SEL-2533 Annunciator

Compact Annunciation With Complete Alarm Monitoring 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

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 up to 1024 Event Records
➤ IRIG-B time synchronization

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

Product Overview

The SEL-2533 Annunciator is an advanced ten-window panel that allows complete alarming, notification, reporting, and communication. The SEL-2533 supports many of the standard ISA-18.1 annunciator sequences. It comes standard with 10 alarm windows that can be independently programmed to alarm through contact inputs or communications. The SEL-2533 is designed to read and acknowledge alarms locally or remotely.

SEL-2533 Base Unit

Standard Features
➤ Ten alarm windows with configurable red or amber LEDs
➤ ISA-18.1 annunciator sequences: A, M, R, F1A, F1M, F2A, F2M, F3A
➤ Two digital inputs and three digital contact outputs
➤ One front and two rear EIA-232 serial ports
➤ Internal power supply 24/48 Vdc, 125/250 Vdc, or 120/240 Vac
➤ IRIG-B input with 1 ms SER time-stamping
➤ acSELERATOR QuickSet PC software
➤ Ten 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-3010 Event Messenger compatibility
➤ SEL-4391 Data Courier™ compatibility
Note: The SEL-3010 is obsolete and no longer available to order.

Optional Features
➤ EIA-232 or EIA-485 serial communications card
➤ DNP3 Level 2 Outstation
➤ Conformal coating
➤ Fourteen digital inputs and fifteen digital outputs
### Functional Overview

The SEL-2533 Annunciator 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-2533 monitors equipment, reports on the status of any equipment that has failed, and notifies local and remote personnel of current conditions. The SEL-2533 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-2533 communicates information to the control center, where the appropriate personnel can be deployed for repair. The SEL-2533 stores the current state of each alarm point in nonvolatile memory. If power is lost at any point, the SEL-2533 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-2533 indicates the status of up to 10 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-2533 to be installed in virtually any system.

### Automation

The SEL-2533 Annunciator makes it easy to automate a system-wide alarming station. The SEL-2533 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, acknowledgment, 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.
Control Inputs and Outputs

The SEL-2533 Annunciator comes standard with two independent control inputs and three Form A outputs. The annunciator can be ordered with up to 14 inputs, and 15 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-2533 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 10 alarm points. This provides maintenance crews with a highly visible alert should a problem arise.

Output 3 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-2533 encounters hardware or software issues such as Flash failure, power supply failure, RAM failure, or EEPROM failure.

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-2533.

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.

Event Messenger Points

The SEL-2533 Annunciator, when used with the SEL-3010, creates ASCII-to-voice translation of up to 32 user-defined messages along with binary data points calculated by the SEL-2533. The combination of the SEL-2533 and the SEL-3010 allows the user to receive voice message alerts on any phone for transition of any Device Word bits in the SEL-2533. Verbal notification of any custom alarm point can now be sent directly to your cell phone through the SEL-2533 and the SEL-3010 (the SEL-3010 must be connected to an analog telephone line).

Note: The SEL-3010 is obsolete and no longer available to order.

Configurable Labels

Each SEL-2533 Annunciator 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-2533. Blank stock labels are also provided for handwritten customization. These customization features allow easy implementation without the need for adhesive labels.

Integration

The SEL-2533 Annunciator 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-2533 comes standard with ACSELERATOR QuickSet software to aid in setting the SEL-2533. The SEL-2533 supports settings from a standard ASCII terminal.

The SEL-2533 is designed to easily establish communications to the following:

➢ Connected computers, modems, and protocol converters
➢ An SEL-3530, SEL-3354, or SEL-2032
➢ SCADA serial ports, and/or RTUs for local or remote communication

Apply an SEL-3530, SEL-3354, or SEL-2032 as the hub of a star network with point-to-point fiber or copper connections between the hub and the SEL-2533 (see
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-2533 comes with several standardized protocols to make communications, operations, and alarm acknowledgment easy. Table 1 lists the various protocols that the SEL-2533 supports.

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 information processors (SEL-3530 RTAC, SEL-2032, SEL-2030, and SEL-2020), SEL computing platforms (SEL-3332 and SEL-3354), 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-2533 Annunciator. 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-2533 without extra wiring. Each MIRRORED BITS channel is monitored for integrity. A communications log tracks the communications status and channel availability, and the SEL-2533 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-2533 Annunciator:

- 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-2533 Annunciator 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-2533 Annunciator 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 10) or through Port 3 on pins 4 and 6. The time code input synchronizes the SEL-2533 control inputs to within ±1 ms and all other SER time-stamped data to ±4 ms of the time-source input. Figure 10 shows the location of the IRIG-B ports on Card B. The SEL-2533 can also be time-synchronized through DNP 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. As a last resort, the SEL-2533 can be manually set to the correct time.

Front- and Rear-Panel Diagrams

Figure 8  Example SER Report

Figure 9  SEL-2533 Panel Mount

Figure 10  SEL-2533 Rear Panel
Dimensions

Figure 11 SEL-2533 Dimension Diagram
## 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

<table>
<thead>
<tr>
<th>Temperature Range</th>
<th>–40° to +85°C (–40° to +185°F), per IEC 60068-2-1 and 60068-2-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note:</td>
<td>Not applicable to UL applications.</td>
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</table>

<table>
<thead>
<tr>
<th>Operating Environment</th>
<th>Pollution Degree</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overvoltage Category</td>
<td>II</td>
<td></td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>5–95%, noncondensing</td>
<td></td>
</tr>
<tr>
<td>Maximum Altitude</td>
<td>2000 m</td>
<td></td>
</tr>
</tbody>
</table>

| 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**
  - 250 V: ON for 200–275 Vdc, OFF below 150 Vdc
  - 220 V: ON for 176–242 Vdc, OFF below 132 Vdc
  - 125 V: ON for 100–137.5 Vdc, OFF below 75 Vdc
  - 110 V: ON for 88–121 Vdc, OFF below 66 Vdc
  - 48 V: ON for 38.4–52.8 Vdc, OFF below 28.8 Vdc
  - 24 V: ON for 15–30 Vdc, OFF for <5 Vdc

- **When Used With AC Control Signals**
  - 250 V: ON for 170.6–300 Vac, OFF below 106 Vac
  - 220 V: ON for 150.3–264 Vac, OFF below 93.2 Vac
  - 125 V: ON for 85–150 Vac, OFF below 53 Vac
  - 110 V: ON for 75.1–132 Vac, OFF below 46.6 Vac
  - 48 V: ON for 32.8–57.6 Vac, OFF below 20.3 Vac
  - 24 V: ON for 14–27 Vac, OFF below 5 Vac

- **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_in ≥ 2.2 V
- **Off (0) State**: V_in ≤ 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
- **Continuous Carry**: 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**:
  - 24 V: 0.75 A, L/R=40 ms
  - 48 V: 0.50 A, L/R=40 ms
  - 125 V: 0.30 A, L/R=40 ms
  - 250 V: 0.20 A, L/R=40 ms
- **Cyclic Capacity (2.5 cycles/second) per IEC 60255-0-20:1974**:
  - 24 V: 0.75 A, L/R=40 ms
  - 48 V: 0.50 A, L/R=40 ms
  - 125 V: 0.30 A, L/R=40 ms
  - 250 V: 0.20 A, L/R=40 ms

**AC Output Ratings**

**Electromechanical**

- **Maximum Operational Voltage (U_e) 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_thermal) 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
- SEL Fast Meter
- SEL Fast Operate
- SEL Fast SER
- SEL Fast Message read request
- SEL Messenger Points

### Power Supply

#### Rated Supply Voltage

- Low-Voltage Model: 24/48 Vdc
- High-Voltage Model: 125/250 Vdc

#### Input Voltage Range

- 110/240 Vac, 50/60 Hz

#### Power Consumption

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

### Intermittence

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

### Electrical Durability Make Ratings

- 3600 VA, \(\cos \phi = 0.3\)

### Electrical Durability Break Ratings

- 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)
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- SEL Fast Operate
- SEL Fast SER
- SEL Fast Message read request
- SEL Messenger Points

### Maximum Concurrent Connections

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

### 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
- Vibration Resistance: IEC 60255-21-1:1988, Class 1
- IEC 60255-21-3:1993, Class 2
- Shock Resistance: IEC 60255-21-2:1988, Class 1
- Cold: IEC 60068-2-1:2007
  - 16 hr at −40°C
- Damp Heat, Cyclic: IEC 60068-2-30:2005
  - 25° to 55°C, 6 cycles, 95% relative humidity
  - 16 hr at +85°C

#### 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
- Impulse: IEC 60255-5:2000
  - IEEE C37.90:2005
  - 0.5 J, 5 kV on power supply, contact I/O

#### RFI and Interference Tests

- EMC Immunity
  - 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
- Radiated RF Immunity: IEC 61000-4-3:2008, 10 V/m
  - IEEE C37.90.2-2004, 35 V/m
  - 4 kV @ 5.0 kHz
  - 2 kV @ 5.0 kHz for comm. ports
- Surge Withstand Capability: IEC 60255-22-1:2005
  - 2.5 kV common-mode
  - 1 kV differential-mode
  - IEEE C37.90.1-2002
  - 2.5 kV oscillatory
  - 4 kV fast transient
- Conducted RF Immunity: IEC 61000-4-6:2008, 10 V/m
- EMC Emissions

### Power Interruption Tests

- Intermittence: IEC 61000-4-11:2004 Voltage Dips
Operating Sequences

All per ISA-18.1-1979 (R1992)

Sequence M—Manual Reset
Ringback Sequence—Ringback
Sequence A—Automatic Reset
Sequence F2A—Automatic Reset First Out With no Subsequent Alarm Flashing
Sequence F1M—Manual Reset First Out With no Subsequent Alarm State
Sequence F1A—Automatic Reset First Out With no Subsequent Alarm State
Sequence F2M—Automatic Reset First Out With no Alarm Flashing
Sequence F3A—Automatic Reset First Out With First Out Flashing and Reset Pushbutton