SEL-2523 Advanced Annunciator Panel

Complete Alarm Monitoring, Annunciation, and Communication

Major Features and Benefits

High Reliability, Low Price
➤ Ten-Year, Worldwide Warranty
➤ −40° to +85°C Operating Temperature
➤ Ruggedized to Meet and Exceed Industrial and Utility Standards
➤ IRIG-B Time Synchronization

Flexible Input, Output, and Logic Choices
➤ Powerful Programmable Logic and Timer Functions
➤ 4 ms Logic Loop Time
➤ EIA-232 and EIA-485 Communications
➤ Modbus® RTU, DNP3, MIRRORED BITS® Communications, SEL ASCII, and SEL Fast Messaging

Critical Reporting
➤ 1 ms Accurate Sequential Events Recorder
➤ Storage of as many as 1024 Event Records

Simple Commissioning Tools
➤ Front-Panel Configuration Access
➤ Simple Programming With ACSELERATOR QuickSet® SEL-5030 Software
Product Overview

The SEL-2523 Annunciator Panel is an advanced annunciator panel that allows complete alarming, notification, reporting, and communication. The SEL-2523 supports many of the standard ISA-18.1 annunciator sequences. It comes standard with 36 alarm windows that can be independently programmed to alarm through contact inputs or communication. The SEL-2523 is designed to read and acknowledge alarms locally or remotely.
SEL-2523 Base Unit

Standard Features

➤ ISA-18.1 annunciator sequences: A, M, M-1, R, R-1, F1A, F2M-1, F3A
➤ Forty-two digital inputs and eleven digital contact outputs
➤ One front and two rear EIA-232 serial ports
➤ Internal power supply 24/48 Vdc or 125/250 Vdc or Vac
➤ IRIG-B input with 1 ms SER time-stamping
➤ ACSELERATOR QuickSet PC software

➤ Thirty-six front panel alarm points with configurable windows and indicating LED labels
➤ Modbus RTU, MIRRORED BITS, SEL ASCII and Compressed ASCII, SEL Fast Meter, Fast Operate, Fast SER, SEL Fast Message, and Ymodem file transfer protocols
➤ SEL-4391 Data Courier® Compatibility

Optional Features

➤ EIA-232 or EIA-485 Serial Communications Card
➤ DNP3 Level 2 Outstation

Functional Overview

The SEL-2523 Annunciator Panel is designed to receive station equipment status information through hard-wired contacts or communications devices to provide a single-point alarm station (see Figure 3). The SEL-2523 monitors equipment, reports on the status of any equipment that has failed, and notifies local and remote personnel of current conditions. The SEL-2523 provides a safe checkpoint for personnel on-site and a common location where local and remote users can monitor the status of an alarm.

When an alarm condition occurs, the SEL-2523 communicates information to the control center, where the appropriate personnel can be deployed for repair. The SEL-2523 stores the current state of each alarm point in nonvolatile memory. If power is lost at any point, the SEL-2523 will return to the last recorded state upon power up, allowing alarms recorded during power outages to be maintained for post-event analysis.

The SEL-2523 indicates the status of up to 36 alarm points and can be programmed to indicate as few or as many points as needed for each application. Multiple alarm panels can be used for high-density alarm applications.

Field-configurable labels allow the alarm panel to be customized and modified as needed. A wide range of power supply and contact input voltages allow the SEL-2523 to be installed in virtually any system.

Schweitzer Engineering Laboratories, Inc.

SEL-2523 Data Sheet
### Automation

The SEL-2523 Annunciator Panel makes it easy to automate a system-wide alarming station. The SEL-2523 comes standard with remote bits, timers, latches, and SELOGIC® variables. Use the logic to replace traditional panel alarms and latching relays, and to eliminate redundant wiring.

Eliminate RTU-to-relay wiring with 40 remote control bits. Set, clear, or pulse remote control bits via serial port commands. Program the remote bits into your control scheme with SELOGIC control equations. Use remote bits for SCADA-type control operations, e.g., alarm trigger, acknowledgement, and device status indication. Replace traditional latching relays for such functions as “remote control enable,” “auto acknowledge,” or “silence” with 32 latching control bits. Program latch set and latch reset conditions with SELOGIC control equations. Set or reset the latch bits via optoisolated inputs, remote bits, or any programmable logic condition. The latch bits retain their state when the device loses power.

### Configurable Labels

Each SEL-2523 Annunciator Panel comes with a set of configurable labels. Use the labels to uniquely identify each alarm point LED. Preprinted labels are included (with factory-default text), as are blank label media and a Microsoft® Word template on CD-ROM. This allows you to quickly make professional-looking labels for the SEL-2523. Blank stock labels are also provided for handwritten customization. These customization features allow easy implementation without the need for adhesive labels.

### Output 11

Output 11 is a Form C contact that can be used either as a standard output contact or as an alarm status (default). The alarm status will close the contact any time the SEL-2523 encounters hardware or software issues such as Flash failure, power supply failure, RAM failure, or EEPROM failure.

### Control Inputs and Outputs

The SEL-2523 Annunciator Panel comes standard with 42 independent control inputs and 11 Form A outputs.

The control inputs can be ordered to any of the standard control input voltages found on station battery systems. Each input has programmable debounce settings to help ride through false operations of connected equipment. Each input has an ac setting that allows you to connect the input to an ac voltage source. This setting allows the SEL-2523 to recognize a proper on/off state when a sinusoidal waveform is applied.

The outputs are all 6 A continuous-carry contacts. The contact can be used to trigger-on critical or noncritical alarms sent to an internal horn. The contact can be used to connect a strobe light or large display LED to trigger-off any of the 36 alarm points. This provides maintenance crews with a highly visible alert should a problem arise.

### Fast SER Protocol

SEL Fast Sequential Events Recorder (SER) Protocol provides SER events to an automated data collection system. SEL Fast SER Protocol is available on any serial port set as “SEL” protocol. Devices with embedded processing capability use these messages to enable and accept unsolicited binary SER messages from an SEL-2523.

SEL relays and communications processors have two separate data streams that share the same serial port. The normal serial interface consists of ASCII character commands and reports that are intelligible to users with a terminal or terminal emulation package. The binary data streams interrupt the ASCII data stream to obtain information, and allow the ASCII data stream to continue. This mechanism allows a single communications channel for ASCII communications (e.g., transmission of a long event report) interleaved with short bursts of binary data to support fast acquisition of metering or SER data.
Integration

The SEL-2523 Annunciator Panel is equipped with three independently operated serial ports: one EIA-232 port on the front and two EIA-232 ports on the rear. An additional EIA-232 or EIA-485 port is available as an ordering option. The SEL-2523 comes standard with acSCELERATOR QuickSet software to aid in setting the SEL-2523. The SEL-2523 supports settings from a standard ASCII terminal.

The SEL-2523 is designed to easily establish communications to the following:

➤ Connected computers, modems, and protocol converters
➤ An SEL-3530, SEL-3364, or SEL-2032
➤ SCADA serial ports, and/or RTUs for local or remote communication

Apply an SEL-3530, SEL-3364, or SEL-2032 as the hub of a star network with point-to-point fiber or copper connections between the hub and the SEL-2523 (see Figure 4). The communications processor supports external communications links, including the public switched telephone network for engineering access to dial-out alerts, and private line connections of the SCADA system. SEL manufactures a variety of standard cables for connecting relays to a variety of external devices. Consult your SEL representative for more information.

The SEL-2523 comes with several standardized protocols to make communications, operations, and alarm acknowledgment easy. Table 1 lists the various protocols that the SEL-2523 supports.

![Figure 4 Example Communications System](image)

Table 1 Open Communications Protocols

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple ASCII</td>
<td>Plain language commands for human and simple machine communications; use for settings, self-test status, SER reporting, and other functions</td>
</tr>
<tr>
<td>Extended Fast Meter and Fast Operate</td>
<td>SEL binary protocol for machine-to-machine communications; quickly updates SEL Communications Processors (SEL-2032, SEL-2030, and SEL-2020), SEL Computing Platforms (SEL-3332 and SEL-3351), RTUs, and other substation devices with device elements, I/O status, time-tags, control commands, and SER; data are checksum protected; binary and ASCII protocols operate simultaneously over the same communications lines so control operator information is not lost while a technician is transferring an event report</td>
</tr>
<tr>
<td>DNP3 Level 2 Outstation</td>
<td>Distributed Network Protocol with point remapping; includes access to alarm points, contact I/O, targets, and SER</td>
</tr>
<tr>
<td>Fast SER Protocol</td>
<td>Provides SER events to an automated data collection system</td>
</tr>
<tr>
<td>Modbus</td>
<td>Modbus; includes access to alarm points, device status, contact I/O, device targets, and SER</td>
</tr>
</tbody>
</table>

**MIRRORED BITS Relay-to-Relay Communications**

The SEL-patented MIRRORED BITS communications technology provides bidirectional device-to-device digital communications. MIRRORED BITS can operate independently on up to two EIA-232 serial ports on a single SEL-2523 Annunciator Panel. This bidirectional digital communication creates eight additional virtual outputs (transmitted MIRRORED BITS) and eight additional virtual inputs (received MIRRORED BITS) for each serial port operating in the MIRRORED BITS mode. Use these MIRRORED BITS to quickly transmit and receive information from devices, external I/O, or Programmable Automation Controllers already connected to the power system. The communications channel provides a fast, efficient, and simple way of alarming the SEL-2523 without extra wiring. Each MIRRORED BITS channel is monitored and logged for integrity. A communications log tracks the communications status and channel availability, and the SEL-2523 will alarm for any channel or device failures.
Configuration and Commissioning

The included acSELERATOR QuickSet software simplifies device configuration in addition to providing the following commissioning and analysis support for the SEL-2523 Annunciator Panel:

- Access settings creation help online
- Organize settings with the device database manager
- Load and retrieve settings using a simple PC communications link
- Analyze SER records to verify alarm operation (see Figure 8)
- Use the PC interface to remotely retrieve reports and other system data
- Monitor alarm operation and status during commissioning tests
- Operate and monitor the device remotely from a virtual front panel (see Figure 7)

Sequential Events Recorder (SER) for Your Digital I/O

The SER records up to 1024 state changes to the millisecond for as many as 96 digital points, and captures the time of device power-up and settings changes. The SEL-2523 Annunciator Panel comes standard with alias names for each element. Each defined SER point can be assigned different element names for the asserted and deasserted state. Assigning familiar names for each element provides the SER record reviewer with a clear, at-a-glance view of an event. Figure 8 shows an example of an SER report.

Control inputs are time-tagged and accurate to the millisecond. All other Device Word bits are time-stamped to the millisecond and processed every four milliseconds.
Time Synchronization

The SEL-2523 Annunciator Panel can be time-synchronized through several different time sources. The IRIG-B input is the most accurate, and can be wired either through the separate IRIG-B input (see Figure 9) or through Port 3 on Pins 4 and 6. The time code input synchronizes the SEL-2523 control inputs to within ±1 ms and all other SER time-stamped data to ±4 ms of the time-source input. Figure 12 shows the location of the IRIG-B ports on Card Slot 1. The SEL-2523 can also be time-synchronized through DNP3 via any of the rear serial ports set to “DNP” protocol. Although the system times can vary, the accuracy will typically be 5 to 10 ms. If necessary, the SEL-2523 can be manually set to the correct time.

Front- and Rear-Panel Diagrams

![SEL-2523 Rack Mount](image9)

![SEL-2523 Panel Mount](image10)
Figure 11 SEL-2523 Rear Panel

Dimensions

RACK-MOUNT CHASSIS

PANEL-MOUNT CHASSIS

Figure 12 SEL-2523 Rack-Mount and Panel-Mount Chassis
Specifications

Compliance
Designed and manufactured under an ISO 9001 certified quality management system
UL Listed to U.S. and Canadian safety standards (File E220228; NRAQ, NRAQ7)
FCC: CFR 47 Part 15, Class A
Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area may be likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Any changes or modifications not expressly approved by the manufacturer can void the user’s authority to operate the equipment.

General
Temperature Range
−40° to +85°C (−40° to +185°F), per IEC 60068-2-1 and 60068-2-2
Note: Not applicable to UL applications.
Operating Environment
Pollution Degree: 2
Overvoltage Category: II
Relative Humidity: 5–95%, noncondensing
Maximum Altitude: 2000 m
Weight
4.2 kg (10 lb)
Printable Window Size
30.5 mm x 61 mm (1.20” x 2.40”)

Inputs
Optoisolated Control Inputs
When Used With DC Control Signals
<table>
<thead>
<tr>
<th>Voltage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 V</td>
<td>ON for 200–275 Vdc, OFF below 150 Vdc</td>
</tr>
<tr>
<td>220 V</td>
<td>ON for 176–242 Vdc, OFF below 132 Vdc</td>
</tr>
<tr>
<td>125 V</td>
<td>ON for 100–137.5 Vdc, OFF below 75 Vdc</td>
</tr>
<tr>
<td>110 V</td>
<td>ON for 88–121 Vdc, OFF below 66 Vdc</td>
</tr>
<tr>
<td>48 V</td>
<td>ON for 38.4–52.8 Vdc, OFF below 28.8 Vdc</td>
</tr>
<tr>
<td>24 V</td>
<td>ON for 15–30 Vdc, OFF for &lt; 5 Vdc</td>
</tr>
</tbody>
</table>

When Used With AC Control Signals
<table>
<thead>
<tr>
<th>Voltage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 V</td>
<td>ON for 170.6–300 Vac, OFF below 106 Vac</td>
</tr>
<tr>
<td>220 V</td>
<td>ON for 150.3–264 Vac, OFF below 93.2 Vac</td>
</tr>
<tr>
<td>125 V</td>
<td>ON for 85–150 Vac, OFF below 53 Vac</td>
</tr>
<tr>
<td>110 V</td>
<td>ON for 75.1–132 Vac, OFF below 46.6 Vac</td>
</tr>
<tr>
<td>48 V</td>
<td>ON for 32.8–57.6 Vac, OFF below 20.3 Vac</td>
</tr>
<tr>
<td>24 V</td>
<td>ON for 14–27 Vac, OFF below 5 Vac</td>
</tr>
</tbody>
</table>

Current Draw at Nominal DC Voltage: 2 to 4 mA (except for 24 V, 8 mA)
Rated Insulation Voltage: 300 Vac
Rated Impulse Withstand Voltage (U_{imp}): 4000 V

Time-Code Input
Format: Demodulated IRIG-B
On (1) State: V_{ih} ≥ 2.2 V
Off (0) State: V_{il} ≤ 0.8 V

Outputs
General
OUT11 is Form C Trip Output, all other outputs are Form A.
Dielectric Test Voltage: 2000 Vac
Impulse Withstand Voltage (U_{imp}): 4000 V
Mechanical Durability: 10,000 no-load operations

DC Output Ratings
Electromechanical
Rated Operational Voltage: 250 Vdc
Rated Voltage Range: 19.2 to 275 Vdc
Rated Insulation Voltage: 300 Vdc
Make: 30 A @ 250 Vdc per IEEE C37.90
Note: Make rating per IEEE C37.90:1989.
Continuous Carry: 6 A @ 70°C; 4 A @ 85°C
Thermal: 50 A for 1 s
Contact Protection: 360 Vdc, 40 J MOV protection across open contacts
Operating Time (coil energization to contact closure, resistive load): Pickup or dropout time ≤ 8 ms typical
Breaking Capacity (10,000 operations) per IEC 60255-0-20:1974:
<table>
<thead>
<tr>
<th>Voltage</th>
<th>Current (A)</th>
<th>Time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 V</td>
<td>0.75</td>
<td>L/R=40 ms</td>
</tr>
<tr>
<td>48 V</td>
<td>0.50</td>
<td>L/R=40 ms</td>
</tr>
<tr>
<td>125 V</td>
<td>0.30</td>
<td>L/R=40 ms</td>
</tr>
<tr>
<td>250 V</td>
<td>0.20</td>
<td>L/R=40 ms</td>
</tr>
</tbody>
</table>

Cyclic Capacity (2.5 cycles/second) per IEC 60255-0-20:1974:
<table>
<thead>
<tr>
<th>Voltage</th>
<th>Current (A)</th>
<th>Time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 V</td>
<td>0.75</td>
<td>L/R=40 ms</td>
</tr>
<tr>
<td>48 V</td>
<td>0.50</td>
<td>L/R=40 ms</td>
</tr>
<tr>
<td>125 V</td>
<td>0.30</td>
<td>L/R=40 ms</td>
</tr>
<tr>
<td>250 V</td>
<td>0.20</td>
<td>L/R=40 ms</td>
</tr>
</tbody>
</table>

AC Output Ratings
Electromechanical
Maximum Operational Voltage (U_o) Rating: 240 Vdc
Insulation Voltage (U_i) Rating (excluding EN 61010-1): 300 Vac
Voltage Protection Across Open Contacts: 270 Vac, 40 J
Rated Operational Current (I_e): 3 A @ 120 Vac; 1.5 A @ 240 Vac
Conventional Enclosed
Thermal Current (I_{thc}) Rating: 5 A
Rated Frequency: 50/60 ± 5 Hz
Pickup/Dropout Time: \( \leq 8 \text{ ms (coil energization to contact closure)} \)

Electrical Durability Make
VA Rating: 3600 VA, \( \cos \phi = 0.3 \)

Electrical Durability Break
VA Rating: 360 VA, \( \cos \phi = 0.3 \)

**Communications**

**Ports**

Standard EIA-232 (3 ports)
- Location (fixed): 1 front panel
- 2 rear panel
- Data Speed: 300–38400 bps

Optional Communications Card
- Standard EIA-232 or EIA-485 (ordering option)
- Data Speed: 300–38400 bps

**Protocols**

- Modbus RTU slave
- DNP3 Level 2 Outstation (Serial)
- SEL Mirrored Bits (MBA, MBB, MB8A, MB8B)
- Ymodem file transfer on the front and rear ports
- Xmodem file transfer on the front port
- SEL ASCII and Compressed ASCII

**Maximum Concurrent Connections**

- DNP3 Level 2 Outstation: 3
- Modbus RTU Slave: 3

**Power Supply**

**Rated Supply Voltage**

- Low-Voltage Model: 24/48 Vdc
- High-Voltage Model: 110/250 Vdc

**Input Voltage Range**

- Low-Voltage Model: 19.2–62.8 Vdc
- High-Voltage Model: 85–275 Vdc

**Power Consumption**

- AC: <40 VA
- DC: <15 W

**Interruptions**

- Low-Voltage Model: 10 ms @ 24 Vdc
- 50 ms @ 48 Vdc
- High-Voltage Model: 50 ms @ 125 Vac/Vdc
- 100 ms @ 250 Vac/Vdc

**Sampling and Processing Specifications**

**Digital Inputs**

- Sampling Rate: 2 kHz

**Contact Outputs**

- Refresh Rate: 2 kHz
- Logic Update: Every 4 ms
- Control Processing: Every 4 ms

**Type Tests**

**Environmental Tests**

- Enclosure Protection: IEC 60529:2001
- IP40 front panel and IP20 for rear terminals

**Dielectric Strength and Impulse Tests**

- Dielectric (HiPot): IEC 60255-5:2000
- IEEE C37.90-2005
- 2.5 kVac on contact I/O
- 3.1 kVdc on power supply

**RFI and Interference Tests**

- Electrostatic Discharge Immunity: IEC 61000-4-2:2001
- Severity Level 4
- 8 kV contact discharge
- 15 kV air discharge
- IEEE C37.90.3-2001
- 8 kV contact discharge
- 15 kV air discharge

**EMC Immunity**

- Radiated RF Immunity: IEC 61000-4-3:2006, 10 V/m
- IEEE C37.90.2-2004, 35 V/m

- Fast Transient, Burst Immunity: IEC 61000-4-4:2004 + CRGD
- IEEE 60255-22-4:2002
- 4 kV @ 5.0 kHz
- 2 kV @ 5.0 kHz for comm. ports

**EMC Emissions**

- Radiated Emissions: IEC 61000-4-6:2006, 10 Vrms
- Magnetic Field Immunity: IEC 61000-4-8:2001
- 1000 A/m for 3 seconds
- 100 A/m for 1 minute

**Power Interruption Tests**

- Conducted RF Immunity: IEC 61000-4-6:2006, 10 Vrms
- Magnetic Field Immunity: IEC 61000-4-8:2001
- 1000 A/m for 3 seconds
- 100 A/m for 1 minute

- EMC Emissions

- Power Interruption Tests
- Interruptions: IEC 61000-4-11:2004 Voltage Dips
Operating Sequences

All per ISA-18.1-1979 (R1992)

- Sequence M—Manual Reset
- Sequence M-1—Manual Reset With Silence
- Sequence R—Ringback
- Sequence R-1—Ringback With Options
- Sequence A—Automatic Reset
- Sequence F1A—Automatic Reset First Out With no Subsequent Alarm State
- Sequence F2M-1—Manual Reset First Out With no Alarm Flashing and Silence Pushbutton
- Sequence F3A—Automatic Reset First Out With First Out Flashing and Reset Pushbutton