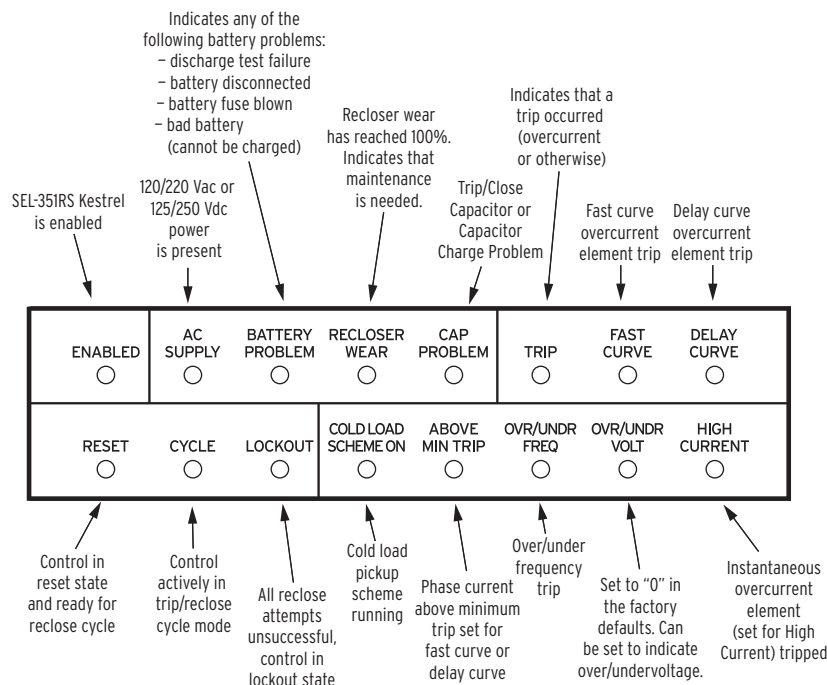


Figure 3.3 Status and Trip Target LEDs

Pushbuttons

Overview

The front-panel pushbuttons shown in *Figure 3.4* allow access to settings, metering values, event information, and other functions and information.

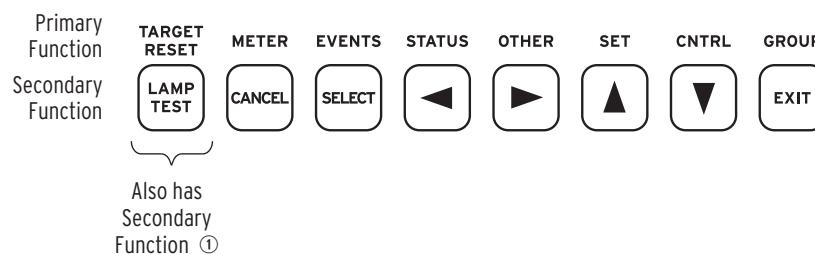






Figure 3.4 Primary and Secondary Functions of Front-Panel Pushbuttons





The front-panel pushbuttons (except TARGET RESET/LAMP TEST) have dual functions (primary and secondary functions). The primary functions are shown above the buttons. A primary function is selected first (e.g., METER pushbutton).

After a primary function is selected, the pushbuttons operate on their secondary functions, which are shown on the face of the buttons (**CANCEL**, **SELECT**, left/right arrows, up/down arrows, **EXIT**). For example, after the **METER** pushbutton is pressed, the up/down arrows are used to scroll through the front-panel metering screens. The primary functions are active again when the selected function (metering) is exited by pressing the **EXIT** pushbutton. The front panel will revert to the default display and the primary functions will be active after there is no front-panel activity for a time determined by Global setting FP_TO (see *Global Settings (Serial Port Command SET G and Front Panel)* in the *Settings Sheets* in the SEL-351RS Kestrel Recloser Control Instruction Manual). The relay is shipped with FP_TO = 15 minutes.

Many of the pushbutton primary functions correspond to serial port commands. Some of the pushbutton primary functions require a password to execute. Refer to *Section 2: Getting Started With Communications* for serial port command, access level, and password information.

Pushbutton Primary Functions

Primary Function	Corresponding Serial Port Command	Access Level	Password for Front-Panel Access	Description
 TARGET RESET	TAR R	1	None	Illuminate all front-panel LEDs for 1 second and clear trip-latched targets TRIP , FAST CURVE , DELAY CURVE , COLD LOAD SCHEME ON , ABOVE MIN. TRIP , OVER/UNDER FREQ , OVER/UNDER VOLT , and HIGH CURRENT .
 INST ENERGY DISPLAY RESET MAX/MIN DISPLAY RESET DEMAND DISPLAY RESET	MET MET E MET RE MET M MET RM MET D MET RD MET RP	1 1 1 1 1 1 1 1	None None None None None None None None	Display instantaneous magnitudes (and angles if applicable) of meter values. Display energy meter values. Reset energy meter values. Display maximum/minimum metering values. Reset maximum/minimum metering values. Display demand and peak demand meter values. Reset demand meter values. Reset peak meter values.
EVENTS 	HIS	1	None	Show SEL-351RS Kestrel event data.
STATUS 	STA	1	None	Show SEL-351RS Kestrel diagnostic and battery information.

Primary Function	Corresponding Serial Port Command	Access Level	Password for Front-Panel Access	Description
OTHER  DATE TIME 79 TAR BRK_MON DISPLAY RESET	 DAT TIM N/A TAR BRE A BRE R	 1 1 N/A 1 1 B	 None None None None None Level B	 Show or set SEL-351RS Kestrel date. Show or set SEL-351RS Kestrel time. Show SEL-351RS Kestrel set reclosures and current reclose count. Show status of internal SEL-351RS Kestrel elements on LCD display and second row of front-panel target LEDs. Show recloser wear and trip operation counters. Reset recloser wear and trip operation counters.
SET  SHOW EZ FZ GROUP GLOBAL PORT SET EZ FZ GROUP GLOBAL PORT PASS	 SHO EZ SHO FZ SHO SHO G SHO P SET EZ SET FZ SET SET G SET P PASS	 1 1 1 1 1 E E 2 2 2 2	 None None None None None Level E Level E Level 2 Level 2 Level 2 Level 2	 Show EZ settings (Group 1–6). Show FZ settings (global EZ settings). Show GROUP settings (Group 1–6). Show GLOBAL settings. Show PORT settings. Set EZ settings (Group 1–6). Set FZ settings (global EZ settings). Set GROUP settings (Group 1–6). Set GLOBAL settings. Set PORT settings. Set passwords.
CNTRL  EXTRA CONTROL POSITION OPERATE OUTPUT CONTACT TEST	 N/A PUL	 N/A 2	 None Level 2	 View position of or operate extra user-configured switch-type control. Pulse output contact (OUT101–ALARM) for 1 second.
GROUP  ACTIVE GROUP DISPLAY CHANGE	 GRO GRO <i>n</i>	 1 B	 None Level B	 Show active setting group. Change active setting group to setting group <i>n</i> .

Secondary Functions

After a primary function is selected (see *Pushbutton Primary Functions on page 3.4*), the pushbuttons operate on their secondary functions (see *Figure 3.5*).

Use the left/right arrows to underscore a desired function, then press the **SELECT** pushbutton to select the function.

Use left/right arrows to underscore a desired setting digit or underscore a desired function, then use the up/down arrows to change the setting digit or scroll up or down in the display. Press the **SELECT** pushbutton to enter the setting or select the displayed option.

Press the **CANCEL** pushbutton to abort a setting change procedure or escape to a higher menu level. Press the **EXIT** pushbutton to return to the default display and have the primary pushbutton functions activated again.

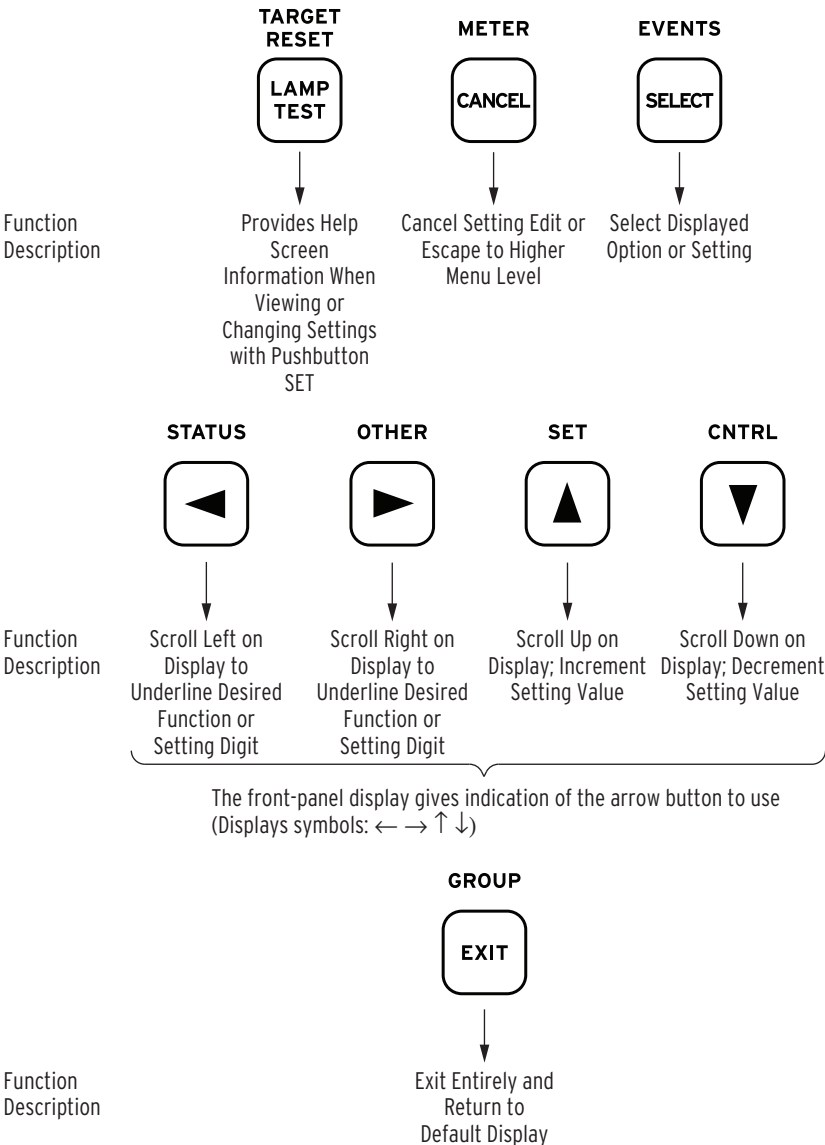
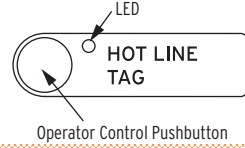






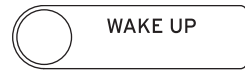


Figure 3.5 SEL-351RS Kestrel Front-Panel Pushbuttons–Secondary Functions

Operator Controls

Except for the **LOCK** operator control pushbutton, all the following operator control pushbuttons should be pressed momentarily to execute their function.

<p>Press the HOT LINE TAG operator control pushbutton to enable/disable a hot line tag. Corresponding LED illuminates to indicate the enabled state.</p> <p>While the hot line tag function is enabled, no closing or auto-reclosing can take place via the recloser control (e.g., the CLOSE operator control is inoperative). The HOT LINE TAG operator control overrides the RECLOSE ENABLED operator control (see below).</p>							
<p>Press the RECLOSE ENABLED operator control pushbutton to enable/disable auto reclosing. Corresponding LED illuminates to indicate the enabled state.</p>							
<p>Press the REMOTE ENABLED operator control pushbutton to enable/disable remote control. Corresponding LED illuminates to indicate the enabled state.</p> <p>NOTE: The REMOTE ENABLED operator control is not operable with the factory settings. See the SEL-351RS Kestrel Recloser Control Instruction Manual for information and ideas on how to program this control.</p>							
<p>Press the ALTERNATE SETTINGS operator control pushbutton to switch the active setting group between the main setting group (Setting Group 1) and the alternate setting group (Setting Group 2). Corresponding LED illuminates to indicate that the alternate setting group is active.</p>							
<p>Continually press the LOCK operator control pushbutton for three (3) seconds to engage/disengage the lock function. While this pushbutton is pressed, the corresponding LED flashes on and off, indicating a pending engagement or disengagement of the lock function. The LED illuminates constantly to indicate the engaged state. While the lock function is engaged, the following operator controls are “locked in position”:</p> <table data-bbox="250 1073 690 1178"> <tr> <td>HOT LINE TAG</td><td>ALTERNATE SETTINGS</td></tr> <tr> <td>RECLOSE ENABLED</td><td>AUX 1</td></tr> <tr> <td>REMOTE ENABLED</td><td>AUX 2</td></tr> </table>	HOT LINE TAG	ALTERNATE SETTINGS	RECLOSE ENABLED	AUX 1	REMOTE ENABLED	AUX 2	
HOT LINE TAG	ALTERNATE SETTINGS						
RECLOSE ENABLED	AUX 1						
REMOTE ENABLED	AUX 2						
<p>While “locked in position,” these operator controls cannot change state if pressed—their corresponding LEDs remain in the same state. When the lock function is engaged, the CLOSE operator control cannot close the recloser, but the TRIP operator control can still trip the recloser.</p> <p>See the <i>Global EZ Settings</i> on page 4.14 for options to defeat the 3-second delay on the LOCK operator control.</p>							
<p>Press the AUX 1 operator control pushbutton to enable/disable user-programmed auxiliary control. Corresponding LED illuminates to indicate the enabled state.</p> <p>NOTE: The AUX 1 operator control is not operable with the factory settings. See the SEL-351RS Kestrel Recloser Control Instruction Manual for information and ideas on how to program this control.</p>							
<p>Press the AUX 2 operator control pushbutton to enable/disable user-programmed auxiliary control. Corresponding LED illuminates to indicate the enabled state.</p> <p>NOTE: The AUX 2 operator control is not operable with the factory settings. See the SEL-351RS Kestrel Recloser Control Instruction Manual for information and ideas on how to program this control.</p>							
<p>Press the WAKE UP operator control pushbutton to wake up the SEL-351RS Kestrel if the front panel is dark (the unit put itself to sleep after an extended outage). After the unit wakes up, the front panel illuminates, and the unit can then be interrogated via the front panel or serial port. The WAKE UP operator control is also used to turn on the SEL-351RS Kestrel after the battery has been installed (see the installation steps in the <i>Section 1: Installation</i>).</p> <p>The SEL-351RS Kestrel wakes up automatically from an extended outage when 120/220 Vac or 125/250 Vdc power returns to the unit.</p>							

Press the **CLOSE** operator control pushbutton to close the recloser. Corresponding **RECLOSER CLOSED LED** illuminates to indicate the recloser is closed.

The **CLOSE** operator control pushbutton does not have to be continually pressed to allow for cold load pickup (i.e., disable fast curves, and desensitize delay curves). There is automatic allowance for cold load pickup. See the Cold Load Pickup Scheme (No. 33) settings in *Section 4: EZ Settings*.

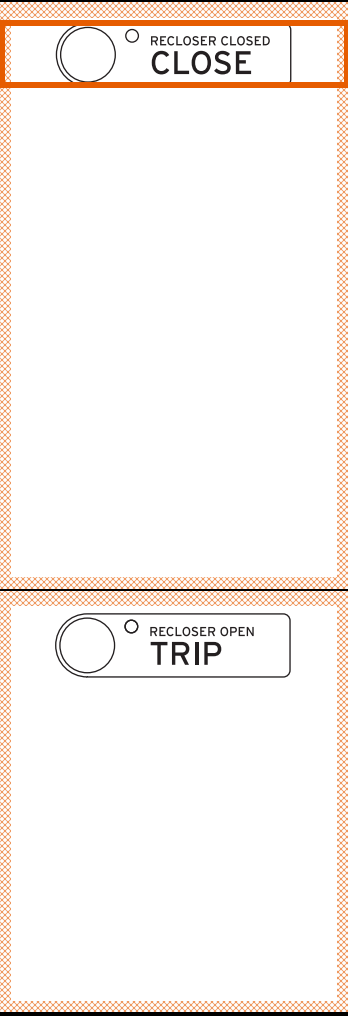
Option: Set a delay, so the operator can press the **CLOSE** operator control pushbutton and then move a safe distance away from the recloser before the SEL-351RS Kestrel issues a close (the **CLOSE** operator control comes with no set delay in the factory settings). With a set delay, press the **CLOSE** operator control pushbutton momentarily, and notice that the corresponding **RECLOSER CLOSED LED** flashes on and off during the delay time, indicating a pending close. Abort the pending close by pressing the **CLOSE** operator control pushbutton again or by pressing the **TRIP** operator control pushbutton. This delay setting for the **CLOSE** operator control is PB8D (range: 0 to 3600 cycles; factory set at 0 cycles—no delay). The delay is set via the **SET G** command (PB8D is not an EZ setting). See *Section 1: Factory-Set Logic* in the SEL-351RS Kestrel Recloser Control Instruction Manual for more information.

NOTE: The time-delay setting for the **PB8** operator control (global setting PB8D) should be left set to the factory default of PB8D = 0 cycles (no time delay) if the control is programmed to operate independently of the close logic. If PB8D > 0 cycles, the operation of corresponding Relay Word bit PB8 will be supervised by SELOGIC setting ULCL. If ULCL is asserted (logical 1), this operator will be effectively disabled.

Press the **TRIP** operator control pushbutton to trip the recloser (and take the control to the lock-out state). Corresponding **RECLOSER OPEN LED** illuminates to indicate the recloser is open.

Option: Set a delay, so the operator can press the **TRIP** operator control pushbutton and then move a safe distance away from the recloser before the SEL-351RS Kestrel issues a trip (the **TRIP** operator control comes with no set delay in the factory settings). With a set delay, press the **TRIP** operator control pushbutton momentarily and notice the corresponding **RECLOSER OPEN LED** flashes on and off during the delay time, indicating a pending trip. Abort the pending trip by pressing the **TRIP** operator control pushbutton again or by pressing the **CLOSE** operator control pushbutton. This delay setting for the **TRIP** operator control is PB9D (range: 0 to 3600 cycles; factory set at 0 cycles—no delay). The delay is set via the **SET G** command (PB9D is not an EZ Setting). See *Section 1: Factory-Set Logic* in the SEL-351RS Kestrel Recloser Control Instruction Manual for more information.

NOTE: The time-delay setting for the **PB9** operator control (Global setting PB9D) should be left set to the factory default of PB9D = 0 cycles (no time delay) if the control is programmed to operate independently of the trip logic.



Section 4

EZ Settings

Overview

This Quick-Start Installation and User's Guide provides only information applicable to the EZ settings—settings associated with traditional recloser control operations.

Topics covered in this section:

- Curve Designations
- EZ (“Easy”) Settings
- Global EZ Settings
- EZ Settings Sheets (end of this section)

Curve Information

CURVE MODIFIERS AVAILABLE FOR ANY CURVE TYPE

Constant Time Adder; Vert. Multiplier/
Time Dial; Min. Response Time

HIGH CURRENT OPTIONS AVAILABLE

High Current Trip; High Current
Lockout

Fast and delay curves are available for overcurrent protection. These curves can be set with any of the numerous resident curve choices:

- Recloser Curves (see *Table 4.1*)
- US Curves (see *Table 4.2*)
- IEC Curves (see *Table 4.2*)

The recloser curves in *Table 4.1* show both the older electronic control designation and the newer microprocessor-based control designation. The recloser curves can be specified in a curve setting using either designation. For example, a given traditional recloser curve has the following two designations:

Older electronic control designation: A

Newer microprocessor-based control designation: 101

Traditional recloser curve A and curve 101 are the *same curve*—use either designation in making curve settings in the SEL-351RS Kestrel® Recloser Control.

NOTE: All 38 traditional recloser curves are available!

Table 4.1 Recloser Curve Designations

Recloser Curve Cross Reference-Old to New					
Old	New	Old	New	Old	New
A	101	P	115	7	152
B	117	R	105	8	113
C	133	T	161	8PLUS	111
D	116	V	137	9	131
E	132	W	138	KG	165
F	163	Y	120	11	141
G	121	Z	134	13	142
H	122	1	102	14	119
J	164	2	135	15	112
KP	162	3	140	16	139
L	107	4	106	17	103
M	118	5	114	18	151
N	104	6	136		

Table 4.2 U.S., IEC, and User-Programmable Curve Designations

U.S. Curve	Description
U1	moderately inverse
U2	inverse
U3	very inverse
U4	extremely inverse
U5	short-time inverse
IEC Curve	Description
C1	class A (standard inverse)
C2	class B (very inverse)
C3	class C (extremely inverse)
C4	long-time inverse
C5	short-time inverse

CURVES CONFORM TO STANDARD
The US and IEC curves conform to IEEE C37.112-1996 IEEE Standard Inverse-Time Characteristic Equations for Overcurrent Relays.

COOPER CURVES
Cooper 200 = IEC Inverse
Cooper 201 = IEC Very Inverse
Cooper 202 = IEC Extremely Inverse

Factory EZ Settings

VIEW EZ SETTINGS WITH COMMANDS

SHO EZ 1 (Group 1);
SHO EZ 2 (Group 2);
SHO FZ (Global).
See Table 2.5.

SET EZ SETTINGS WITH COMMANDS

SET EZ 1 (Group 1);
SET EZ 2 (Group 2);
SET FZ (Global).
See Table 2.5.

WARNING

Anytime an EZ setting is changed, review all the EZ settings before enabling the new settings. Pay close attention in circumstances where a setting was once set to OFF or N and then later turned on (enabled). Other related settings may need to be turned on, though may still be set to OFF or N.

The SEL-351RS Kestrel ships with the factory EZ settings shown in *Table 4.3*. The corresponding number references provide a quick way to find the settings (or subsettings) in the *Settings Descriptions* on page 4.5.

The reference to Settings Groups 1 and 2 at the top of *Table 4.3* refers to the two choices for the active setting group:

- Settings Group 1 = main settings
- Settings Group 2 = alternate settings

Refer to *Operator Controls* on page 3.7 (**ALTERNATE SETTINGS** operator control pushbutton) for more information on how to switch between these two setting groups. In the factory EZ settings, these two setting groups are set the same.

The Global EZ settings at the end of *Table 4.3* apply to both settings Groups 1 and 2.

Those factory settings indicated with an ^a in *Table 4.3* are hidden with these particular factory settings. As a general rule, if a main setting is set to N, then the subsettings that follow are hidden. *Settings Descriptions* explains the details behind hiding the settings. Complete setting ranges are also given in *Settings Descriptions*.

Table 4.3 EZ Settings Quick Reference (Sheet 1 of 2)

No.	Settings Groups 1 (Main) and 2 (Alternate) EZ Settings	Factory Settings
1	Control Identifier	RECLOSER R1
2	Circuit Identifier	FEEDER 2101
3	CT Ratio	1000.0
4	PT Ratio	100.0
5	Min. trip (A pri.)	400.00
6	Fast curve	A
	Time-dial—fast curve	1.00 ^a
	EM reset—fast curve	N ^a
7	Delay curve	C
	Time-dial—delay curve	1.00 ^a
	EM reset—delay curve	N ^a
8	Operations—fast curve	2
9	Operations to lockout	4
10	Reclose interval 1 (cycles)	300.00
11	Reclose interval 2 (cycles)	600.00
12	Reclose interval 3 (cycles)	600.00
13	Reclose interval 4 (cycles)	OFF
14	Reset time for auto-reclose (cycles)	1800.00
15	Reset time from lockout (cycles)	600.00
16	Close power wait time (cycles)	900.00

Table 4.3 EZ Settings Quick Reference (Sheet 2 of 2)

No.	Settings Groups 1 (Main) and 2 (Alternate) EZ Settings	Factory Settings
17	Complex fast curve (Y/N)	N
	Const. time adder fast curve (cycles)	0.00 ^a
	Vert. multiplier fast curve	1.00 ^a
	Min. response fast curve (cycles)	0.00 ^a
18	Complex delay curve (Y/N)	N
	Const. time adder delay curve (cycles)	0.00 ^a
	Vert. multiplier delay curve	1.00 ^a
	Min. response delay curve (cycles)	0.00 ^a
19	High current trip1 (Y/N)	N
	High current trip1 (multiple)	OFF ^a
	High current trip delay (cycles)	0.00 ^a
	Activate high current trip1	OFF ^a
20	High current lockout (Y/N)	N
	High current lockout (multiple)	OFF ^a
	Activate high current lockout	OFF ^a
21	Cold load pickup scheme (Y/N)	N
	Cold load pickup (multiple)	OFF ^a
	Loss of load diversity time (cycles)	0.00 ^a
	Restore min. trip—time limit (cycles)	OFF ^a
	Restore min. trip (Y/N)	N ^a
22	Sequence coordination (Y/N)	N
23	Underfrequency loadshedding (Y/N)	N
	Underfrequency pickup (Hz)	OFF ^a
	Underfrequency time delay (cycles)	6.00 ^a
24	Demand meter time constant (min.)	5
	Global EZ Settings	
25	System Frequency (Hz)	60
26	Recloser Wear Monitor (Y,N)	Y
27	Reset trip-latched LEDs on close (Y,Y1,N,N1)	Y
28	Phantom Power Angle (0–330 deg. in 30-degree steps)	0
29	Current Transformer Polarity (POS,NEG)	POS
30	Power-off Delay After AC Loss (OFF,1–1440 min.)	180
31	Power-off Delay After Wake Up (OFF, 1–1440 min.)	20

^a Factory defaults cause these settings to be hidden. As a general rule, if a main setting is set to N, the subsettings that follow are hidden.

Settings Descriptions

WARNING

Anytime an EZ setting is changed, review all the EZ settings before enabling the new settings. Pay close attention in circumstances where a setting was once set to Off or N and then later turned on (enabled). Other related settings may need to be turned on, although these may still be set to Off or N.

Settings Groups 1 (Main) and 2 (Alternate) EZ Settings

No.	Setting	Default	Range	Incr.
1	Control Identifier	RECLOSER R1	0–9, A–Z, - , / , . , space	

The Control Identifier setting contains the control installation designation (e.g., RECLOSER R1). This identifier is listed at the top of event, history, meter, and status reports (see *Table 2.6*).

- This setting may be up to 30 characters long.
- This setting cannot be made via the front-panel interface.

No.	Setting	Default	Range	Incr.
2	Circuit Identifier	FEEDER 2101	0–9, A–Z, - , / , . , space	

The Circuit Identifier setting contains the greater circuit or substation designation (e.g., FEEDER 2101). This identifier is listed at the top of event, history, meter, and status reports (see *Table 2.6*).

- This setting may be up to 30 characters long.
- This setting cannot be made via the front-panel interface.

No.	Setting	Default	Range	Incr.
3	CT Ratio	1000.0	1.0–6000	0.1

The CT Ratio (current transformer [CT] ratio) setting programs the SEL-351RS Kestrel to operate with a recloser CT ratio (e.g., for the common recloser CT ratio 1000:1, the setting CT Ratio = 1000.0 is made).

- **IMPORTANT:** The following setting changes in accordance to the CT Ratio setting:
Min. trip (No. 5)

No.	Setting	Default	Range	Incr.
4	PT Ratio	100.00	1.00–10000	0.1

The PT Ratio setting is the potential transformer (PT) ratio.

- When calculating the PTR, remember that the unit for the power transformer primary voltage is Vac not kVac.

No.	Setting	Default	Range	Incr.
5	Min. trip	400.00	OFF, 100.00–3199.99 Amps primary	0.01

The Min. trip setting determines the minimum current threshold for overcurrent detection in primary amps.

The displayed Amps primary setting range for Min. trip is calculated by multiplying the effective Amps secondary range [0.10 to 3.20] by the CT Ratio (No. 3) [1000]:

$$(0.10 \text{ to } 3.20) \cdot 1000 = 100.00 \text{ to } 3200.00 \text{ range (Amps primary)}$$

If the CT Ratio setting changes, the displayed Amps primary setting range for Min. trip changes accordingly. Due to processor calculations and rounding techniques, displayed range numbers may appear slightly different than expected (e.g., 3199.99 instead of 3200.00).

► **IMPORTANT:** If Min. trip (No. 5) is set to OFF, then overcurrent protection and reclosing are disabled.

► **IMPORTANT:** If Min. trip is set to OFF, then the following settings are all hidden and set to OFF or N:

Fast curve (No. 6)	Complex fast curve (No. 17)
Delay curve (No. 7)	Complex delay curve (No. 18)
Operations fast curve (No. 8)	High current trip (No. 19)
Operations to lockout (No. 9)	High current lockout (No. 20)

No.	Setting	Default	Range	Incr.
6	Fast curve	A	OFF, U1–U5, C1–C5, recloser or user curve	

The Fast curve setting selects the time-overcurrent curve for fast curve tripping. Curve designations are provided in *Table 4.1* and *Table 4.2*.

► This setting is hidden and set to OFF if Min. trip (No. 5) is set to OFF.

► If Fast curve is programmed with a US (U1–U5) or IEC (C1–C5) curve, enter the following two settings:

Setting	Default	Range	Incr.
Time-dial fast curve	1.00	0.50–15.00 for US curves U1–U5 0.05–1.00 for IEC curves C1–C5	0.01 0.01

The Time-dial fast curve setting shifts the US or IEC curve in time by the entered multiplier.

► This setting is hidden and nonoperative if Fast curve is programmed with a recloser curve.

Setting	Default	Range	Incr.
EM reset fast curve	N	Y/N	

The EM reset fast curve setting enables the electromechanical reset emulation for the US or IEC curve, if set to Y.

► This setting is usually set to N, except for special applications.

► This setting is hidden and set to N if Fast curve is programmed with a recloser curve.

No.	Setting	Default	Range	Incr.
7	Delay curve	C	OFF, U1–U5, C1–C5, recloser or user curve	

The Delay curve setting selects the time-overcurrent curve for delay curve tripping. Curve designations are provided in *Table 4.1* and *Table 4.2*.

- This setting is hidden and set to OFF if Min. trip (No. 5) is set to OFF.
- If Delay curve is programmed with a US (U1–U5) or IEC (C1–C5) curve, enter the following two settings:

Setting	Default	Range	Incr.
Time-dial delay curve	1.00	0.50–15.00 for US curves U1–U5 0.05–1.00 for IEC curves C1–C5	0.01 0.01

The Time-dial delay curve setting shifts the US or IEC curve in time by the entered multiplier.

- This setting is hidden and nonoperative if Delay curve is programmed with a recloser curve.

Setting	Default	Range	Incr.
EM reset delay curve	N	Y/N	

The EM reset delay curve setting enables the electromechanical reset emulation for the US or IEC curve, if set to Y.

- This setting is usually set to N, except for special applications.
- This setting is hidden and set to N if Delay curve is programmed with a recloser curve.

No.	Setting	Default	Range	Incr.
8	Operations fast curve	2	OFF, 1–5	1

The Operations fast curve setting determines the number of fast curve trip operations (e.g., if Operations fast curve = 2, then the phase fast curve is enabled for the first two [2] trip operations).

- This setting is hidden and set to OFF if Fast curve (No. 6) is set to OFF.
- This setting only enables the fast curve operations; it does not disable the delay curve (the delay curve is always active). Traditional protection schemes use fast curves followed by delay curves so the delay curves do not have to be defeated. If a slower first operation than second operation is desired, higher logic level settings changes are required.

No.	Setting	Default	Range	Incr.
9	Operations to lockout	4	OFF, 1–5	1

The Operations to lockout setting determines the total number of curve trip operations. The difference between setting Operations to lockout and setting Operations fast curve (No. 13) is the number of remaining delay curve operations (e.g., $4 - 2 = 2$).

The setting range for Operations to lockout adjusts according to Operations fast curve (e.g., if Operations fast curve = 2, then the range for Operations to lockout is from 2 to 5).

- If Delay curve (No. 7) = OFF, then Operations to lockout is set automatically equal to Operations fast curve, and there are no delay curve operations (e.g., $2 - 2 = 0$).
- This setting is hidden and set to OFF if Min. trip (No. 5) is set to OFF.
- **IMPORTANT:** If Operations to lockout (No. 9), is set to OFF, then overcurrent protection and reclosing are disabled. However, if both Min. trip (No. 5) and Delay curve (No. 10) are set to values other than OFF, the delay curve element is still active. If absolutely no protection is desired (e.g., “switch” mode), Min. trip (No. 5) or Delay curve (No. 7) must also be set to OFF.

Table 4.4 Seconds-to-Cycles Conversion (60 Hz) (Sheet 1 of 2)

Seconds	Cycles		Seconds	Cycles	
	(50 Hz)	(60 Hz)		(50 Hz)	(60 Hz)
0.3	15	18	15	750	900
0.5	25	30	20	1000	1200
1	50	60	30	1500	1800
2	100	120	45	2250	2700
3	150	180	60	3000	3600
5	250	300	90	4500	5400

Table 4.4 Seconds-to-Cycles Conversion (60 Hz) (Sheet 2 of 2)

Seconds	Cycles		Seconds	Cycles	
	(50 Hz)	(60 Hz)		(50 Hz)	(60 Hz)
7	350	420	120	6000	7200
10	500	600	180	9000	10800

for 50 Hz systems:

_____ seconds x 50 cycles/second = _____ cycles; _____ minutes x 3000 cycles/minute = _____ cycles

for 60 Hz systems:

_____ seconds x 60 cycles/second = _____ cycles; _____ minutes x 3600 cycles/minute = _____ cycles

No.	Setting	Default	Range	Incr.
10	Reclose interval 1	300.00	OFF, 12.00–999999.00 cycles	0.25 cyc.
11	Reclose interval 2	600.00	OFF, 90.00–999999.00 cycles	0.25 cyc.
12	Reclose interval 3	600.00	OFF, 120.00–999999.00 cycles	0.25 cyc.
13	Reclose interval 4	OFF	OFF, 120.00–999999.00 cycles	0.25 cyc.

The Reclose interval settings (1 through 4) are each successively and individually timed. Reclose interval timing cannot proceed until the following two conditions are met:

- The trip condition has gone away (minimum trip time is factory-set at 12 cycles).
- The recloser has opened.

At the end of a reclose interval, an auto reclose attempt is made.

The number of available Reclose interval settings corresponds to the Operations to lockout (No. 9) setting.

For example, if the Operations to lockout setting is Operations to lockout (No. 9) = 4, then settings Reclose interval 1, Reclose interval 2, and Reclose interval 3 are available (three reclose attempts). Because it is not available, Reclose interval 4 is hidden and set to OFF.

The number of reclosing attempts (i.e., available Reclose interval settings) is always one less than the number of trip operations (e.g., 4 “trips” – 1 = 3 “reclosures”).

- All the Reclose interval settings are hidden and set to OFF if the Operations to lockout (No. 9) setting is not set greater than 1 (reclosing is disabled; 1 “trip” – 1 = 0 “reclosures”).
- If a Reclose interval setting is set to OFF, the corresponding auto reclose attempt and any following auto-reclose attempts are aborted.

No.	Setting	Default	Range	Incr.
14	Reset time for auto-reclose	1800.00	180.00–999999.00 cycles	0.25 cyc.
15	Reset time from lockout	600.00	0.00–999999.00 cycles	0.25 cyc.

The Reset time for auto-reclose setting qualifies an auto-reclose of the recloser. The Reset time from lockout setting qualifies a manual/remote close of the recloser from the lockout state. Traditionally, the Reset time from lockout setting is set shorter than the Reset time for auto-reclose setting.

Reset timing is blocked (and the reset timer is reloaded) if any overcurrent elements are picked up. Reset timing can only proceed if all the overcurrent elements are continually dropped out.

- Both the Reset time for auto-reclose and Reset time from lockout settings are hidden if the Operations to lockout (No. 9) setting is not set greater than 1 (reclosing is disabled; 1 “trip” – 1 = 0 “reclosures”).

No.	Setting	Default	Range	Incr.
16	Close power wait time	900.00	OFF, 0.00–999999 cycles	0.25 cyc.

The Close power wait time setting is a time window that starts timing after a reclose interval times out. During this time window, the SEL-351RS Kestrel checks:

- If the trip/close capacitors are charged and there is no battery failure, this indicates that the close power is present, and reclosing proceeds.
- If the trip/close capacitors are not charged, this indicates that the close power is not present and reclosing is stalled. Also, if there is a battery failure, there is a problem with the battery or battery system and reclosing is stalled. If either of these conditions are present throughout the time window, reclosing is aborted at the end of the time window, and the SEL-351RS Kestrel goes to the lockout state.
- **IMPORTANT:** If Close power wait time is set to OFF, then the SEL-351RS Kestrel waits indefinitely for the close conditions to appear, in order for reclosing to proceed—there is no restrictive time window.
- This setting is hidden and set to 0 cycles if the Operations to lockout (No. 9) setting is not set greater than 1 (reclosing is disabled; 1 “trip” – 1 = 0 “reclosures”).

No.	Setting	Default	Range	Incr.
17	Complex fast curve	N	Y/N	

The Complex fast curve setting enables the following three settings for the fast curve, if set to Y.

- This setting is hidden and set to N if Fast curve (No. 6) is set to OFF.

Setting	Default	Range	Incr.
Const. time adder—fast curve	0.00	0.00–60 cycles	0.25 cyc.

The Const. time adder fast curve setting adds a constant time to the phase fast curve, if set to other than 0 cycles.

- This setting is hidden and set to zero (0) if Complex fast curve is set to N.

Setting	Default	Range	Incr.
Vert. multiplier—fast curve	1.00	0.10–2	0.01

The Vert. multiplier fast curve setting shifts the fast curve in time, by the entered multiplier, if Fast curve (No. 6) is programmed with a recloser curve. If no particular multiplier is desired, set Vert. multiplier fast curve equal to 1.00.

- If Fast curve (No. 6) is programmed with a US (U1–U5) or IEC (C1–C5) curve, Vert. multiplier fast curve is hidden and nonoperative. The preceding Time-dial fast curve (No. 6) subsetting provides the US and IEC curves with an effective vertical multiplier instead.
- This setting has no multiplying effect on the Constant time adder fast curve and Min. response time fast curve settings. They all operate independently.
- This setting is hidden and set to 1.00 if Complex fast curve is set to N and Fast curve (No. 8) is programmed with a recloser curve.

Setting	Default	Range	Incr.
Min. response—fast curve	0.00	0.00–60 cycles	0.25 cyc.

The fast curve can trip no faster than the Min. response time fast curve setting.

If the Min. response time fast curve setting is set equal to zero (0), it has no effect on the fast curve. If the Min. response time fast curve setting is set equal to 15 cycles, for example, the fast curve cannot trip on the portion of the curve that is faster than 15 cycles—the fast curve effectively flattens out at 15 cycles.

- This setting is hidden and set to zero (0) if Complex fast curve is set to N.

No.	Setting	Default	Range	Incr.
18	Complex delay curve	N	Y/N	

The Complex delay curve setting enables the following three settings for the delay curve, if set to Y.

- This setting is hidden and set to N if Delay curve (No. 7) is set to OFF.

Setting	Default	Range	Incr.
Const. time adder delay curve	0.00	0.00–60 cycles	0.25 cyc.

The Const. time adder delay curve setting adds a constant time to the delay curve, if set other than 0 cycles.

- This setting is hidden and set to zero (0) if Complex delay curve is set to N.

Setting	Default	Range	Incr.
Vert. multiplier delay curve	1.00	0.10–2	0.01

The Vert. multiplier delay curve setting shifts the delay curve in time, by the entered multiplier, if Delay curve (No. 7) is programmed with a recloser or user curve. If no particular multiplier is desired, set Vert. multiplier delay curve equal to 1.00.

- If Delay curve (No. 7) is programmed with a US (U1–U5) or IEC (C1–C5) curve, Vert. multiplier delay curve is hidden and nonoperative. The preceding Time-dial delay curve (No. 7) subsetting provides the US and IEC curves with an effective vertical multiplier, instead.
- This setting has no multiplying effect on the Constant time adder delay curve and Min. response time delay curve settings. They all operate independently.
- This setting is hidden and set to 1.00 if Complex delay curve is set to N and Delay curve (No. 7) is programmed with a recloser curve.

Setting	Default	Range	Incr.
Min. response delay curve	0.00	0.00–60 cycles	0.25 cyc.

The delay curve can trip no faster than the Min. response time delay curve setting.

If the Min. response time delay curve setting is set equal to zero (0), it has no effect on the delay curve. If the Min. response time delay curve setting is set equal to 15 cycles, for example, the delay curve cannot trip on the portion of the curve that is faster than 15 cycles—the delay curve effectively flattens out at 15 cycles.

- This setting is hidden and set to zero (0) if Complex delay curve is set to N.

No.	Setting	Default	Range	Incr.
19	High current trip	N	Y/N	

The High current trip setting enables the following three settings for high current tripping, if set to Y. High current tripping is not affected by the cold load pickup scheme.

- This setting is hidden and set to N if Fast curve (No. 6) and Delay curve (No. 7) are both set to OFF.

Setting	Default	Range	Incr.
High current trip	OFF	OFF, 1.00–50.00 multiples of Min. trip	0.01

The High current trip (multiples of Min. trip) setting determines the phase current threshold for high current tripping. Example: If High current trip = 12.00 (multiples of Min. trip) and Min. trip (No. 5) = 400 Amps primary, then the current threshold for high current tripping operates at a value equal to:

$$12.00 \cdot 400 \text{ Amps primary} = 4800 \text{ Amps primary}$$

The upper limit of this setting (50.00 multiples) is calculated from the Amps secondary range upper limit [20] and settings CT Ratio (No. 3) [1000] and Min. trip (No. 5) [400]:

$$(20 \cdot 1000)/400 = 50 \text{ multiples (upper limit)}$$

Due to processor calculations and rounding techniques, displayed range numbers may appear slightly different than expected (e.g., 49.99 instead of 50.00).

- This setting is hidden and set to OFF if High current trip is set to N.

No.	Setting	Default	Range	Incr.
	Setting	Default	Range	Incr.
	High current trip delay	0.00	0–16000 cycles	0.25 cyc.
<p>The High current trip delay setting programs an intentional time delay for the high current tripping. If set to zero (0), high current tripping operates instantaneously.</p> <p>➤ This setting is hidden and set to zero (0) if High current trip is set to N.</p>				
	Setting	Default	Range	Incr.
	Activate high current trip	OFF	OFF, 1–5	1
<p>The Activate high current trip setting determines when high current tripping is enabled (e.g., if Activate high current trip = 2, then high current tripping is enabled for the second [2nd] trip operation and every following trip operation). The setting range for Activate high current trip adjusts according to Operations to lockout (e.g., if Operations to lockout = 4, then the range for Activate high current trip is from 1 to 4).</p> <p>➤ This setting is hidden and set to OFF if High current trip is set to N.</p>				

No.	Setting	Default	Range	Incr.
20	High current lockout	N	Y/N	
<p>The High current lockout setting enables the following two settings for high current lockout, if set to Y. High current lockout is not affected by the cold load pickup scheme.</p> <p>➤ This setting is hidden and set to N if Fast curve (No. 6) and Delay curve (No. 7) are both set to OFF.</p>				
	Setting	Default	Range	Incr.
	High current lockout	OFF	OFF, 1.00–50.00 multiples of Min. trip	0.01
<p>The High current lockout (multiples of Min. trip) setting determines the exceeded current threshold at which the SEL-351RS Kestrel goes to the lockout state immediately when tripping.</p> <p>Example: If High current lockout = 13.00 (multiples of Min. trip) and Min. trip (No. 5) = 400 Amps primary, then the current threshold for high current lockout operates at a value equal to:</p> $13.00 \cdot 400 \text{ Amps primary} = 5200 \text{ Amps primary}$ <p>The upper limit of this setting (50.00 multiples) is calculated from the Amps secondary range upper limit [20] and settings CT Ratio (No. 3) [1000] and Min. trip (No. 5) [400]:</p> $(20 \cdot 1000)/400 = 50 \text{ multiples (upper limit)}$ <p>Due to processor calculations and rounding techniques, displayed range numbers may appear slightly different than expected (e.g., 49.99 instead of 50.00).</p> <p>➤ This setting is hidden and set to OFF if High current lockout is set to N.</p>				
	Setting	Default	Range	Incr.
	Activate high current lockout	OFF	OFF, 1–5	1
<p>The Activate high current lockout setting determines when high current lockout is enabled (e.g., if Activate high current lockout = 3, then high current tripping is enabled for the third [3rd] trip operation and every following trip operation).</p> <p>The setting range for Activate high current lockout adjusts according to Operations to lockout (e.g., if Operations to lockout = 4, then the range for Activate high current lockout is from 1 to 4).</p> <p>➤ This setting is hidden and set to OFF if High current lockout is set to N.</p>				

No.	Setting	Default	Range	Incr.
21	Cold load pickup scheme	N	Y/N	

The Cold load pickup scheme setting enables the cold load pickup scheme when set to Y.

- This setting is hidden and set to N if Delay curve (No. 7) is set to OFF.
- If Cold load pickup scheme is set to Y, then you are prompted to program the following settings:

No.	Setting	Default	Range	Incr.
	Setting	Default	Range	Incr.
	Cold load pickup	OFF	OFF, 1.00–50.00 multiples of Min. trip	0.01

The Cold load pickup setting determines the phase current threshold for overcurrent detection when the Cold load pickup scheme is active.

Example: If Cold load pickup = 1.70 (multiples of Min. trip), Min. trip (No. 5) = 400 Amps primary, and the cold load pickup scheme is active, then the current threshold for overcurrent detection operates at a value equal to:

$$1.70 \cdot 400 \text{ Amps primary} = 680 \text{ Amps primary}$$

The upper limit of this setting (50.00 multiples) is calculated from the Amps secondary range upper limit [20] and settings CT Ratio (No. 3) [1000] and Min. trip (No. 5) [400]:

$$(20 \cdot 1000)/400 = 50 \text{ multiples (upper limit)}$$

Due to processor calculations and rounding techniques, displayed range numbers may appear slightly different than expected (e.g., 49.99 instead of 50.00).

- If Cold load pickup is set to OFF, then the current threshold for overcurrent detection remains unchanged (threshold remains equal to Min. trip [No. 5]).
- This setting is hidden and set to OFF if Cold load pickup scheme is set to N or Delay curve (No. 7) is set to OFF.

Setting	Default	Range	Incr.
Loss of load diversity time	0.00	0.00–999999 cycles	0.25 cyc.

The Loss of load diversity timer starts to time if **both** the following are true:

- The recloser is open.
- The control is in the lockout state or reclosing is defeated.

When the Loss of load diversity timer times out, the **cold load pickup scheme is activated**, causing the following to occur:

- Fast curves are disabled.
- Delay curve elements are desensitized per preceding cold load pickup settings (the curves are not shifted—coordination is maintained).

When the recloser is closed, the cold load pickup scheme remains active. If the recloser remains closed, the current thresholds for overcurrent detection return **naturally** to their regular Min. trip (No. 5) level when the inrush current goes below the regular level for at least 15 seconds. The fast curve is enabled again.

- This setting is hidden and set to zero (0) if Cold load pickup scheme is set to N.

Setting	Default	Range	Incr.
Restore min. trips–time limit	OFF	OFF, 0.00–999999 cycles	0.25 cyc.

The Restore min. trips–time limit is an option to **force** current thresholds for overcurrent detection from temporary cold load pickup values back to regular Min. trip (No. 5) level. This time limit is set if the user is concerned about an overcurrent element being desensitized too long in the cold load inrush scheme (**force** the threshold back, do not let it return **naturally** as described with the preceding Loss of load diversity timer setting).

Restore min. trips–time limit ≠ OFF:

The Restore min. trips–time limit starts to time if the recloser is closed and both of the following are true:

- The cold load pickup scheme is active for at least one element (see preceding Cold load pickup and Loss of load diversity settings).
- At least one of the following three Restore min. trip settings is set to Y.

If the recloser remains closed, the Restore min. trips–time limit times out and selected current thresholds for overcurrent detection (see following three Restore min. trip settings) are forced back to the regular Min. trip (No. 5) level. The fast curve is also enabled again. The **natural** return to the regular Min. trip levels (described with the preceding Loss of load diversity timer setting) can also occur if the inrush current goes below the Min. trip level for at least 15 seconds **before** Restore min. trips–time limit times out.

Restore min. trips–time limit = OFF:

If the cold load pickup scheme is active, then the current thresholds for overcurrent detection can only return back to their regular Min. trip levels **naturally** as described with the preceding Loss of load diversity timer setting.

- This setting is hidden and set to OFF if Cold load pickup scheme is set to N.

No.	Setting	Default	Range	Incr.
	Setting	Default	Range	Incr.
	Restore min. trip	N	Y/N	

Restore min. trip = Y:

If the cold load pickup scheme is active, the current threshold for overcurrent detection is **forced** back to the regular Min. trip (No. 5) level when the preceding Restore min. trips–time limit times out.

Restore min. trip = N:

If the cold load pickup scheme is active, the current threshold for overcurrent detection can only return back to its regular Min. trip level **naturally** as described with the preceding Loss of load diversity timer setting.

- This setting is hidden and set to N if Restore min. trips–time limit is set to OFF or Delay curve (No. 7) is set to OFF.

No.	Setting	Default	Range	Incr.
22	Sequence coordination	N	Y/N	

The Sequence coordination setting keeps the SEL-351RS Kestrel in step with a downstream recloser control, preventing the over-reaching SEL-351RS Kestrel Fast curve elements from tripping for faults beyond the downstream recloser.

Sequence coordination advances the operations counter each time the following sequence occurs:

- The SEL-351RS Kestrel is in the reset state.
- Fast curve (No. 6) element picks up and starts timing for a fault.
- Fast curve (No. 6) element remains picked up for at least 1.25 cycles, but then drops out before tripping (fault was interrupted by downstream device closer to the fault).

When the operations counter is advanced beyond the Operations fast curve (No. 8), no more advancing of the operations counter occurs (the Fast curve elements are disabled). The Fast curve elements are enabled again (the operations counter is reset) after a time period equal to Reset time for auto reclose (No. 14).

- This setting is hidden **and** set to N if the Fast curve setting is set to OFF.

No.	Setting	Default	Range	Incr.
23	Underfrequency loadshedding	N	Y/N	

The Underfrequency loadshedding setting enables the underfrequency loadshedding scheme, if set to Y.

- If Underfrequency loadshedding is set to Y, enter the following two settings:

Setting	Default	Range	Incr.
Underfrequency pickup	OFF	OFF, 40.10–65 Hz	0.01 Hz

The Underfrequency pickup setting determines the frequency threshold for underfrequency loadshedding.

Setting	Default	Range	Incr.
Underfrequency time delay	6.00	2.00–16000 cycles	0.25 cyc.

The Underfrequency time delay setting determines the time delay for underfrequency loadshedding.

No.	Setting	Default	Range	Incr.
24	Demand meter time constant	5	5, 10, 15, 30, 60 minutes	

The Demand meter time constant setting determines the thermal demand meter response time.

Global EZ Settings

No.	Setting	Default	Range	Incr.
25	System Frequency	60	50, 60 Hz	

Enter nominal System frequency.

No.	Setting	Default	Range	Incr.
26	Recloser Wear Monitor	Y	Y, N	

The Recloser Contact Wear Monitor provides information that helps in scheduling and maintenance.

Recloser Wear Monitor = Y:

The recloser wear monitor must be set at a higher level, with the **SET G** command (see *Section 8: Metering and Monitoring* in the SEL-351RS Kestrel Recloser Control Instruction Manual). Default settings are set for a G&W Viper-SP or ABB Elastimold MVR single-phase recloser rated to 27 kV.

This monitoring function accumulates the number of trip operations and integrates the number of close-open operations and the current during each opening operation. The integrated close-open information is compared to a predefined recloser maintenance curve to calculate the percent contact wear.

Recloser Wear Monitor = N:

The recloser wear monitor is turned off.

No.	Setting	Default	Range	Incr.
27	Reset trip–latched LEDs on close	Y	Y, Y1, N, N1	

Figure 3.3 shows the front-panel trip–latched LEDs. They are: **TRIP**, **FAST CURVE**, **DELAY CURVE**, **OVER/UNDER FREQ**, **OVER/UNDER VOLT**, and **HIGH CURRENT**.

These LEDs latch in at the rising edge of trip and remain illuminated—even after power is turned off and then on again.

Reset trip–latched LEDs on close = Y or Y1:

The trip–latched LEDs extinguish automatically when the recloser closes.

Reset trip–latched LEDs on close = N or N1:

The trip–latched LEDs extinguish automatically (or are newly latched in) when the SEL-351RS Kestrel trips again.

Settings options Y1 and N1 disable the embedded 3–second qualifying time delay on the **LOCK** operator control (see *Operator Controls* on page 3.7). In this mode, the **LOCK** operator control effectively operates as the other operator controls, with no time delay.

No.	Setting	Default	Range	Incr.
28	Phantom Power Angle	0	0–330 degrees	30 degree steps

The Phantom Power Angle setting is used for power and energy metering calculations. When like phase voltage and current connections are made, this setting should be set to zero (i.e. default setting). When a different phase voltage is being used to power the SEL-351RS Kestrel than the phase protected (e.g., A-phase CT connection and B-phase voltage connection), the phantom power angle setting corrects the angle for power and energy metering. Using the example given, A-phase CT connection, B-phase PT connection and assuming ABC rotation, set the Phantom Power Angle to 120 degrees.

Note: The Phantom Power Angle setting is only used in power and energy metering and not in current and voltage metering or in protection elements, such as the 27/59 under-/overvoltage elements, power elements, and event report oscillography.

No.	Setting	Default	Range	Incr.
29	Current Transformer Polarity	POS	POS, NEG	

The Current Transformer Polarity setting provides an easy way to change the polarity of the measured current signals, thus the resulting power direction and impedances.

No.	Setting	Default	Range	Incr.
30	Power-off Delay After AC Loss	180	OFF, 1–1440 minutes	1

If the supply voltage (ac or dc) is de-energized, the SEL-351RS operates off battery power and initiates a countdown timer that starts with the Power-off Delay After AC Loss setting value, in minutes.

- If the supply voltage (ac or dc) does not reenergize before the countdown timer reaches zero, the SEL-351RS Kestrel will shut itself off.
- During the supply outage, if the countdown timer has not reached 0 and the battery voltage drops too low, the control will be disabled and will shut off immediately to protect the battery.

The final action before the control shuts down is to make a Going to Sleep entry in the Sequential Events Recorder (SER). When the countdown reaches one minute, the TOSLP (to sleep) Relay Word bit asserts and stays asserted, to allow some final control action to be taken before protection is disabled. If ac power comes back after the TOSLP bit has asserted, but before the SEL-351RS Kestrel shuts down, the TOSLP bit will be deasserted and the control will abort the countdown. If ac power fails again, the countdown timer will load with the PWRDN_AC setting and start over again.

No.	Setting	Default	Range	Incr.
31	Power-off Delay After Wake Up	20	OFF, 1–1440 minutes	1

When the SEL-351RS Kestrel is in sleep mode, it wakes up when either of the following occur:

- The ac source is reenergized.
- The front-panel **WAKE UP** pushbutton is operated.

After the SEL-351RS Kestrel is awakened via the front-panel **WAKE UP** pushbutton, the SEL-351RS Kestrel initiates a countdown timer that starts with the Global setting value PWRDN_WU in minutes. If the ac source does not reenergize before the countdown timer reaches zero, the SEL-351RS Kestrel will shut itself off.

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EZ Settings Sheets for the SEL-351RS Kestrel Recloser Control

WARNING

Anytime an EZ setting is changed, review all the EZ settings before enabling the new settings. Pay close attention in circumstances where a setting was once set to OFF or N and then later turned on (enabled)—other related settings may need to be turned on, though may still be set to OFF or N.

Settings Groups 1 (Main) and 2 (Alternate) EZ Settings (SET EZ n Command; n = 1, 2)

Control Identifier (30 characters)

Range: 0–9, A–Z, -, /, ., space

Circuit Identifier (30 characters)

Range: 0–9, A–Z, -, /, ., space

CT Ratio

Range: 1.0–6000

Incr.: 0.1

PT Ratio

Range: 1.00–10000

Incr.: 0.01

Min. trip (*Ranges given for CT Ratio = 1000.0*)

Range: OFF, 50.00–32000 A primary

Incr.: 0.01

Fast Curve (see *Recloser Curve Designations on page SET.5*)

Range: OFF, U1–U5 (US), C1–C5 (IEC)

Time-dial—fast curve

Range: 0.50–15.00 (U1–U5), 0.05–1.00 (C1–C5)

Incr.: 0.01

EM reset—fast curve

Range: Y/N

Delay Curve (see *Recloser Curve Designations*)

Range: OFF, U1–U5 (US), C1–C5 (IEC)

Time-dial—delay curve

Range: 0.50–15.00 (U1–U5), 0.05–1.00 (C1–C5)

Incr.: 0.01

EM reset—delay curve

Range: Y/N

Operations—fast curve

Range: OFF, 1–5

Incr.: 1

Operations to lockout

Range: OFF, 1–5

Incr.: 1

Reclose interval 1

Range: OFF, 12.00–999999 cycles

Incr.: 0.25

Reclose interval 2

Range: OFF, 90.00–999999 cycles

Incr.: 0.25

Reclose interval 3

Range: OFF, 120.00–999999 cycles

Incr.: 0.25

Reclose interval 4

Range: OFF, 120.00–999999 cycles

Incr.: 0.25

Reset time for auto-reclose

Range: 180.00–999999 cycles

Incr.: 0.25

Reset time from lockout

Range: 0.00–999999 cycles

Incr.: 0.25

Close power wait time

Range: OFF, 0.00–999999 cycles

Incr.: 0.25

Complex fast curve

Range: Y/N

Const. time adder–fast curve

Range: 0.00–60 cycles

Incr.: 0.25

Vert. multiplier–fast curve

Range: 0.10–2

Incr.: 0.01

Min. response–fast curve

Range: 0.00–60 cycles

Incr.: 0.25

Complex delay curve

Range: Y/N _____

Const. time adder–delay curve

Range: 0.00–60 cycles

Incr.: 0.25 _____

Vert. multiplier–delay curve

Range: 0.10–2

Incr.: 0.01 _____

Min. response–delay curve

Range: 0.00–60 cycles

Incr.: 0.25 _____

High current trip

Range: Y/N _____

High current trip (*range given for CT Ratio = 1000.0*)

Range: 1.00–(20000/Min. trip)

multiples of Min. trip

Incr.: 0.01 _____

High current trip delay

Range: 0–16000 cycles

Incr.: 0.25 _____

Activate high current trip (*range given for operations to lockout = 5*)

Range: OFF, 1–5

Incr.: 1 _____

High current lockout

Range: Y/N _____

High current lockout (*range given for CT Ratio = 1000.0*)

Range: 1.00–(20000/Min. trip)

multiples of Min. trip

Incr.: 0.01 _____

Activate high current lockout (*range given for operations to lockout = 5*)

Range: OFF, 1–5

Incr.: 1 _____

Cold load pickup scheme

Range: Y/N _____

Cold load pickup (*range given for CT Ratio = 1000.0*)

Range: 1.00–(20000/Min. trip)

multiples of Min. trip

Incr.: 0.01 _____

Loss of load diversity time

Range: 0.00–999999 cycles

Incr.: 0.25 _____

Restore min. trip—time limit

Range: OFF, 0.00–999999 cycles

Incr.: 0.25 _____

Restore min. trip

Range: Y/N _____

Sequence coordination	
Range: Y/N	
Underfrequency loadshedding	
Range: Y/N	
Underfrequency pickup	
Range: OFF, 40.10–65 Hz	
Incr.: 0.01	
Underfrequency time delay	
Range: 2.00–16000 cycles	
Incr.: 0.25	
Demand meter time constant	
Range: 5, 10, 15, 30, 60 minutes	

Global EZ Settings (SET FZ Command)

System Frequency	
Range: 50, 60 Hz	
Recloser Wear Monitor	
Range: Y, N	
Reset trip-latched LEDs on close	
Range: Y, Y1, N, N1	
Phantom Power Angle	
Range: 0–330 degrees	
Incr.: 30	
Current Transformer Polarity	
Range: POS, NEG	
Power-off Delay After AC Loss	
Range: OFF, 1–1440 minutes	
Incr.: 1	
Power-off Delay After Wake Up	
Range: OFF, 1–440 minutes	
Incr.: 1	

Recloser Curve Designations

Quick Reference for Curve Settings:

Fast Curve

Delay curve

Use any mix of old and new recloser curve designations when making curve settings.

Recloser Curve Cross Reference-Old to New					
Old	New	Old	New	Old	New
A	101	P	115	7	152
B	117	R	105	8	113
C	133	T	161	8PLUS	111
D	116	V	137	9	131
E	132	W	138	KG	165
F	163	Y	120	11	141
G	121	Z	134	13	142
H	122	1	102	14	119
J	164	2	135	15	112
KP	162	3	140	16	139
L	107	4	106	17	103
M	118	5	114	18	151
N	104	6	136		

US Curve	Description
U1	moderately inverse
U2	inverse
U3	very inverse
U4	extremely inverse
U5	short-time inverse

IEC Curve	Description
C1	class A (standard inverse)
C2	class B (very inverse)
C3	class C (extremely inverse)
C4	long-time inverse
C5	short-time inverse

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Section 5

Battery

Overview

BATTERY LIST

See Battery Replacement on page 5.3.

DO NOT TRANSPORT THE SEL-351RS KESTREL WITH THE BATTERY INSIDE THE ENCLOSURE!

The SEL-351RS Kestrel® Recloser Control is available with a 12 volt, 16 amp-hour or 40 amp-hour sealed lead-acid battery. The battery supplies power to the SEL-351RS Kestrel when supply power (120/220 Vac or 125/250 Vdc) is interrupted. A fully charged 16 Amp-hour battery supplies the trip/close cycle and control power for up to 15 hours depending on ambient temperature and load.

The SEL-351RS Kestrel puts itself to sleep after battery capacity discharges to a certain threshold or one of the delay timers expire:

- Power-Off Delay After AC Loss (OFF, 6.5-20.01–1440 min)
- Power-Off Delay After Wake Up (OFF, 1–1440 min)

See *Section 4: EZ Settings* for explanations and default settings.

The SEL-351RS Kestrel wakes up if any of the following occur:

- Supply power is restored
- The **WAKE UP** operator control is pressed

Battery Status

The status of the battery can be checked via the front panel or serial port.

The **BATTERY PROBLEM** LED illuminates for any of the following battery problems:

- Load test failure
- Damaged (battery cannot charge)

Press the **STATUS** pushbutton on the front panel of the SEL-351RS Kestrel to access more battery status information. With the secondary function up/down arrow pushbuttons, move to the battery status screens, listed in *Table 5.1*:

Table 5.1 Battery Status Information Accessed From the Front Panel
(Sheet 1 of 2)

Display	Description
MODE = STARTUP	Control is in Startup mode
MODE = CUR_CHG	Battery is charging
MODE = FST_CHG	Battery is charging
MODE = FLT_CHG	Battery is charging
MODE = DISCHRG	Battery is discharging

Table 5.1 Battery Status Information Accessed From the Front Panel
(Sheet 2 of 2)

Display	Description
MODE = BAT_TST	Battery load test in progress
MODE = BAT_FLR	Battery is damaged, disconnected, fuse is open, battery monitor/charger failed, or communications with the battery monitor/charger are permanently interrupted
MODE = CAP_CHG	Close capacitors are being charged, during which time the battery charger is disabled
MODE = WAIT	Battery charge is in Wait mode for a second before going to one of the charging modes
5V_PS =	Internal 5 V power supply level for battery monitor/charger
12V_AUX =	12 V power output level—available via connector positions Z18, Z19 and Z20, Z21
VBAT =	Voltage level of 12 V battery
IBAT =	Current level (in A) at which the 12 V battery is charging or discharging (preceded by a minus sign for discharging)

Execute the **STATUS** command, and have the same information available via the preceding front-panel **STATUS** pushbutton.

Automatic Battery Load Test

The SEL-351RS Kestrel automatically load tests the 12 V battery about every 24 hours. See the *Battery System Monitor* subsection in *Section 8: Metering and Monitoring* of the SEL-351RS Kestrel Recloser Control Instruction Manual for additional information.

Battery Load Test Via Serial Port

Execute the **BTT NOW** command to immediately start a battery test.

When the battery test is initiated, the following message is displayed:

```
Battery test initiated.
```

A period appears after this message for each second of the battery test. Battery test may run up to 10 seconds.

If the battery test cannot be started, the control responds with:

```
Command Not Allowed: Control is in <CMODE>.
```

At the end of the test, **OK** or **FAILED** is displayed. If the battery fails the load test, the **BATTERY PROBLEM LED** is illuminated.

Execute the **BTT** command to see how much time remains until the next automatic battery discharge test. If the battery is okay, the following message is displayed:

```
Battery test state is: OK/FAILED  
Time until next battery test: XX (hours)
```

The “next battery test” is the automatic load test described in *Automatic Battery Load Test on page 5.2*.

Battery Replacement

DO NOT TRANSPORT
THE SEL-351RS KESTREL
WITH THE BATTERY INSIDE
THE ENCLOSURE!

The SEL-351RS Kestrel can be ordered with a 16 or 40 Ah, 12 V battery. Either of these battery types can be used as a replacement for the installed battery. The part numbers and characteristics are listed in *Table 5.2*. Additional specifications are shown in *Battery Specifications on page 6.2*.

Table 5.2 Battery Options

Function	Option 1	Option 2
Part Number	015-0029 (EnerSys XE 16)	015-0033 (EnerSys XE 40)
Capacity	16 Ah	40 Ah
Weight	6.4 kg (≤ 14.1 lbs)	16.1 kg (≤ 35.4 lbs)

To replace the battery, see *Battery Installation and Connection on page 1.11*.

Perform a **BTT NOW** command to verify that the replacement battery is in good condition (see *Battery Load Test Via Serial Port on page 5.2*).

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Section 6

Specifications

Compliance

Designed and manufactured under an ISO 9001 certified quality management system

General

AC Current Input

1 A Nominal:	3 A continuous, linear to 20 A symmetrical; 100 A for 1 s, 125 A peak for one cycle
Burden:	0.13 VA @ 1 A 1.31 VA @ 3 A

AC Voltage Input

Nominal Range:	67–120 Vrms Line-to-Neutral
Continuous:	300 Vrms Line-to-Neutral (connect any voltage up to 300 Vac)
Short-Term Overvoltage:	600 Vac for 10 seconds
Burden:	0.03 VA @ 67 V 0.06 VA @ 120 V 0.80 VA @ 300 V

Power Supply

Rated Range:	85–264 Vac 100–350 Vdc
Frequency Range:	40.1–65 Hz
Burden:	< 90 VA

12 V Auxiliary Power Supply

With AC Present:	12 Vdc \pm 10%
Without AC Present:	10.2–16 Vdc (Battery Voltage)
Power:	13 W continuous

Output Contacts

Make:	30 A per IEEE C37.90-1989
Carry:	6 A continuous carry at 70°C 4 A continuous carry at 85°C
1 s Rating:	50 A
MOV Protection:	270 Vac / 360 Vdc; 75 J
Pickup Time:	< 5 ms, typical
Dropout Time:	< 5 ms, typical
Breaking Capacity (10000 operations, L/R = 40 ms):	
24 V	0.75 A
48 V	0.50 A
125 V	0.30 A
250 V	0.20 A
Cyclic Capacity (2.5 cycle/second, L/R = 40 ms):	
24 V	0.75 A
48 V	0.50 A
125 V	0.30 A
250 V	0.20 A

Note: Make per IEEE C37.90-1989

Note: Breaking and Cyclic Capacity per IEC 60255-0-20:1974.

Trip and Close Outputs

Coil Voltage:	155 + 5, –3 Vdc
Coil Current:	12–17 A (Close), 4 A (Trip)
Pulse Duration:	53–55 ms (Close), 28–30 ms (Trip)

Optoisolated Input

DC Range	
12 Vdc:	Pickup 9.6–14.4 Vdc
Note: Optoisolated inputs draw approximately 4–10 mA of current.	

Frequency

System Frequency:	50 or 60 Hz
Frequency Tracking Range:	40.1–65 Hz

Note: Voltage connected to V required for frequency tracking.

Communications Ports

EIA-232:	One front; two side
EIA-485:	One side, 2100 Vdc of isolation
Per Port Baud Rate Selections:	300, 1200, 2400, 4800, 9600, 19200, 38400, 57600
USB:	One side, (Type B connector, CDC class device)
Ethernet:	One 10/100BASE-T side port (RJ45 connector) (discontinued option) Two 10/100BASE-T side port optional (RJ45 connector) One or two 100BASE-FX side ports optional multimode (LC connectors) Internal Ethernet switch included with second Ethernet port.

Time-Code Input

Recloser control accepts demodulated IRIG-B time-code input at isolated BNC and Port 2 on the side panel. Do not connect the time-code input into both the BNC and Port 2 at the same time. Recloser control time is synchronized to within ± 5 ms of time-source input.

Synchronization Accuracy

Internal Clock:	$\pm 1 \mu\text{s}$
Synchrophasor Reports (e.g., MET PM , EVE P , CEV P):	$\pm 10 \mu\text{s}$
All Other Reports:	$\pm 5 \text{ ms}$

Simple Network Time Protocol (SNTP) Accuracy

Internal Clock:	$\pm 5 \text{ ms}$
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Unsynchronized Clock Drift

Relay Powered:	2 minutes per year, typical
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Operating Temperature

Relay Module:	–40° to +85°C (–40° to +185°F)
Batteries:	–40° to +80°C (–40° to +176°F)
Entire SEL-351RS Kestrel Unit:	–40° to +60°C (–40° to +140°F)

Note: LCD contrast impaired for temperatures below –20°C (–4°F). The entire SEL-351RS Kestrel unit was tested at +70°C (+158°F). The difference in ratings allows for temperature rise due to sunlight.

Weight

< 34 kg (75 lbs) including batteries

Battery Specifications

Base Version Requirement

Normal Capacity:	16.0 amp-hours at +25°C (+77°F)
Run Time (Relay electronics operate at typical load plus one trip/close cycle):	≥ 15 hours at +25°C (+77°F) ≥ 5 hours at –40°C (–40°F)
Estimated Life:	≥ 4 years at +25°C (+77°F) ≥ 1 year at +80°C (+176°F)
Recharge Time:	≤ 16 hours at +25°C (+77°F)

Extended Capacity Option Requirement

Normal Capacity:	40 amp-hours at +25°C (+77°F)
Run Time (Relay electronics operate at typical load plus one trip/close cycle):	≥ 48 hours at +25°C (+77°F)
Estimated Life:	≥ 4 years at +25°C (+77°F) ≥ 1 year at +80°C (+176°F)
Recharge Time:	≤ 40 hours at +25°C (+77°F)

Type Tests

Environmental Tests

Cold:	IEC 60068-2-1:2007 Environmental testing procedures, Part 2-1: Tests—Test Ad: Cold
Dry Heat:	IEC 60068-2-2:2007 Environmental testing procedures, Part 2-2: Tests—Test Bd: Dry Heat
Damp Heat Cyclic:	IEC 60068-2-30:2005 Basic environmental testing procedures, Part 2-30: Tests, Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle), (six-day type test)

Dielectric Strength and Impulse Tests

Dielectric:	IEC 60255-5:2000 IEEE C37.90-2005 2500 Vac on analogs, contact inputs, and contact outputs except Trip and Close; 3100 Vdc on power supply for 10 s
Impulse:	IEC 60255-5:2000 Electrical relays, Part5: Insulation tests for electrical relays. Section 6.1.3: Impulse Voltage Tests Severity Level: 0.5 Joule, 5 kV

Electrostatic Discharge Test

ESD:	IEC 60255-22-2:2008 IEC 61000-4-2:2008 Electrical disturbance tests for measuring relays and protective equipment, Electrostatic discharge tests, Severity Level: 2, 4, 6, 8 kV contact discharge all points except serial ports, 15 kV air discharge to all other points IEEE C37.90.3-2001 IEEE Standard for Electrostatic Discharge Tests for Protective Relays. Severity Level: 2, 4, and 8 kV contact; 4, 8, and 15 kV air
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RFI and Interference Tests

Conducted RF Immunity:	IEC 60255-22-6:2001 IEC 61000-4-6:2008 Immunity to conducted disturbance induced by radio frequency fields. Severity Level: 10 Vrms
RFI Immunity:	IEC 61000-4-3:2008 Radiated, radio-frequency, electromagnetic field immunity, Severity Level: 10 V/m IEEE C37.90.2-2004 Standard for withstand capability of relay systems to radiated electromagnetic interference from transceivers, Severity Level: 35 V/m
Digital Radio Telephone RF Immunity:	ENV 50204:1995 Radiated electromagnetic field from digital radiotelephones—Immunity test Severity Level: 10V/m at 900 MHz and 1.89 GHz
Surge Withstand:	IEEE C37.90.1-2002 Severity Level: 2.5 kV oscillatory; 4.0 kV fast transient

Electromagnetic Compatibility Emissions Tests

Radiated and Conducted Emissions:	Canada ICES-001(A) / NMB-001(A)
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Vibration and Shock Tests

Sinusoidal Vibration:	IEC 60255-21-1:1988 Severity Level: Class 1 Endurance, Class 2 Response
Shock and Bump:	IEC 60255-21-2:1988 Severity Level: Class 1—Shock withstand, Bump, Class 2—Shock Response
Seismic:	IEC 60255-21-3:1993 Severity Level: Class 2—Quake response

Miscellaneous

Enclosure Protection:	NEMA 250-2008 Enclosures for Electrical Equipment, Enclosure type 3R IEC 60529:2001 + CRGD:2003 BS EN 60529 Second Edition:1992 + REAF:2004 IP45 (Swing Open Enclosure only)
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Recloser Type Tests

ANSI/IEEE C37.60-2003, performed with the following single-phase reclosers:

G&W Viper-SP	27 kV, 12.5 kA interrupting 800 A continuous
ABB Elastimold MVR	27 kV, 12.5 kA interrupting 800 A continuous

Section 6.3 Switching Tests

Performed at ≥ 27 kV and 60 Hz, using Table 9.

Load-Switching: 10 close-open operations at ≥ 800 A

Line-Charging
Switching: 20 close-open operations at ≥ 5 A

Cable-Charging
Switching: 20 close-open operations at ≥ 25 A

Section 6.5 Rated Symmetrical Interrupting Current Tests

Performed at ≥ 27 kV and 60 Hz, using Table 6 and Table 10b. Each operation is an open-close-open-close-open sequence.

16 operations at 11.25 kA to 12.5 kA

56 operations at 5.63 kA to 6.87 kA

44 operations at 1.88 kA to 2.5 kA

Section 6.13 Control Electronic Elements Surge Withstand Capability (SWC) Tests

Clause 6.13.1 Oscillatory and fast transient surge tests
Performed in accordance with IEEE Std. C37.90.1-2002

Clause 6.13.2 Simulated surge arrester operation test
Gap flashover at $0.8 \cdot \text{BIL}$ rating
Peak surge current of 7000 A following gap flashover

ANSI/IEEE C37.60-2012, performed with the following single-phase reclosers:

G&W Viper-SP 38 kV, 12.5 kA interrupting
800 A continuous

ABB Elastimold MVR 38 kV, 12.5 kA interrupting
800 A continuous

Section 6.111 Control Electronic Elements Surge Withstand Capability (SWC) Tests

Clause 6.111.2 Oscillatory and fast transient surge tests
Performed in accordance with IEEE Std. C37.90.1-2002

Clause 6.111.3 Simulated surge arrester operation test
Gap flashover at $0.8 \cdot \text{BIL}$ rating
Peak surge current of 6000 A following gap flashover

Processing Specifications and Oscillography

AC Voltage and Current Inputs

128 samples per power system cycle, 3 dB low-pass filter cut-off frequency of 3 kHz.

Digital Filtering

Digital low-pass filter then decimate to 32 samples per cycle followed by one cycle cosine filter.

Net filtering (analog plus digital) rejects dc and all harmonics greater than the fundamental.

Protection and Control Processing

Four times per power system cycle.

Oscillography

Length: 15, 30, or 60 cycles

Total Storage: 11 seconds of analog and binary

Trigger: Programmable with Boolean expression

Format: ASCII and Compressed ASCII

Time-Stamp Resolution: 1 μ s when high-accuracy time source is connected (**EVE P** or **CEV P** commands)

Time-Stamp Accuracy: See *Time-Code Input* on page 6.1

Sequential Events Recorder

Time-Stamp Resolution: 1 ms

Time-Stamp Accuracy
(with respect to time source): ± 5 ms

Relay Elements Pickup Ranges and Accuracies

Instantaneous/Definite-Time Overcurrent Elements (50)

Pickup Range: 0.05–20.00 A, 0.01 A steps

Steady-State Pickup
Accuracy: $\pm 3\%$ of setting and ± 0.01 A

Transient Overreach: $\pm 5\%$ of pickup

Time Delay: 0.00–16,000.00 cycles, 0.25–cycle steps

Timer Accuracy: ± 0.25 cycle and $\pm 0.1\%$ of setting

Time-Overcurrent Elements (51)

Pickup Range: 0.05–3.2. A, 0.01 A steps

Steady-State Pickup
Accuracy: $\pm 3\%$ of setting and ± 0.01 A

Time Dial Range: 0.5–15.0, 0.01 steps (US)
0.05–1.00, 0.01 steps (IEC)
0.10–2.00, 0.01 steps (Recloser curves)

Curve Timing Accuracy: ± 1.50 cycles and $\pm 4\%$ of curve time for current between 2 and 30 multiples of pickup

Second Harmonic Blocking Elements

Pickup Range: 5–100% of fundamental, 1% steps

Steady-State Pickup
Accuracy: 2.5 percentage points

Pickup/Dropout Time: < 1.25 cycles

Time Delay: 0.00–16,000.00 cycles, 0.25 cycle steps

Timer Accuracy: ± 0.25 cycles and $\pm 0.1\%$ of setting

Under- (27)/Overvoltage (59) Elements

Pickup Range: 0.00–300.00 V, 0.01 V, or 0.02 V steps

Steady-State Pickup
Accuracy: $\pm 1\%$ and ± 2 V for 12.5–300.00 V

Transient Overreach: $\pm 5\%$ of pickup

Under-/Overfrequency Elements (81)

Pickup Range: 40.10–65.00 Hz, 0.01 Hz steps

Time Delays: 2.00–16,000.00 cycles, 0.25-cycle steps

Timer Accuracy: ± 0.25 cycle and $\pm 0.1\%$ of setting

Steady-State *plus*
Transient Overshoot: ± 0.01 Hz for 1 Hz step change

Undervoltage Frequency
Element Block Range: 25.00–300.00 V

Timers

Pickup Ranges: 0.00–999,999.00 cycles
0.25-cycle steps (reclosing relay and some programmable timers)
0.25-cycle steps (some programmable and other timers)

Pickup/Dropout
Accuracy: ± 0.25 cycle and $\pm 0.1\%$ of setting

Metering Accuracy

Accuracies are specified at 20°C and at nominal system frequency and voltages < 250 V unless noted otherwise.

Voltage V: $\pm 0.2\%$, (67–300.0 V)
 Current I: $\pm 0.1\%$ and ± 1 mA (0.1–20 A)
 Phase Angle Accuracy: $\pm 0.5^\circ$
 Power Accuracy (MW/MVAR): at load angle

Accuracy (MW/MVAR)	at load angle
for phase current ≥ 0.2 A secondary:	
0.35% / –	0° or 180° (unity power factor)
0.40% / 6.00%	± 8 or $\pm 172^\circ$
0.75% / 1.50%	$\pm 30^\circ$ or $\pm 150^\circ$
1.00% / 1.00%	$\pm 45^\circ$ or $\pm 135^\circ$
1.50% / 0.75%	$\pm 60^\circ$ or $\pm 120^\circ$
6.00% / 0.40%	$\pm 82^\circ$ or $\pm 98^\circ$
– / 0.35%	$\pm 90^\circ$ (power factor = 0)

Energy Meter Accumulators: Separate IN and OUT accumulators updated twice per second, transferred to nonvolatile storage once per day.

ASCII Report Resolution: 0.1 MWh

Accuracy: The accuracy of the energy meter depends on applied current and power factor as shown in the power metering accuracy table above. The additional error introduced by accumulating power to yield energy is negligible when power changes slowly compared to the processing rate of twice per second.

Synchrophasor Accuracy

Maximum Data Rate in Messages per Second

IEEE C37.118 Protocol: 60 (nominal 60 Hz system)
 50 (nominal 50 Hz system)

IEEE C37.118 Accuracy: Level 1 at maximum message rate when phasor has the same frequency as phase voltage

Current Range: $(0.1-2) \cdot I_{\text{NOM}}$

Frequency Range: ± 5 Hz of nominal (50 or 60 Hz)

Voltage Range: 30 V–300 V

Phase Angle Range: -179.99° to 180.00°

Power Element Accuracy

Pickup Setting 0.07–0.4 VA: $\pm 0.01 \text{ A} \cdot V_{\text{SECONDARY}}$ and $\pm 10\%$ of setting at unity power factor for power elements and zero power factor for reactive power elements

Pickup Setting 0.4–2600 VA: $\pm 0.005 \text{ A} \cdot V_{\text{SECONDARY}}$ and $\pm 5\%$ of setting at unity power factor

Appendix A

Quick-Start Guide Change Information

Changes in this guide to date are summarized below (most recent revisions listed at top).

Table A.1 Quick-Start Guide Change Information

Revision Date	Summary of Revisions
20240618	Section 1 ➤ Removed reference to SEL-2925 BLUETOOTH® Serial Adapter.
20220510	Section 2 ➤ Removed reference to SEL-351RS Product Literature CD.
20211020	Section 6 ➤ Added <i>Electromagnetic Compatibility Emissions Tests to Specifications</i> .
20171025	Section 1 ➤ Updated <i>Figure 1.2: SEL-351RS Kestrel Front View With Swing-Open Enclosure</i> . Section 6 ➤ Updated <i>Specifications</i> .
20150227	Preface ➤ Updated <i>Safety Information</i> . Section 1 ➤ Updated <i>Table 1.1: Control Cable Receptacle Pin Descriptions and Recloser Connection Details</i> . ➤ Added <i>Changing the CT Tap</i> subsection. Section 6 ➤ Changed <i>Certifications</i> to <i>Compliance</i> and moved it to the beginning of <i>Specifications</i> .
20140328	Section 6 ➤ Updated <i>Recloser Type Tests</i> .
20130430	Section 1 ➤ Changed rating of 12 Vdc auxiliary power supply from 6 W to 13 W continuous. Section 6 ➤ Changed rating of 12 Vdc auxiliary power supply from 6 W to 13 W continuous.
20121112	Section 1 ➤ Added compatibility with Elastimold MVR single-phase recloser. Section 4 ➤ Changed Reset Time From Lockout lower limit to 0.00 cycles.
20110518	Section 1 ➤ Added <i>Optional Convenience Outlet Connections</i> . ➤ Added convenience outlet fuse to <i>Table 1.2: Replacement Fuses for the SEL-351RS Kestrel Recloser Control</i> .
20100510	➤ Initial version.

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SCHWEITZER ENGINEERING LABORATORIES, INC.

2350 NE Hopkins Court • Pullman, WA 99163-5603 U.S.A.

Phone: +1.509.332.1890 • Fax: +1.509.332.7990

selinc.com • info@selinc.com