SEL-3355-2

Automation Controller

Instruction Manual

20250730

SCHWEITZER ENGINEERING LABORATORIES

PM3355-04

Part Number: PM3355-04

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Preface

Manual Overview

This manual includes necessary information to properly install and configure the SEL-3355-2.

The scope of this manual covers product information described in the following list of manual sections and topics:

- Section 1: Introduction and Specifications. Top-level features, functions, and specifications.
- Section 2: Installation. Mounting and wiring the SEL-3355-2.
- Section 3: Hardware Setup and Serviceability. Accessing main board features and control jumpers. Installing and removing expansion cards, power supplies, and SATA drives.
- Section 4: BIOS Setup. Accessing and configuring BIOS settings.
- Section 5: SATA Drive RAID. Configuring SATA drives for fault tolerance and performance.
- Section 6: Operating System and Software Installation. Installing an operating system and additional software.
- Section 7: System Software and Settings. Using the SEL-3355 system monitoring interface.
- Section 8: Software Backup and Failure Recovery. Using backup tools to create a backup copy of the system configuration.
- Section 9: Intel Active Management Technology (AMT). Remote monitoring, control, and management via Ethernet.
- Section 10: Troubleshooting. Common issues regarding configuring and operating the SEL-3355-2.
- Appendix A: Manual Versions. Change log for manual versions.
- Appendix B: Legacy SEL SysMon Software. Introduction to the legacy system health monitoring software.

Information on bundled application software is outside the scope of this manual. Please refer to any included software manuals, quick-start guides, or online help files.

Safety Information

⚠CAUTION

To ensure proper safety and operation, the equipment ratings, installation instructions, and operating instructions must be checked before commissioning or maintenance of the equipment. The integrity of any protective conductor connection must be checked before carrying out any other actions. It is the responsibility of the user to ensure that the equipment is installed, operated, and used for its intended function in the manner specified in this manual. If misused, any safety protection provided by the equipment may be impaired.

Dangers, Warnings, and Cautions

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

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

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

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

Safety Symbols

The following symbols are often marked on SEL products.

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

Safety Marks

The following statements apply to this device.

General Safety Marks

⚠CAUTION There is danger of explosion if the battery is incorrectly replaced. Replace only with Panasonic No. BR-2330A or equivalent recommended by manufacturer. See Owner's Manual for safety instructions. The battery used in this device may present a fire or chemical burn hazard if mistreated. Do not recharge, disassemble, heat above 100°C or incinerate. Dispose of used batteries according to the manufacturer's instructions. Keep battery out of reach of children.	**⚠ATTENTION** Une pile remplacée incorrectement pose des risques d'explosion. Remplacez seulement avec un Panasonic No. BR-2330A ou un produit équivalent recommandé par le fabricant. Voir le guide d'utilisateur pour les instructions de sécurité. La pile utilisée dans cet appareil peut présenter un risque d'incendie ou de brûlure chimique si vous en faites mauvais usage. Ne pas recharger, démonter, chauffer à plus de 100 °C ou incinérer. Éliminez les vieilles piles suivant les instructions du fabricant. Gardez la pile hors de la portée des enfants.
For use in Pollution Degree 2 environment.	Pour l'utilisation dans un environnement de Degré de Pollution 2.
Ambient air temperature shall not exceed 40°C (104°F) in locations where touch temperature safety is required.	La température de l'air ambiant ne doit pas dépasser 40 °C (104 °F) dans les endroits où la sécurité relative à la température de surface est requise.
Terminal Ratings Tightening Torque Compression Screw Terminal: 0.6–0.8 Nm (5–7 in-lb) Compression Screw Terminal Mounting Ear: 0.18–0.25 Nm (1.6–2.2 in-lb) Grounding Screw: 0.9–1.4 Nm (8–12 in-lb) Serial Port: 0.6–0.8 Nm (5–7 in-lb) Video Port: 0.6–0.8 Nm (5–7 in-lb) Wire Size Ground Wiring: 12 AWG, length <3 m	Spécifications des bornes Couple de serrage Borne à vis à compression : 0,6–0,8 Nm (5–7 livres-pouce) Fiche de montage de la borne à vis à compression : 0,18–0,25 Nm (1,6–2,2 livres-pouce) Vis de terre : 0,9–1,4 Nm (8–12 livres-pouce) Port série : 0,6–0,8 Nm (5–7 livres-pouce) Port vidéo : 0,6–0,8 Nm (5–7 livres-pouce) Calibre de fil Câblage de mise à la terre : 12 AWG, longueur <3 m

Other Safety Marks (Sheet 1 of 2)

⚠DANGER Disconnect or de-energize all external connections before opening this device. Contact with hazardous voltages and currents inside this device can cause electrical shock resulting in injury or death.	**⚠DANGER** Débrancher tous les raccordements externes avant d'ouvrir cet appareil. Tout contact avec des tensions ou courants internes à l'appareil peut causer un choc électrique pouvant entraîner des blessures ou la mort.
⚠DANGER Contact with instrument terminals can cause electrical shock that can result in injury or death.	**⚠DANGER** Tout contact avec les bornes de l'appareil peut causer un choc électrique pouvant entraîner des blessures ou la mort.
⚠WARNING Use of this equipment in a manner other than specified in this manual can impair operator safety safeguards provided by this equipment.	**⚠AVERTISSEMENT** L'utilisation de cet appareil suivant des procédures différentes de celles indiquées dans ce manuel peut désarmer les dispositifs de protection d'opérateur normalement actifs sur cet équipement.
⚠WARNING Have only qualified personnel service this equipment. If you are not qualified to service this equipment, you can injure yourself or others, or cause equipment damage.	**⚠AVERTISSEMENT** Seules des personnes qualifiées peuvent travailler sur cet appareil. Si vous n'êtes pas qualifiés pour ce travail, vous pourriez vous blesser avec d'autres personnes ou endommager l'équipement.
⚠WARNING Never use standard null-modem cables with the SEL-3355-2. Using any non-SEL cable can cause severe power and ground problems involving Pins 1, 4, and 6 on the SEL-3355-2 communications ports.	**⚠AVERTISSEMENT** Ne jamais utiliser de cables standards à inversion de signaux ("null-modem") avec le SEL-3355-2. L'utilisation d'un cable d'une autre provenance que SEL peut causer de sérieux problèmes de neutre et d'alimentation impliquant les fiches 1, 4 et 6 sur les ports de communication du SEL-3355-2.
⚠WARNING Do not operate device unless properly grounded.	**⚠AVERTISSEMENT** Ne pas mettre en marche l'appareil sauf s'il est bien mis à la terre.

Other Safety Marks (Sheet 2 of 2)

⚠WARNING Failure to ensure proper voltage levels can cause equipment damage.	**⚠AVERTISSEMENT** L' application de niveaux de tension inadéquats peut causer des dommages à l'équipement.
⚠WARNING Faulty USB peripheral devices that draw excessive current may become very hot and cause severe burns if touched.	**⚠AVERTISSEMENT** Les périphériques USB défectueux qui consomment trop de courant peuvent devenir très chauds et causer de graves brûlures de peau.
⚠CAUTION Equipment components are sensitive to electrostatic discharge (ESD). Undetectable permanent damage can result if you do not use proper ESD procedures. Ground yourself, your work surface, and this equipment before removing any cover from this equipment. If your facility is not equipped to work with these components, contact SEL about returning this device and related SEL equipment for service.	**⚠ATTENTION** Les composants de cet équipement sont sensibles aux décharges électrostatiques (DES). Des dommages permanents non-décelables peuvent résulter de l'absence de précautions contre les DES. Raccordez-vous correctement à la terre, ainsi que la surface de travail et l'appareil avant d'en retirer un panneau. Si vous n'êtes pas équipés pour travailler avec ce type de composants, contacter SEL afin de retourner l'appareil pour un service en usine.

Technical Support

Obtain technical assistance from the following:

Schweitzer Engineering Laboratories, Inc.
2350 NE Hopkins Court
Pullman, WA 99163-5603 U.S.A.
Tel: +1.509.338.3838
Fax: +1.509.332.7990
Internet: selinc.com/support
Email: info@selinc.com

Section 1
Introduction and Specifications

Overview

The SEL-3355-2 Automation Controller uses a high-performance x86-64 architecture processor to support modern operating systems like Microsoft Windows and Linux. The extremely rugged SEL hardware of the SEL-3355-2 enables you to use your choice of operating system and software in very harsh environments not suitable for general purpose computers.

Features

The SEL-3355-2 provides a rugged, easy-to-use automation controller platform for substation, industrial, or other harsh environments. The following features and enhancements are included in the system:

- **x86-64 Architecture.** The SEL-3355-2 uses the Intel Xeon E3 microprocessor architecture to deliver very high performance and broad operating system and software compatibility. Multiple processor cores and Intel Hyper-Threading Technology enable you to run multiple time-critical applications simultaneously. Choose between 2.0 GHz and 2.8 GHz quad-core CPU options.
- **Operating System Choices.** The SEL-3355-2 may be purchased as hardware only, or it may be purchased with a variety of modern Microsoft Windows operating systems to provide added flexibility and functionality along with enhanced security features.
- **Form Factor.** The SEL-3355-2 is built on a 19" rack-mount chassis, designed for substation and industrial control applications. The system includes rear-panel I/O connectors for linking to networks, peripherals, storage, video, audio, alarm, and serial I/O—all with protection against electrical shock and surge.
- **Power Supply.** The SEL-3355-2 supports two load-sharing, hot-swappable power supply modules, enabling you to power the SEL-3355-2 from two independent power sources for maximum availability and without needing to use inverters.
- **Mass Storage.** The SEL-3355-2 supports four 2.5-inch SATA drives, which are hot-swappable and accessible after removing the front drive-bay panel. High-performance, industrial-rated, solid-state drives (SSD) are available as ordering options.
- **RAID.** The integrated SATA controller supports redundant array of independent disks (RAID) configurations to maximize data availability and improve storage volume performance.

- **Display Interfaces.** DVI, DisplayPort, or HDMI video connections enable you to connect as many as three simultaneous, independent, high-definition displays.
- **Audio Interface.** Analog HD audio inputs and outputs enable connection to amplified speakers, microphone, and audio sources for clear audible user feedback, audio capture and analysis, and voice recognition. Digital audio can be streamed through the digital display interfaces for simple integration and high-definition surround-sound.
- **USB Connectivity.** The SEL-3355-2 has four rear-panel and two front-panel USB ports for connection to a local keyboard, mouse, and any USB peripherals. Each port is individually current-limited, protecting the system from external short circuits, and enabling high-power devices such as USB hard drives to be powered from any USB port.
- **PCIe Expansion.** The SEL-3355-2 supports as many as four standard PCIe form-factor expansion cards and one 32-bit PCI card, enabling you to customize the system I/O to meet your application needs. Choose from a selection of SEL PCIe expansion cards or install your own custom, third-party expansion card.
- **Ethernet.** Two 10/100/1000 Mbps Ethernet port connections on the rear panel support high-speed network connectivity and enable connections to independent networks or redundant paired network connections. Network interface cards such as the SEL-3390E4 and SEL-3390T can be added to the SEL-3355-2 for additional network connectivity.
- **Serial I/O.** Two standard EIA-232 serial ports enable connection to adjacent electronic devices such as automation controllers, communications radios, and modems. As many as four SEL-3390S8 Serial Expansion Cards can be added to the SEL-3355-2 for applications that require many serial I/O connections and IRIG time synchronization and distribution.
- **IRIG-B Input/Output.** Synchronize the system time to a satellite clock by using the IRIG-B input on COM1. Add SEL-3390T or SEL-3390S8 cards for high-precision IRIG-B inputs and outputs, for time distribution to downstream devices.
- **System Monitoring.** An embedded controller works in unison with the system software to provide an extra level of system reliability and to detect failures in the application software or operating system. The system logs any abnormal conditions, enables the system alarm to alert operators of a problem.
- **Watchdog.** If a system lockup is detected, the watchdog can trigger a system restart to attempt to return to a normal operating state.
- **Alarm Contact Output.** System software controls the alarm contact output to signal in case of system health problems or malfunctions. The Form C contact supports both normally open and normally closed alarm operation.
- **Remote Management.** The SEL-3355-2 supports remote access over Ethernet by using Windows Remote Desktop or Intel vPro Active Management Technology (AMT), enabling full access to system video, keyboard, mouse, and storage.

Models and Options

Models

Complete ordering information is not provided in this instruction manual. See the latest SEL-3355-2 Model Option Table at selinc.com.

Options

The SEL-3355-2 has the following options and features:

- Processor
  - Intel Xeon E3-1505L Quad-Core 2.0 GHz
  - Intel Xeon E3-1505M Quad-Core 2.8 GHz
- RAM
  - 4 to 64 GB DDR ECC PC4-17000 (2133 MHz)
- Conformal Coating
  - Conformally coated circuit boards
- Mounting
  - Horizontal 19-inch rack
  - Horizontal panel
- Power Supplies
  - 48 Vdc,125/250 Vdc, 120/240 Vac power supply module
  - Primary and secondary power supply modules
- SATA Drives
  - As many as four industrial or two consumer SATA drives
  - Industrial-grade single-level cell (SLC) drives: 30 to 250 GB, 10-year warranty
  - Industrial-grade psuedo-SLC (pSLC) drives: 120 to 480 GB, 5-year warranty
  - Industrial-grade 3D triple-level cell (3D TLC) drives: 240 to 7680 GB, 5-year warranty
  - Consumer-grade multi-level cell (MLC) drives: 240 to 1920 GB, 3-year warranty
- PCI Expansion Cards
  - Five expansion slots: two PCIe x4, two PCIe x1, and one 32-bit legacy PCI
  - As many as two SEL-3390E4 quad-gigabit network interface cards
  - As many as four SEL-3390S8 six-port serial expansion cards
  - As many as two SEL-3390T time and Ethernet adapter cards
- Software
  - Selectable factory-installed operating systems and software applications

Applications

The SEL-3355-2 may be used for many applications. With proper software installed, the SEL-3355-2 provides a comprehensive solution for substation integration as shown in *Figure 1.1*. The SEL-3355-2 provides real-time data to local clients such as human-machine interfaces (HMIs), remote-terminal units (RTUs), and supervisory control and data acquisition (SCADA) interfaces. Additionally, it provides time synchronization and data access to the connected intelligent electronic devices (IEDs).

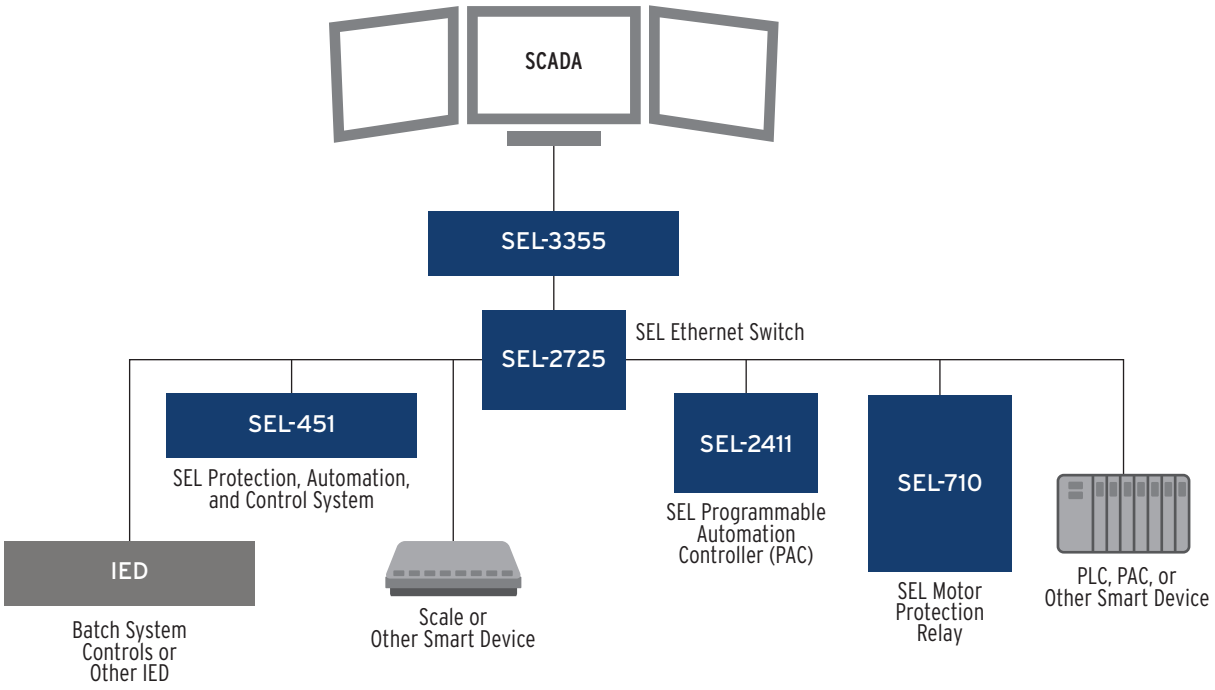

Figure 1.1 Functional Model

Specifications

Compliance

Designed and manufactured under an ISO 9001 certified quality management system

47 CFR 15B, Class A

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

UL Recognized to U.S. and Canadian safety standards (File E220228; NRAQ)

CE Mark

UKCA Mark

RCM Mark

RoHS Compliant

General

SEL Operating Systems

SEL Real-Time Automation Controller (RTAC)[a]
SEL Blueframe

Supported Third-Party Operating Systems

Microsoft Windows: 8, 10[b], 11 IoT LTSC[b]
Microsoft Windows Server: 2012, 2016[b], 2019[b], 2022[b]
CentOS Linux[c]: 6, 7
Red Hat Enterprise Linux[c]: 6, 7, 8, 9
AlmaLinux[c]: 8,9,10
Ubuntu Linux[c]: 16.04, 18.04, 20.04, 22.04, 24.04 LTS
VMware ESXi[c]: certified for versions 7 and 8
OpenSUSE[c]: 15
SUSE Enterprise Linux[c]: 15 YES certified, bulletin 153153

[a] Available via SEL-3533 RTAC Conversion Kit.
[b] Factory-installed option.
[c] Limited support for system Alarm, Watchdog, and AUX LEDs.
Note: For the optional SEL-3390S8, SEL-3390E4, and SEL-3390T expansion cards, refer to their instruction manuals for their supported operating systems.

CPU

Intel Xeon E3-1505L Quad-Core

Speed:	2.0 GHz base, 2.8 GHz turbo
Cache:	1 MB L2, 8 MB L3

Intel Xeon E3-1505M Quad-Core

Speed:	2.8 GHz base, 3.7 GHz turbo
Cache:	1 MB L2, 8 MB L3

RAM

4–64 GB DDR4 ECC PC4-17000 (2133 MHz)

Chipset

Intel CM236 Chipset

Expansion Cards

Five Half-Length, Full-Height PCI Expansion Card Slots:	2 PCIe x4 (Revision 2.0) 2 PCIe x1 (Revision 2.0) 1 32-bit 5 V PCI

PCI Card Power Limits

PCIe x4 and PCI:	≤25 W
PCIe x1:	≤10 W
Total Combined:	≤34 W

Mass Storage

Internal Drive Bay:	Supports 2.5 inch SATA drives, four industrial-grade drives, two consumer-grade drives Intel CM236 SATA Controller provides standard AHCI and Intel RST RAID modes SATA II 3.0 Gb/s RAID level 0, 1, 5, 10 Hot-Swap Support
Optional SATA Drives:	Industrial-Grade SLC SSD 30–250 GB 10-year warranty Industrial-Grade pSLC SSD 120–480 GB 5-year warranty Industrial-Grade 3D TLC SSD 240–7680 GB 5-year warranty Consumer-Grade MLC SSD 240–1920 GB 3-year warranty

Real-Time Clock/Calendar

Battery Type:	IEC No. BR-2330A Lithium
Battery Life:	10 years with power 2 years without power
Drift:	200 ppm

BIOS

AMI UEFI

Trusted Platform Module

Infineon SLM 9670AQ TPM 2.0

Intel Active Management Technology

Intel AMT v11, accessible through ETH1

Operating Environment

Operating Temperature Range

With E3-1505L CPU:	–40° to +75°C (–40° to +167°F)*
With E3-1505M CPU:	–40° to +60°C (–40° to +140°F)*

* Requires Industrial-Grade SSDs. See the SEL Application Note "Determining Solid-State Drive (SSD) Lifetimes for SEL Automation Controllers" (AN2016-03).

Note: UL ambient 40°C. See *Safety Information on page viii in the Preface* for additional restrictions.

Storage Temperature Range:	–40° to +85°C (–40° to +185°F)
Relative Humidity:	5 to 95% noncondensing

Insulation Class: 1

Pollution Degree 2

Overvoltage Category:

Category	Maximum Altitude	Atmospheric Pressure
Category II	5,000 m	80–110 kPa

Weight

9.072 kg (20 lb) maximum

Peripheral Connections

Video

Intel P530 Graphics Controller

As many as three total displays using any combination of DVI and/or DisplayPort outputs:
- DVI-D outputs:
  - One display per output
  - Maximum resolution*: 1920 x1080 @ 60 Hz
  - Digital output only; does not support passive VGA adapters
- DisplayPort 1.2 output
  - As many as three displays via DisplayPort MST
  - Maximum resolution*: 4096 x 2304 @ 60 Hz (one display)
  - 1920 x 1200 @ 60 Hz (three displays)
- Cable length < 10 m for Surge Immunity compliance.

*High-resolution displays require high-quality cables. Ensure your display cables are as short as possible and rated for the required screen resolution.

Audio

TSI (IDT) 92HD91 HD Audio Codec

3 Analog 3.5 mm TRS Jacks:
- Line input
- Line/headphone output
- Microphone input
- Cable length <2 m for Electromagnetic Compatibility Immunity compliance

Intel Display Audio

Digital Audio Outputs: DVI-D1, DVI-D2, DisplayPort

USB

Four Rear-Panel Ports, Two Front-Panel Ports
- USB 3.2 Gen 1 (SuperSpeed USB 5 Gbps)
- 2000 mA Maximum Current Each
- Cable length <2 m for Electromagnetic Compatibility Immunity compliance

Two Internal Ports on 1 Main Board Header
- USB 2.0 (High Speed USB 480 Mbps)

Communications Ports

Ethernet

Two Rear-Panel 1 Gb Copper RJ45 Ports

ETH1: Intel WGI219LM, 10/100/1000 Mbps RJ45 copper

ETH2: Intel WGI210IT, 10/100/1000 Mbps RJ45 copper

Optional SEL-3390E4 and SEL-3390T Expansion Cards: As many as 8 additional 10/100/1000 Mbps ports, copper or LC fiber SFP

Note: See the SEL-3390E4 and the SEL-3390T instruction manuals for additional information.

Serial Ports

Standard Ports: 2 EIA-232 ports, DB-9 connectors
300 to 115200 bps

Optional SEL-3390S8 Expansion Cards: As many as 24 additional EIA-232/422/485 ports, RJ45 connectors 300 to 921600 bps

Note: See the SEL-3390S8 instruction manual for additional information.

(Meets EIA/TIA-562 Specifications)

Time-Code Inputs and Outputs

Main Board (Input Only)

Connector: COM1 DB-9 serial port

Time-Code: Demodulated IRIG-B TTL compatible

Optional SEL-3390S8 Expansion Card (Input/Output)

Connector: RJ45 serial port

Time-Code: Demodulated IRIG-B TTL compatible

Note: See the SEL-3390S8 instruction manual for additional information.

Optional SEL-3390T Expansion Card (Input/Output)

Connector: BNC

Time-Code: Demodulated IRIG-B TTL compatible

Note: See the SEL-3390T instruction manual for additional information.

Note: Outputs generated from either IRIG-B input or SEL-3355-2 clock.

Power Supply

See *Table 1.1* for additional burden information.

SEL-9331 160 W LV Power Supply

Voltage Rating: 48 Vdc

Voltage Range: 38–58 Vdc

Maximum Constant Burden: 178 W

Maximum Peak Burden: 225 W

DC Ripple: <15% rated voltage

Peak Inrush: 15.5 A peak, 48 ms duration
Measured per IEC 60255-1, Section 6.10. Quiescent current level derived from 40 W input.

Interruption: 100 ms @ 48 Vdc

Insulation: 3600 Vdc

Input Isolated From Chassis Ground: Yes

SEL-9331 160 W HV Power Supply

Voltage Ratings: 125/250 Vdc or 120/220/240 Vac; 50/60 Hz

DC Range: 100–300 Vdc

Maximum DC Dropout: 88 Vdc

AC Range: 85–264 Vac

Frequency Range: 45–65 Hz

Maximum Constant Burden: 188 W, 194 VA

Maximum Peak Burden: 240 W, 248 VA

DC Ripple: <15% Rated Voltage

Peak Inrush:	16.6 A peak, 4 ms duration, 240 Vac 12.8 A peak, 9 ms duration, 250 Vdc Measured per IEC 60255-1, Section 6.10. Quiescent current level derived from 75 W input.
Interruption:	200 ms @ 125 Vdc/120 Vac
Insulation:	3600 Vdc
Power Factor:	>0.9 (at full load)
Input Isolated From Chassis Ground:	Yes

Recommended External Overcurrent Protection

Breaker Type:	Standard
Breaker Rating:	20 A at 250 Vdc
Current Breaking Capacity:	10 kA
Grounded Neutral Systems:	Device in series with the HOT or energized conductor
DC and Isolated Systems:	Device in series with both conductors

Fuse Ratings

LV Power Supply Fuse

Rating:	15 A
Maximum Rated Voltage:	500 Vdc, 500 Vac
Breaking Capacity:	20 kA at 500 Vdc
Type:	Time-lag T

HV Power Supply Fuse

Rating:	5 A
Maximum Rated Voltage:	250 Vdc, 277 Vac
Breaking Capacity:	1500 A at 277 Vac
Type:	Time-lag T
Heater Fuses F2, F3:	5 A, 125 V slow blow 125 Vdc/50 A break rating

Note: Fuses are not serviceable.

Contact Inputs and Outputs

Alarm Output Contact

Output Type:	Relay, Form C, break-before-make
Pilot Duty Ratings*:	B300 (UL) R300 (UL)
Rated Voltage**:	24–250 Vdc 110–240 Vrms

Note: The voltage across any of the contact output terminals must not exceed the operational voltage.

Operational Voltage**:	0–300 Vdc 0–264 Vrms
Contact Protection:	MOV protection across open contacts 264 Vrms continuous voltage 300 Vdc continuous voltage
Continuous Carry**:	6 A @ 70°C, 4 A @ 85°C
Pickup/Dropout Time**:	≤6 ms (resistive load)
Power Supply Burden**:	≤1 W
Mechanical Endurance**:	10,000 no-load operations
Make (Short Duration Contact Current)**:	30 Adc 1,000 operations @ 250 Vdc 2,000 operations @ 125 Vdc

Note: 200 ms on, 15 ms off, current interrupted by independent means.

Short-Time Thermal Withstand**:	50 A for 1 s
Limiting Making Capacity**:	1,000 W @ 250 Vdc (L/R = 40 ms)
Limiting Breaking Capacity/Electrical Endurance**:	10,000 operations 10 operations in 4 s, followed by 2 min idle

Rated Voltage	Resistive Break	Inductive Break L/R = 40 ms (DC) PF = 0.4 (AC)
24 Vdc	1.25 Adc	1.25 Adc
48 Vdc	0.63 Adc	0.63 Adc
125 Vdc	0.30 Adc	0.30 Adc
250 Vdc	0.20 Adc	0.20 Adc
110 Vrms	0.30 Arms	0.30 Arms
240 Vrms	0.20 Arms	0.20 Arms

* Per UL 508.
** Parameters verified by SEL per IEC 60255-1:2009 and IEEE C37.90-2005.

Terminal Connections

Compression Screw Terminal

Power Wiring	
Insulation:	300 V min.
Size:	12–18 AWG
Alarm Wiring	
Insulation:	300 V min.
Size:	12–18 AWG
Tightening Torque	
Minimum:	0.6 Nm (5 in-lb)
Maximum:	0.8 Nm (7 in-lb)
Crimp Ferrule Recommended	
Mounting Ear Tightening Torque	
Minimum:	0.18 Nm (1.6 in-lb)
Maximum:	0.25 Nm (2.2 in-lb)

Grounding Screw

Ground Wiring	
Insulation:	300 V min.
Size:	12 AWG, length <3 m
Tightening Torque	
Minimum:	0.9 Nm (8 in-lb)
Maximum:	1.4 Nm (12 in-lb)
Ring Terminal Recommended	

Serial Port

Tightening Torque	
Minimum:	0.6 Nm (5 in-lb)
Maximum:	0.8 Nm (7 in-lb)

Video Port

Tightening Torque

Minimum:	0.6 Nm (5 in-lb)
Maximum:	0.8 Nm (7 in-lb)

Product Standards

Communications Equipment in Utility Substations:	IEC 61850-3:2013 IEEE 1613-2009 Severity Level: Class 1
Industrial Environment:	IEC 61000-6-2:2005 IEC 61000-6-4:2006
Electrical Equipment for Measurement, Control, and Laboratory Use:	IEC 61010-1:2010/AMD1:2016/COR:2019 UL 61010-1:2019, C22.2 No. 61010-1:12 IEC 61010-2-201:2017 UL 61010-2-201:2017, C22.2 No. 61010-2-201:14
Measuring Relays and Protection Equipment:	IEC 60255-26:2013 IEC 60255-27:2013

Type Tests

Note: To ensure good EMI and EMC performance, type tests were performed using shielded Ethernet and serial cables with the shell grounded at both ends of the cable, and the USB, video, and audio cables with ferrite chokes. Double-shielded cables are recommended for best EMI and EMC performance.

Electromagnetic Compatibility Emissions

Conducted and Radiated Emissions:	CISPR 11:2009 + A1:2010 CISPR 22:2008 CISPR 32:2015 IEC 61000-6-4:2006 IEC 61850-3:2013 FCC 15-107:2014 FCC 15-109.2014 Severity Level: Class A Canada ICES-001(A) / NMB-001(A)
Harmonic Current:	IEC 61000-3-2:2014 Severity Level: Class A
Voltage Flicker:	IEC 61000-3-3:2013

Electromagnetic Compatibility Immunity

Conducted RF:	IEC 61000-4-6:2013 Severity Level: 10 Vrms
Electrostatic Discharge:	IEC 61000-4-2:2008 IEEE C37.90.3-2001 Severity Level: 2, 4, 6, 8 kV contact discharge; 2, 4, 8, 15 kV air discharge
Fast Transient/Burst:	IEC 61000-4-4:2012 Severity Level: Class A 4 kV, 5 kHz on power supply and outputs; 2 kV, 5 kHz on communications lines
Magnetic Field:	IEC 61000-4-8:2009 Severity Level: 1000 A/m for 3 s 100 A/m for 1 m
Power Supply:	IEC 61000-4-11:2004 IEC 61000-4-17:1999+A1:2001+A2:2008 IEC 61000-4-29:2000
Radiated Radio Frequency:	IEC 61000-4-3:2006+A1:2007 Severity Level: 10 V/m IEEE C37.90.2-2004 Severity Level: 20 V/m
Surge Withstand Capability:	IEC 61000-4-18:2006+A1:2010 Severity Level: Power supply and outputs 2.5 kV peak common mode 1.0 kV peak differential mode Communications ports 1.0 kV peak common mode IEEE C37.90.1-2012 Severity Level: 2.5 kV oscillatory 4 kV fast transient
Surge Immunity:	IEC 61000-4-5:2005 1 kV line-to-line 2 kV line-to-earth 2 kV communications ports

Environmental

Change of Temperature:	IEC 60068-2-14:2009 Severity Level: 5 cycles, 1°C per minute ramp –40° to +60°C (E3-1505M CPU) –40° to +75°C (E3-1505L CPU)
Cold, Operational:	IEC 60068-2-1:2007 Severity Level: 16 hours at –40°C
Cold, Storage:	IEC 60068-2-1:2007 Severity Level: 16 hours at –40°C
Damp Heat, Cyclic:	IEC 60068-2-30:2005 Severity Level: 12 + 12-hour cycle 25° to 55°C, 6 cycles, >93% relative humidity
Damp Heat, Steady:	IEC 60068-2-78:2012 Severity Level: 40°C, 240 hours, >93% relative humidity
Dry Heat, Operational:	IEC 60255-1:2009 IEC 61850-3:2013 IEC 60068-2-2:2007 Severity Level: 16 hours at 60°C (E3-1505M CPU) 16 hours at 75°C (E3-1505L CPU)
Dry Heat, Storage:	IEC 60255-1:2009 IEC 61850-3:2013 IEC 60068-2-2:2007 Severity Level: 16 hours at 85°C
Free Fall:	IEEE 1613-2009 Severity Level: 100 mm
Vibration:	IEC 60255-21-1:1988 Severity Level: Endurance Class 2 Response Class 2 IEC 60255-21-2:1988 Severity Level: Shock Withstand, Bump Class 1 Shock Response Class 2 IEC 60255-21-3:1993 Severity Level: Quake Response Class 2

Safety

Enclosure Protection: IEC 60529:2001 + CRGD:2003
Severity Level: IP30

Dielectric Strength: IEC 60255-27:2013
IEEE C37.90-2005
Severity Level:
3600 Vdc on power supply
2500 Vac on contact output
1500 Vac Ethernet ports
Type tested for one minute

Impulse: IEC 60255-27:2013
IEEE C37.90-2005
Severity Level:
5 kV common mode, power supply, contact outputs
1.5 kV Ethernet ports

Table 1.1 System Power Consumption

Power Consumption (Watts)[a]			
Component	**Minimum**	**Typical**	**Maximum**
Base System (E3-1505L CPU, 1 PSU, 4GB RAM, 1 SATA Drive):	25 W	35 W	50 W
Additional Consumption From Optional Components			
E3-1505M CPU:	+2 W	+5 W	+13 W
2nd Power Supply:	+10 W	+10 W	+13 W
8–64 GB RAM Configuration:	+2 W	+2 W	+3 W
Additional SATA Drives, Each:	+1 W	+2 W	+3 W
SEL-3390E4 Ethernet Card, Each:	+6 W	+8 W	+10 W
SEL-3390S8 Serial or SEL-3390T Expansion Card, Each:	+4 W	+5 W	+7 W
Chipset Heater[b]			
cold startup (<5°C [41°F]):	N/A	N/A	+90 W
continuous operation (0°C [32°F]):	0 W	+5 W	+10 W
continuous operation (–40°C [–40°F]):	0 W	+20 W	+40 W

[a] Minimum: 0% load on all components; minimum power consumption started and idle.
Typical: 25–50% load on all components; good indication of most application loads.
Maximum: 100% load on all components; generally cannot be reached in normal applications.
[b] Chipset heaters operate at low temperatures to keep the CPU and PCH within specified operating limits.

Table 1.2 Peripheral Connection Rated Current Output

Connection	Current Limit
DVI-D	0.2 A, +5 Vdc, 1 W total for both
DisplayPort	0.6 A, +3.3 Vdc, 2 W
COM 1 and COM 2	0.5 A, +5 Vdc, 2.5 W each
USB Ports	2 A, +5 Vdc, 10 W each, 25 W all ports combined

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Section 2
Installation

Overview

The first steps in applying the SEL-3355-2 are installing and connecting the unit. This section describes common installation features and requirements. A successful installation requires an understanding of both the hardware and software functions.

To install and connect the SEL-3355-2 safely and effectively, you must be familiar with the device configuration features and options. Carefully plan unit placement, cable connections, and communication during initial design.

This section contains connection drawings for mouse, keyboard, monitors, Ethernet ports, USB, serial ports, and power. Use these drawings as a starting point for planning your particular application.

Unit Placement and Maintenance

Proper placement of the SEL-3355-2 helps ensure that you receive years of trouble-free operation. Use the following guidelines for proper installation of the SEL-3355-2.

Physical Location

Mount the SEL-3355-2 in a sheltered indoor environment (a building or an enclosed cabinet) that does not exceed the temperature and humidity ratings for the unit (see *Specifications on page 1.5*). The unit is rated Installation/Overvoltage Category II and Pollution Degree 2. This rating allows mounting of the unit indoors or in an outdoor (extended) enclosure where the unit is protected against exposure to direct sunlight, precipitation, and full wind pressure, but temperature and humidity are not controlled. To satisfy safety requirements, the unit shall be installed in a suitable fire/electrical/mechanical enclosure. To protect against electrical shock hazards, the enclosure shall prevent access to the rear power supply and I/O terminals during normal operation.

Unit Mounting

Panel-mount and 19-inch rack-mount options are available. The following diagrams show dimensions and panel cutout size for the unit.

The finned aluminum front and rear heat sinks provide efficient passive cooling to the ambient air around the SEL-3355-2. No fans or forced air ventilation are required, but a minimum of 2.5 cm (1 inch) clearance around the heat sinks is recommended.

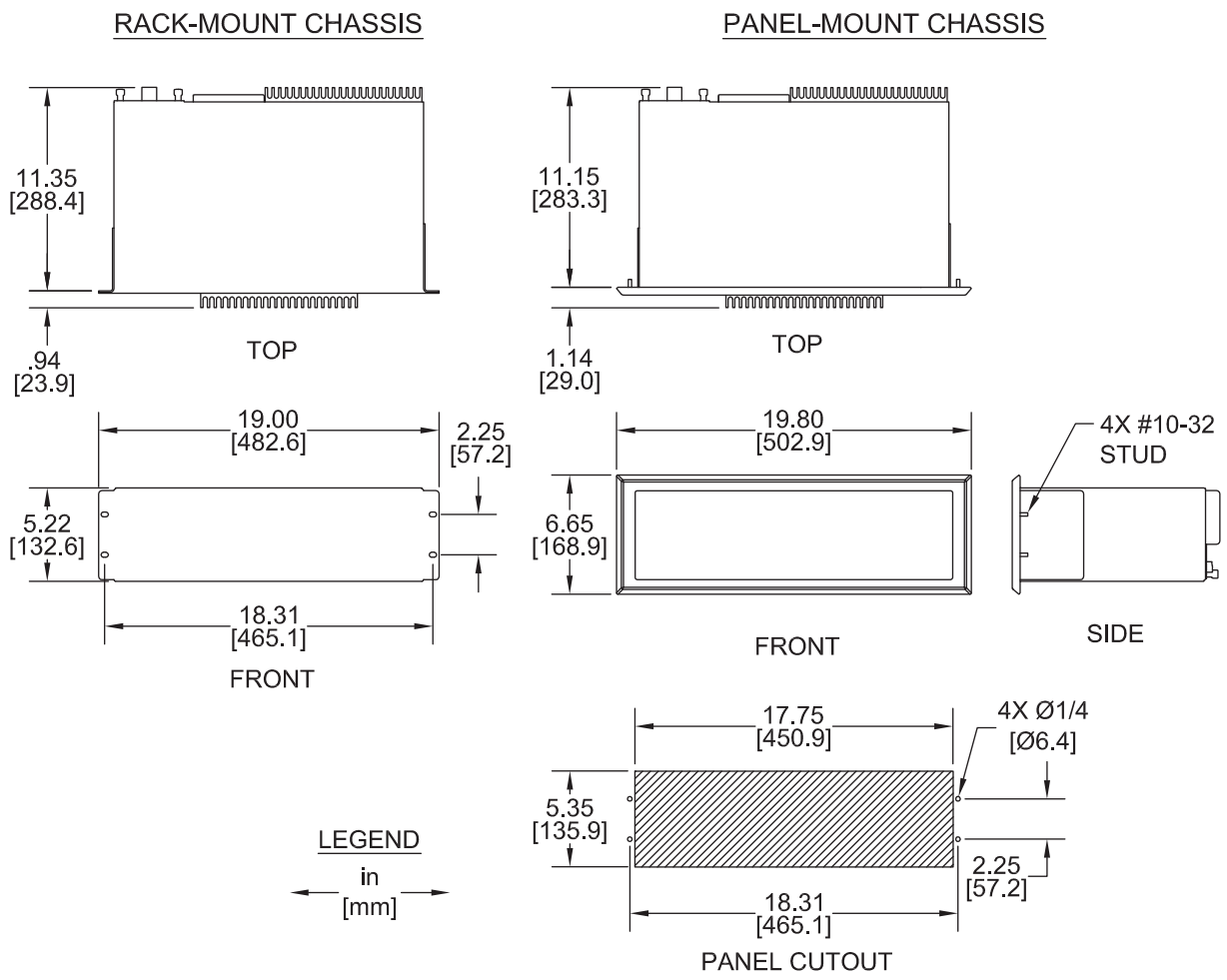


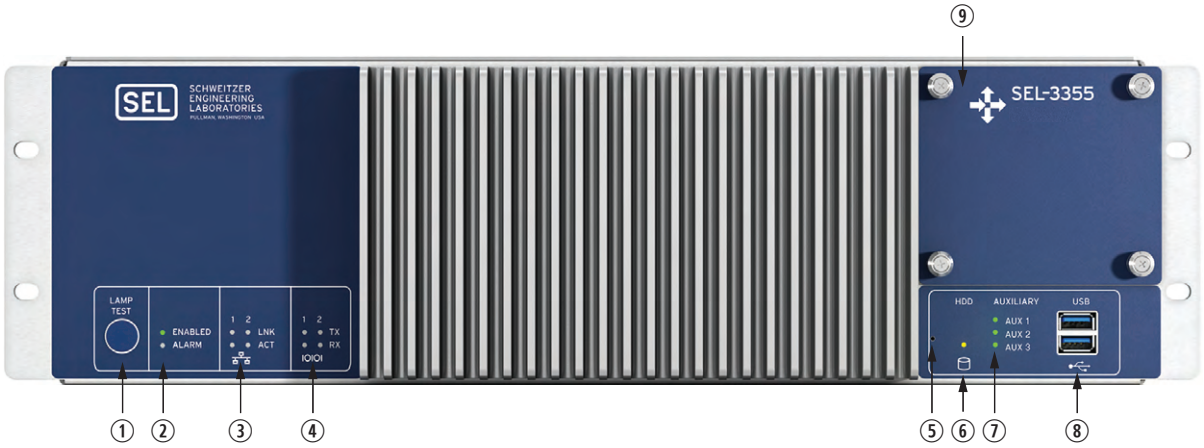
Figure 2.1 Dimensions Diagram

Cleaning

Use care when cleaning the SEL-3355-2. Use a mild soap or detergent solution and a damp cloth to clean the unit chassis. Allow the unit to air dry, or wipe dry with a soft, dry cloth. Do not use abrasive materials or polishing compounds on any unit surface. A permanent plastic sheet covers the front and rear panels; do not use harsh chemical solvents such as xylene or acetone when cleaning these surfaces.

Front Panel

Figure 2.2 shows the physical layout of the connectors on the front panel of an SEL-3355-2.



① **LAMP TEST** Button. Press and hold to test front-panel LEDs. Can be programmed to be an on/off or reset button.
② **ENABLED** and **ALARM** LEDs provide operational status. A green ENABLED LED indicates normal operation. The ALARM LED illuminates red when a nonoptimal system condition exists.
③ **ETHERNET** Status Indicators. Link (LNK) indicates that the port is connected, and activity (ACT) indicates when data are being transmitted and received.
④ **SERIAL** Status indicators. Transmit (TX) and receive (RX) LEDs indicate activity on serial ports.
⑤ **PINHOLE** Button. Provide reset and power functions, and requires a push-pin to prevent accidental use.
⑥ **HDD** Activity Indicator. Illuminates when SATA drives are accessed.
⑦ **AUXILIARY** Status Indicators. Three programmable, bicolor LEDs for your custom application.
⑧ **USB** Ports. Two easily accessible ports to connect USB peripherals.
⑨ **SATA** Drive Bay. Removable cover plate enables easy access to SATA drives from the front panel.

Figure 2.2 Front Rack-Mount Diagram

Lamp Test Button

Press the **LAMP TEST** button to illuminate all LEDs. Press and hold the **LAMP TEST** button to cycle through an LED test pattern. The **LAMP TEST** button can be configured to function as a power or reset button or be completely disabled (see *Boot Features on page 4.2*).

Status Indicators

The **ENABLED** LED displays operational status with green for normal operation, and red to indicate that the system is starting up, has halted, or is experiencing an error condition.

The **ALARM** LED illuminates red when the alarm contact operates, indicating a nonoptimal system condition exists. For details regarding alarm contact function, see *Alarm Contact on page 2.7*.

Ethernet LEDs indicate network status and network activity for built-in Ethernet ports.

Serial LEDs indicate activity on serial ports.

The **HDD** LED indicates SATA drive activity. The blink rate indicates how much SATA drive activity is taking place. A fast blink indicates more SATA drive activity.

Auxiliary LEDs labeled **AUX 1**, **AUX 2**, and **AUX 3** are programmable for your custom application.

USB Ports

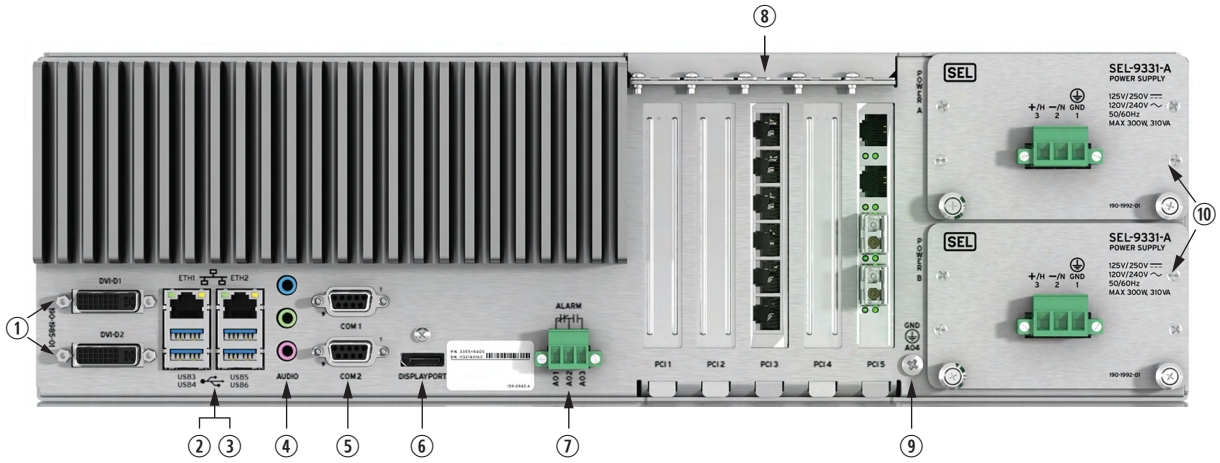
Attach one or two USB devices, enabling custom, application-specific peripherals. Enter the BIOS setup to selectively disable the USB port(s).

SATA

Loosen four thumbscrews to remove the front-panel drive-bay cover and access the SATA drive bay to install or remove 2.5-inch SATA drives.

Rear Panel

Figure 2.3 shows the physical layout of the connectors on the rear panel of an SEL-3355-2.



① **DVI-D**. Connect digital monitors by using native DVI or an HDMI adapter.
② **ETH1** and **ETH2**. Onboard independent Gigabit Ethernet interfaces.
③ **USB** Ports. Connect as many as four USB peripherals at the rear panel.
④ **AUDIO** Ports. Line Input (blue), Line Output (green), and Microphone Input (pink).
⑤ **COM1** and **COM2**. Standard EIA-232 serial ports with configurable +5 Vdc power on Pin 1.
⑥ **DISPLAYPORT**. Connect new digital monitors supporting the DisplayPort interface.
⑦ **ALARM**. The Form C alarm contact output can be wired either normally closed or normally open.
⑧ **PCI** Expansion Slots. Install SEL or third-party PCI or PCI Express expansion cards for additional network, serial, or other application-specific I/O.
⑨ **Earth Ground** Terminal Screw. The earth ground connection for the SEL-3355-2.
⑩ **POWER** supply modules. The rated input voltage is clearly marked on the chassis near the terminals.

Figure 2.3 Rear-Panel Diagram

Video

Connect multiple displays by using three video ports. Choose between DVI-D and DisplayPort. Connect HDMI monitors with a DVI-to-HDMI adapter connected to either DVI port. Use VGA, DVI, and HDMI adapter dongles connected to the DisplayPort to make use of these video displays. Digital audio can be streamed from the video ports to devices by using DisplayPort and HDMI connections.

Ethernet

The SEL-3355-2 is equipped with two built-in high-speed Gigabit Ethernet 10/100/1000BASE-T (**ETH1** and **ETH2**) copper ports for connecting to two independent networks. Ports may be teamed for redundancy or used individually. Please refer to online help documents if a teaming configuration is required. All Ethernet ports may be used at the same time and have unique SEL-programmed MAC addresses.

The right LED on each rear Ethernet port illuminates yellow to indicate that a link or connection is present. The left LED flashes green during data transfer.

Additional copper or fiber-optic Ethernet ports can be added to the SEL-3355-2 by installing PCI Express expansion cards such as the SEL-3390E4 or SEL-3390T. For information on those cards, please refer to the expansion card instruction manual.

USB

Attach as many as four USB devices at the rear-panel enabling custom, application-specific peripherals. Enter the BIOS setup to selectively disable USB port(s).

Audio

Use line-in, line/headphone-out, and microphone jacks for high-definition analog audio applications.

Serial

Two built-in serial ports are BIOS configurable for +5 V port power. Each serial port has a communications port number assigned in the operating system similar to a standard computer. Additional serial ports can be added to the SEL-3355-2 by installing PCI Express expansion cards such as the SEL-3390S8. For information on those cards, please refer to the expansion card instruction manual.

The serial communications ports function as standard EIA-232 ports by default. Additional serial ports features, such as +5 V port power, are configurable via software settings. Please refer to *Serial Port Configuration on page 4.4* to configure the serial port features.

NOTE: The COM 1 hardware has a limited serial buffer receive size and should not be used with modems or other external communications equipment that do not have flow control capabilities.

Serial port **COM 1** can be configured to have a non-standard pinout, using Pins 4 and 6 as an IRIG-B input instead of the standard DTR/DSR modem control signals. This enables the SEL-3355-2 to synchronize the system clock to a GPS clock or other precise time source, with an accuracy of 500 ms or better. To change the configured pinout of **COM 1**, refer to *COM 1 Jumpers on page 3.3*. The IRIG-B input accepts a demodulated (also referred to as unmodulated) IRIG-B002 input. The IRIG-B002 time-code format is a binary-coded decimal (BCD) time-code (HH,MM,SS,DDD)—this time-code format is "regular" IRIG-B. The IRIG-B000 time-code formats consist of BCD time code (HH,MM,SS,DDD), plus additional information and control functions that depend upon user applications. The IRIG-B input will accept IRIG-B000, but will not process the additional data, providing the same functionality as IRIG-B002. Note that IRIG-B002 does not include the year, which you must manually set on the SEL-3355-2 system clock during initial setup and any time the RTC battery is removed.

On SEL-3355-2 systems running Microsoft Windows operating systems, the Windows Time interface is used to synchronize the system clock to the IRIG-B input. Use the Services control panel to verify that the Windows Time service is set to automatic startup for proper system-time synchronization. The Windows Time service can also be configured to be an NTP server, providing time synchronization to other devices through an Ethernet connection.

See *Figure 2.4* for the serial port DB-9 female connector pin numbers. The corresponding EIA-232 serial port pin functions are shown in *Table 2.1*.

Table 2.1 EIA-232 Serial Port Connector Pin Definition (Sheet 1 of 2)

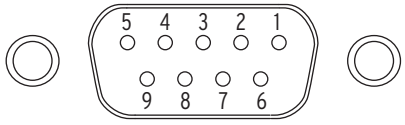
Pin	Ports 1-2
1	DCD or +5 Vdc[a]
2	RXD
3	TXD
4	DTR or +IRIG-B[b]
5	GND

Table 2.1 EIA-232 Serial Port Connector Pin Definition (Sheet 2 of 2)

Pin	Ports 1-2
6	DSR or –IRIG-B[b]
7	RTS
8	CTS
9	RI

[a] Software configurable.
[b] Jumper configurable on COM1, DTR/DSR on COM2.

Pin 1 on each port can provide as much as 0.5 A at +5 V (2.5 W).



Female chassis connector, as viewed from outside panel.

Figure 2.4 EIA-232 DB-9 Connector Pin Numbers

The communications circuits have internal surge protection.

Common serial cable configurations are shown in *Figure 2.5* and *Figure 2.6*. Refer to SEL-5801 Cable Selector Software (free software download from selinc.com) for the most recent cable configurations. Please refer to the individual device manual and Cable Selector Software prior to selecting a proper cable.

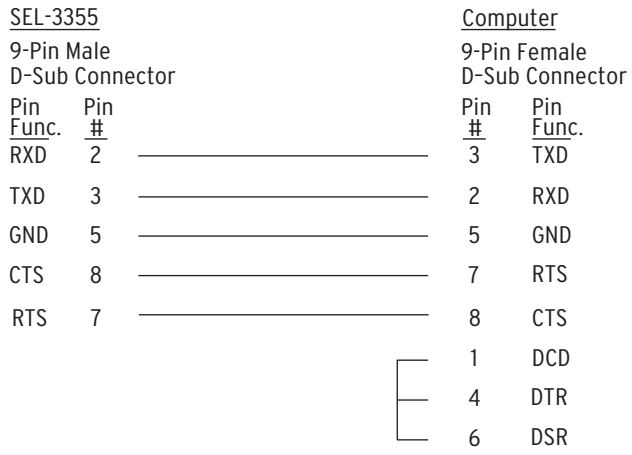


Figure 2.5 SEL-C235 Cable

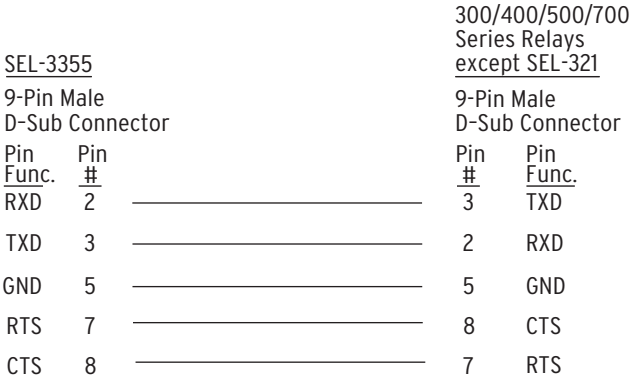


Figure 2.6 SEL-C282 Cable

The following list provides additional rules and practices you should follow for successful communication when using EIA-232 serial communications devices and cables:

- Keep the length of the communications cables as short as possible to minimize communications circuit interference, and to minimize the magnitude of hazardous ground potential differences that can develop during abnormal power system conditions.
- Ensure that the length of the EIA-232 communications cable is no longer than 15.2 m (50.0 ft) and always use shielded cables for communications circuit lengths longer than 3.0 m (10.0 ft). At data rates more than 480,800 bps, the cable length should be less than 2.0 m to avoid errors from electrical transients.
- Always use modems or fiber optics for communication over long distances, and to provide isolation from ground potential differences between device locations.
- Always route communications cables away from power and control circuits. Switching spikes and surges in power and control circuits can cause noise in the communications circuits if not adequately separated.
- Use the lowest data rate that provides adequate data transfer speed. Lower-speed communication is less susceptible to interference and will transmit greater distances over the same medium than communication at higher speeds.

PCI Expansion

NOTE: SEL-3390E4 and SEL-3390T cards can be used in either Slot 4 or 5. SEL-3390S8 cards can be used in Slots 2–5.

Five expansion slots are available for SEL rugged or third-party expansion cards. Slot 1 is legacy 32-bit PCI, Slots 2 and 3 are PCIe x1, and Slots 4 and 5 are PCIe x4. To install additional networking, serial, time, video, or other expansion cards shut down the operating system and unplug the power source. Then unscrew the top panel and remove the blanker plate for the expansion slot required.

Grounding

Connect the grounding terminal (see A04 in *Figure 2.3*) labeled **GND** on the rear panel to a rack frame ground or main station ground for proper safety and performance. Use 12 AWG (4 mm^2) or heavier wire, less than 3 m (9.8 ft) in length, for this connection. This terminal connects directly to the internal chassis ground of the SEL-3355-2. All safety grounds must be connected so that all components remain grounded when servicing the power supplies.

Alarm Contact

The grounding terminal should be connected before the application or removal of power to the alarm contact terminals. Wire a Form C dry alarm contact output either normally closed or normally open. The **ALARM** LED on the front panel provides the indication of the alarm contact state. The default state of the alarm when powered off and during system startup is active. The alarm will clear during startup once the system software has loaded, or if the Watchdog is disabled (via main board control jumper or BIOS setting). During normal operation, the system software controls alarm operation based on the software and hardware operational status. For additional information, see *Section 7: System Software and Settings*. For contact ratings, see *Specifications on page 1.5*.

Power

NOTE: The power supply **GND 1** connection shown in *Figure 2.7* is the same type of ground as the chassis **GND A04** shown in *Figure 2.3*. Both terminations can be connected to ground with a short connection wire from the terminal block. SEL recommends using the chassis ground connection.

⚠WARNING
Do not operate device unless properly grounded.

⚠WARNING
Failure to ensure proper voltage levels can cause equipment damage.

⚠WARNING
Stranded wire presents a risk of exposing the user to contact with hazardous voltages if not all of the strands are captured in the terminals. Use Crimp Ferrules to safely capture all wire strands.

NOTE: If equipment is powered from a power converter, an external breaker may not be required between the power converter and the equipment. Refer to power converter and power system external overcurrent protection requirements.

The grounding terminal should be connected before application or removal of power to the power terminals. Connect the power terminals on the rear panel to an appropriate voltage level power source. Install an optional second redundant power supply and wire it to an independent power source for maximum availability. Power supplies are hot-swappable.

During startup at cold temperatures, the SEL-3355-2 uses chipset heaters to guarantee the CPU and PCH are operating within their temperature limits. The heaters draw a maximum of 90 watts of additional power for a short period of time after startup, gradually decreasing power as the CPU and PCH heat up. At the coldest rated startup temperature (–40°C) the heater may operate at full power for three to five minutes after startup. At warmer temperatures, the heater will operate at full power for a shorter period; for example, it will only operate for a few seconds at 0°C startup.

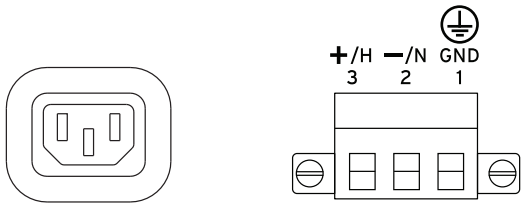


Figure 2.7 Power Connections

Place an external switch, circuit breaker, or other overcurrent protection device in the power leads. The overcurrent protection device must interrupt both the hot- and neutral-power leads if dc powered. An overcurrent protection device rated for 20 A is recommended. Be sure to locate this device within 3 m (9.8 ft) of the SEL-3355-2. Disconnect devices must comply with IEC 60947-1 and IEC 60947-3-1.

Initial Checkout and Startup

NOTE: Passwords and usernames should be configured during initial setup to ensure device security. Forgetting the Administrator username or password may require re-installation of your operating system.

NOTE: At temperatures below 5°C (41°F) the SEL-3355-2 will perform a preheat cycle before booting into the operating system. During this time the CPU is held in reset, the screen will remain blank, and the alarm is asserted. The preheat cycle will take as long as 5 minutes in extremely cold conditions.

Step 1. Connect a monitor, keyboard, and mouse to the SEL-3355-2 as shown in *Figure 2.3*.

Step 2. Apply power to the SEL-3355-2 and turn on the monitor.

Step 3. The SEL-3355-2 will go through the initial BIOS startup and then start the operating system that was installed from the factory, if any. Some additional setup may be required at this stage, such as providing a system name, username, and passwords.

Step 4. Enter the username and password to log in to the operating system if present; otherwise, proceed with the operating system installation.

Proceed with hardware and BIOS setup if necessary.

Section 3
Hardware Setup and Serviceability

Overview

The SEL-3355-2 has unique hardware, which sets its deployment and servicing apart from standard computers. This section details the individual hardware components that make up the core of the automation controller, its expansion capabilities, and the technical specifications and requirements of the various components.

Main Board

Figure 3.1 shows the components and their locations on the SEL-3355-2 main board.

⚠CAUTION
The main board is not field serviceable and should not be removed from the SEL-3355-2. Doing so will compromise the thermal interface material between the CPU, PCH, and heat sink, which, if not replaced properly, can cause damage to the system.

⚠CAUTION
There is danger of explosion if the battery is incorrectly replaced. Replace only with Panasonic No. BR-2330A or equivalent recommended by manufacturer. See Owner's Manual for safety instructions. The battery used in this device may present a fire or chemical burn hazard if mistreated. Do not recharge, disassemble, heat above 100°C or incinerate. Dispose of used batteries according to the manufacturer's instructions. Keep battery out of reach of children.

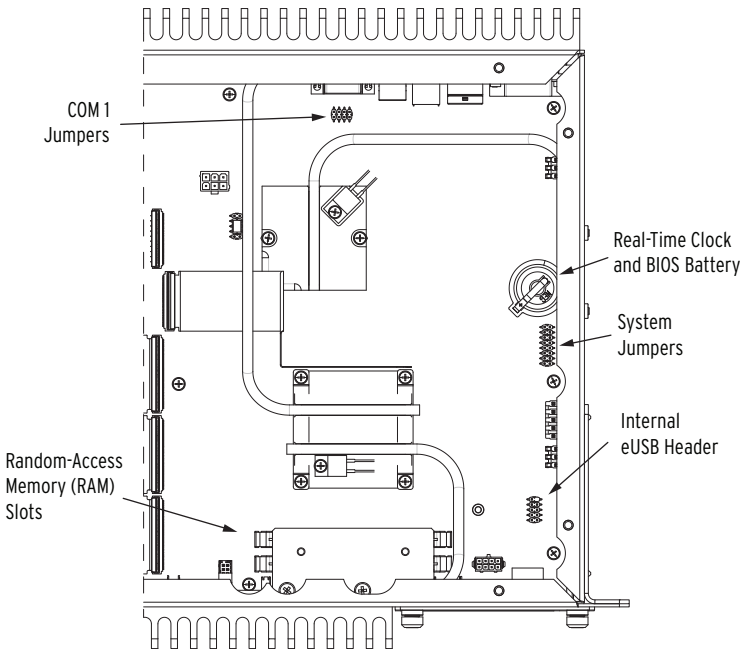


Figure 3.1 Main Board Diagram

Top Panel Removal

To access the main board and PCI expansion slots you must first remove the top panel from the SEL-3355-2. To do so, remove the screws as shown in *Figure 3.2*.

CAUTION
Equipment components are sensitive to electrostatic discharge (ESD). Undetectable permanent damage can result if you do not use proper ESD procedures. Ground yourself, your work surface, and this equipment before removing any cover from this equipment. If your facility is not equipped to work with these components, contact SEL about returning this device and related SEL equipment for service.

DANGER
Disconnect or de-energize all external connections before opening this device. Contact with hazardous voltages and currents inside this device can cause electrical shock resulting in injury or death.

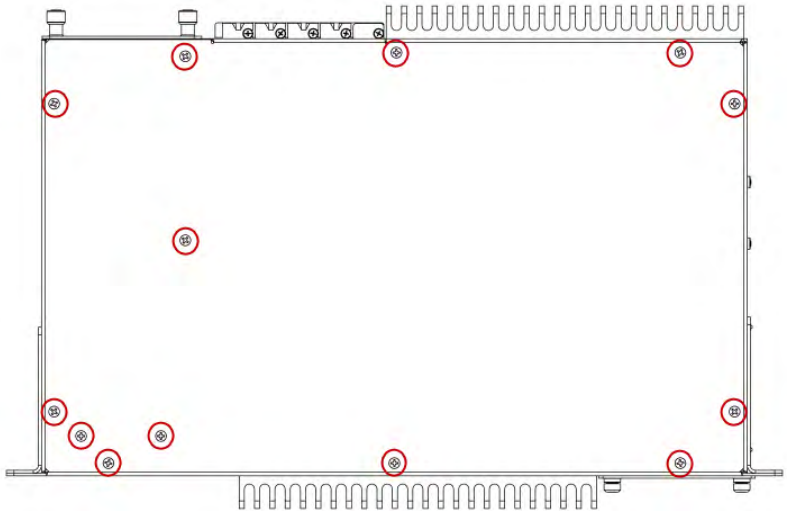


Figure 3.2 Top Panel Removal

System Jumpers

Table 3.1 shows the system jumpers and their functions on the SEL-3355-2 main board. The jumpers can be accessed from the top of the unit by removing the top panel (see *Top Panel Removal on page 3.1*).

The factory-default configuration of the system jumpers has shunts installed on only one of the two pins of each jumper location, such that the pins in each jumper position are not bridged. To enable a system jumper function, remove the jumper shunt from the listed jumper position and then install the shunt in the same position such that both pins are bridged by the shunt.

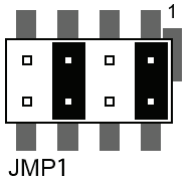
Table 3.1 System Jumper Descriptions

Jumper Positions	Description
A	**BIOS Clear** Returns BIOS settings to their factory defaults. Does not affect the Trusted Platform Module (TPM) state.
B	**BIOS Recovery** Initiates the BIOS recovery mode to recover from a corrupted system BIOS. See *Recovery Mode on page 4.6*.
C	**Watchdog Disable** Completely disables the system watchdog. See *Watchdog on page 3.8*.
D	**Password Disable** Bypasses the BIOS password if one is set. May be used to bypass operating system or software passwords, such as the SEL RTAC or SEL Blueframe operating systems, or Window systems running the SEL SysMon software (see *Password Recovery on page 7.8*).
E	**SEL Operating System Factory Reset** If the SEL-3355 has an SEL operating system installed, such as SEL RTAC or SEL Blueframe, this jumper will return the operating system to a factory default configuration.
F	**Reserved**
G	**Reserved**
H	**Reserved**

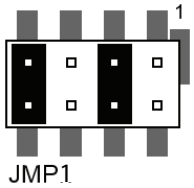
COM 1 Jumpers

The COM 1 jumpers, labeled JMP1 on the SEL-3355-2 main board, configure pins 4 and 6 on COM 1 as either standard DTR/DSR modem control signals (default) or IRIG-B input for time synchronization.

1–2 and 5–6 bridged:
IRIG-B input



3–4 and 7–8 bridged:
DTR/DSR signals (default)



Real-Time Clock and BIOS Battery

The SEL-3355-2 contains a button cell battery that is used to maintain BIOS settings and clock when an external power source is disconnected.

You can replace the real-time clock and BIOS battery in the SEL-3355-2. If your BIOS battery needs to be replaced, the time and date will revert to midnight 1/1/2009. You can confirm this by entering the BIOS after the device restarts and examining the **Event Logs > View SMBIOS Event Log**. You will see a `CMOS Battery Failure` message. Perform the following steps to replace the battery:

⚠DANGER
Disconnect or de-energize all external connections before opening this device. Contact with hazardous voltages and currents inside this device can cause electrical shock resulting in injury or death.

⚠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.

⚠CAUTION
Equipment components are sensitive to electrostatic discharge (ESD). Undetectable permanent damage can result if you do not use proper ESD procedures. Ground yourself, your work surface, and this equipment before removing any cover from this equipment. If your facility is not equipped to work with these components, contact SEL about returning this device and related SEL equipment for service.

⚠CAUTION
There is danger of explosion if the battery is incorrectly replaced. Replace only with Panasonic No. BR-2330A or equivalent recommended by manufacturer. See Owner's Manual for safety instructions. The battery used in this device may present a fire or chemical burn hazard if mistreated. Do not recharge, disassemble, heat above 100°C or incinerate. Dispose of used batteries according to the manufacturer's instructions. Keep battery out of reach of children.

Step 1. Follow your company standard procedure to remove a device from service.

Step 2. Disconnect power from the SEL-3355-2 retaining the chassis ground connection.

Step 3. Disconnect any attached network and serial connections.

Step 4. Disconnect any attached peripheral cabling such as audio cables, USB keyboards and mice cables, video cables, or alarm contact cabling.

Step 5. Remove the SEL-3355-2 from the mounting location.

Step 6. Ground the SEL-3355-2 to an ESD mat and follow ESD procedures to ground yourself to the ESD mat.

Step 7. Remove the screws as shown in *Figure 3.2*.

Step 8. Remove the top panel.

Step 9. Locate the battery on the right side of the main board (see *Figure 3.1*).

Step 10. Remove the spent battery from beneath the clip of the battery holder.

Step 11. Replace the battery with an exact replacement.

Use a 3 V lithium coin cell, Panasonic No. BR-2330A or equivalent. The positive side (+) of the battery faces up.

Step 12. Reinstall the top cover and screws.

Step 13. Disconnect ESD mat connections.

Step 14. Remount the SEL-3355-2 to the mounting location.

Step 15. Reconnect any network and peripherals cabling disconnected in *Step 3* and *Step 4*.

Step 16. Reconnect power to the SEL-3355-2.

Step 17. Turn on the SEL-3355-2.

Step 18. Follow instructions (press **<F2>** during startup) to enter the BIOS and reset system date and time from **Main > System Date and System Time**.

Step 19. Save settings and exit (**<F10>**).

Step 20. Follow your company standard procedure to return the SEL-3355-2 to service.

Random-Access Memory (RAM) Slots

Each RAM slot accepts a single mini-UDIMM memory module with a capacity of as much as 32 GB each. The SEL-3355-2 has two RAM slots to hold a maximum 64 GB of RAM.

Internal eUSB Header

The main board for the SEL-3355-2 contains one eUSB header. With the proper SEL adapter, you can attach a USB device permanently inside the unit.

PCI Expansion Slots

NOTE: You can typically install a lower-speed PCI Express card into a higher speed PCI Express slot, although it will operate at the lower speed.

Figure 3.3 shows the expansion slot locations and their functionality. Be sure to select the right type of PCI/PCI Express card for your application. Typical consumer-rated expansion cards do not match the temperature rating of the SEL-3355-2; therefore, they may negatively impact the total system reliability. See *Requirements on page 3.5* for recommendations.

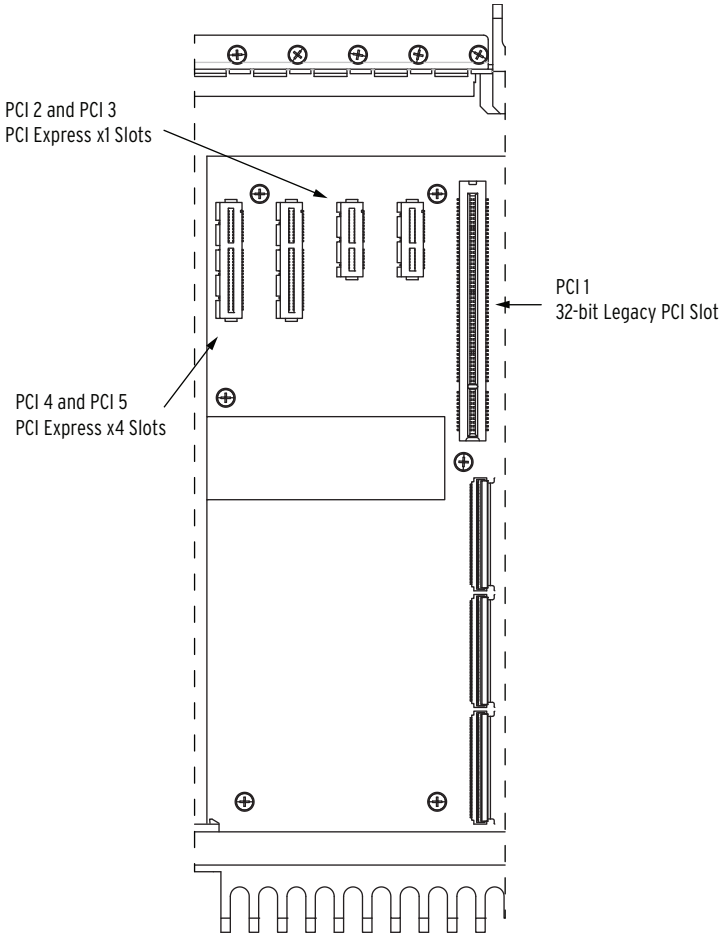


Figure 3.3 PCI Expansion Slots

Expansion Slot	Function
PCI 1	A legacy 32-bit, +5 V PCI slot for older legacy PCI expansion cards.
PCI 2 and PCI 3	Two PCI Express x1 slots for PCIe x1 cards.
PCI 4 and PCI 5	Two PCI Express x4 slots for PCIe x1 or x4 cards.

Removal and Installation

When installing or removing expansion cards, ensure that the system is shut down and the power supply is disconnected. Each expansion card in the SEL-3355-2 is secured to the chassis by a screw at the rear panel. Once installed, the foam pads on the expansion board and top panel hold the cards securely to resist shock and vibration.

PCIe cards with x1 interfaces can be plugged into x4 slots (PCI 4 and PCI 5) without affecting the performance of the card or the SEL-3355-2. Legacy PCI cards will not fit into PCIe slots, nor will PCIe cards fit into the legacy PCI slot.

Requirements

Each expansion slot can accommodate a half-length, full-height expansion card per the PCI/PCIe specification. This allows a maximum card height of 107 mm (4.2 in) and maximum card length of 168 mm (6.6 in).

The expansion slots are compliant with PCI/PCIe power requirements. The PCIe x4 and legacy PCI slots have a maximum of 25 W, and the PCIe x1 slot has a maximum of 10 W. The total combined PCI slot power should not exceed 34 W. Exceeding these limits will adversely affect system performance and may lead to data loss and/or permanent damage.

When installing third-party PCI/PCIe expansion cards, take great care and consideration regarding the heat dissipation and temperature specifications of the expansion cards. Because the SEL-3355-2 has an unventilated chassis to prevent dust and other contamination from entering, the air temperature inside the chassis is typically much higher than external ambient air. This, combined with the added heat dissipation of the expansion cards, can limit the operating temperature range of the expansion cards when installed in the SEL-3355-2. SEL recommends performing thermal and reliability testing on any third-party expansion cards installed in the SEL-3355-2, prior to deploying the system.

Power Supplies

The SEL-3355-2 allows for dual, redundant power supply configurations to maximize availability in critical service situations. The SEL-3355-2 supports different power sources of varying voltage levels, allowing you to wire to a primary and backup power source with seamless transition during a service outage. Please see *Specifications on page 1.5* for available power supply configurations.

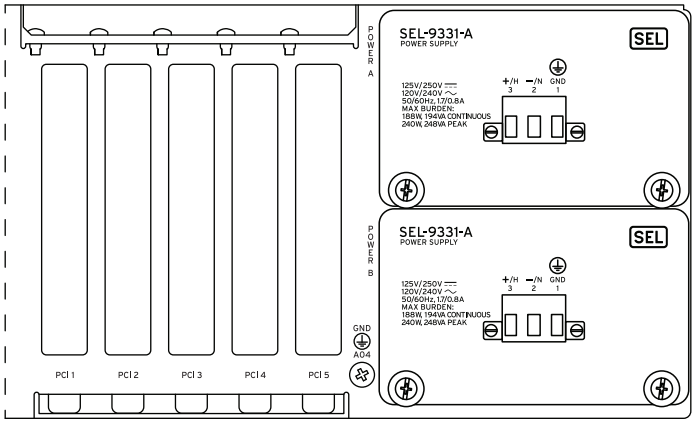


Figure 3.4 Power Supply Installation

Removal and Installation

The SEL-3355-2 power supplies contain two thumbscrews that secure them to the SEL-3355-2 chassis. To remove a power supply, disconnect its power source, unscrew the thumbscrews until they spin freely, and then pull the power supply out until it is free of the chassis. Installation is the opposite of removal.

Load-Sharing Configuration

If two power supplies are present in the SEL-3355-2, they will always try to share the load equally. In the event that one supply fails or loses its input source, the remaining power supply will provide power to the entire system.

SATA Drives

CAUTION
Industrial-grade SATA drives (85°C or higher operating temperature rating) are required when installing more than two drives in an SEL-3355-2. Do not install more than two SATA drives when using consumer-grade drives, or drive failure may occur.

A key feature of the SEL-3355-2 is its data storage capacity. The SEL-3355-2 has a front-facing drive bay that can house as many as four industrial-grade 2.5 inch (laptop-sized) Serial ATA (SATA) drives. The SATA drives can be combined into redundant volumes in a redundant array of independent disks (RAID) configuration (see *Section 5: SATA Drive RAID* for information on configuring RAID on the SEL-3355-2). Refer to *Requirements on page 3.5* for help with SATA drive selection.

NOTE: Most operating systems will logically address each drive from the bottom slot upwards in the drive bay.

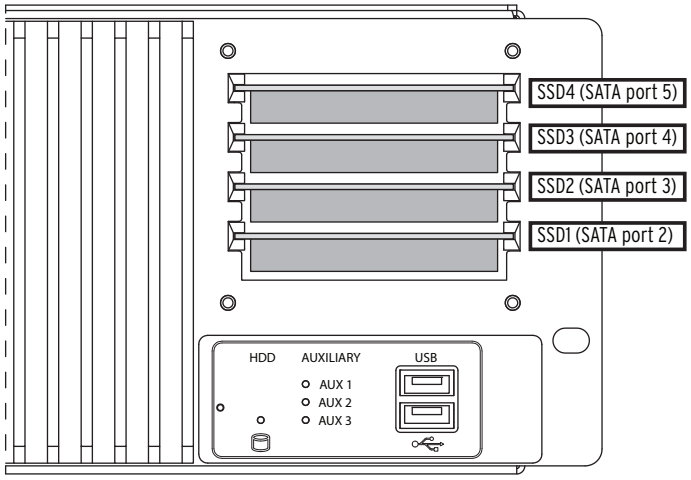


Figure 3.5 SATA

Drive Types

There are four types of SATA drives offered as factory-installed options for the SEL-3355-2: industrial-grade single-level cell (SLC) solid-state drives (SSDs), industrial-grade psuedo-SLC (pSLC) SSDs, industrial-grade 3D triple-level cell (3D TLC) SSDs, and consumer-grade multi-level cell (MLC) SSDs. The type of SSD you choose depends on your application.

SLC technology provides the highest level of endurance and reliability. SLC drives are suited for the most demanding applications and provide the best value for high-endurance applications in industrial environments. SLC SSDs from SEL carry the full SEL 10-year warranty.

pSLC drives provide high capacity at a lower cost but with reduced endurance. These drives are suited for industrial environments that require a large amount of drive space. pSLC SSDs from SEL carry a 5-year warranty.

MLC and 3D TLC drives provide the highest capacities and lowest cost but have the lowest endurance. These drives are suitable for applications that do not require a significant amount of write/erase cycles. Industrial-grade 3D TLC SSDs are appropriate for industrial environments and carry a 5-year warranty, while Consumer-grade MLC SSDs are for use in office environments and carry a 3-year warranty.

For help in determining the best type of SSD for your application, download Application Note *AN2016-03: Determining Solid-State Drive Lifetimes for SEL Rugged Computers* from the SEL website.

Removal and Installation

The drive bay is secured by a cover with four thumbscrews. Unscrew each of the thumbscrews until they spin freely and remove the drive-bay cover. Each SATA drive is attached to a sled plate with four screws. The sleds each fit into a slot, allowing for easy insertion and removal of the drive. The SEL-3355-2 SATA drive-bay slots are labeled SSD1–SSD4, with SSD1 being the bottom slot and SSD4 being the top. The SATA port numbers listed in the Intel Rapid Storage Technology software are offset from the SSD slot numbers by one, so SSD1 is connected to SATA port 2, SSD2 is port 3, SSD3 is port 4, and SSD4 is port 5.

Requirements

Each SATA drive slot can accommodate a standard 2.5 inch form factor SATA drive, with a maximum drive height of 10 mm (0.40 inches). The SATA drive bay provides +5 V power to the drive slots, which accommodates most standard 2.5-inch SATA drives. Drives that require 12 V or 3.3 V power are not supported. The +5 V total combined continuous power consumption of all installed SATA drives must not exceed 16 W (3.2 A). Exceeding this limit will adversely affect system performance and may lead to data loss and/or permanent damage.

When installing SATA drives, take great care and consideration regarding the power consumption and temperature specifications of the SATA drives. Because the SEL-3355-2 has an unventilated chassis to prevent dust and other contamination from entering the chassis, the air temperature inside the chassis is typically much higher than external ambient air. This, combined with the added heat dissipation of the SATA drives, can limit the operating temperature range of the SATA drives when installed in the SEL-3355-2. For this reason, industrial-grade SATA drives (85°C or higher operating temperature rating) are required when installing more than two drives in an SEL-3355-2. Do not install more than two SATA drives when using consumer-grade drives, or drive failure may occur. SEL recommends performing thermal and reliability testing on any third-party SATA drives installed in the SEL-3355-2, prior to deploying the system.

Watchdog

The SEL-3355-2 has a built-in watchdog for automatic system recovery in the case of software or operating system failures. The watchdog works as a count-down timer that upon reaching zero, triggers a system reset. A service or driver in the operating system is responsible for periodically servicing the watchdog to delay the system reset. Under normal conditions, the operating system will schedule this service or driver to run periodically to prevent the watchdog from ever resetting the system. If the operating system or one of the applications is locked in a processing loop that prevents other processes from running normally, the watchdog timer will have time to reach zero and reset the SEL-3355-2. This reset allows the operating system and application software to attempt to restart and return to a good working state.

The initial state of the watchdog at system startup depends on the configuration of the Watchdog BIOS setting and the mainboard Watchdog Disable jumper (Jumper Position C). *Table 3.2* describes how these settings affect the watchdog on startup. For information on changing the BIOS settings and jumpers, see *System Jumpers on page 3.2* and *Main Menu on page 4.2*.

Table 3.2 Watchdog Settings

Watchdog BIOS Setting	Watchdog Jumper (System Jumper C)	Watchdog Behavior
Disabled (Default)	Not Installed (Default)	The watchdog is available but disarmed; it cannot cause a reset until it is armed by the operating system. In this state, the watchdog cannot reset the system if a lockup occurs during initial startup.
Intel TCO Armed	Not Installed	The Intel TCO watchdog is available and armed; it can cause a reset anytime if not serviced by the operating system. In this state, the watchdog can reset the system if a lockup occurs during startup and normal runtime.
SEL Armed	Not Installed	The SEL watchdog is available and armed; it can cause a reset any time if not serviced by the system software. In this state, the watchdog can reset the system if a lockup occurs during startup and normal runtime. Only use this setting with the legacy SEL SysMon software (see *Appendix B: Legacy SEL SysMon Software*).
<Any>	Installed	The watchdog is not available; the operating system cannot detect or arm the watchdog. In this state, the watchdog cannot ever reset the system.

Microsoft Windows and Server operating systems will detect and start servicing the Intel TCO watchdog automatically. No software or settings changes are required for the watchdog to function. Many Linux-based operating systems require installing a watchdog management package for the Intel TCO watchdog to function.

The SEL watchdog, if enabled, requires system software to service the watchdog. In Windows, the legacy SEL SysMon software must be installed (see *Appendix B: Legacy SEL SysMon Software*). In Linux, a custom application or script that uses the SEL System Control (SSC) API must be created. For more information, see the documentation included with the SEL SysMon software and Linux SSC API that can be downloaded from the SEL-3355 webpage.

Section 4
BIOS Setup

Overview

NOTE: The SEL Blueframe and SEL RTAC operating systems may install a restricted BIOS to enhance system security. If the system has had one of these operating systems installed and pressing **<F2>** during startup does not grant access to BIOS Setup, then the restricted BIOS is installed, which does not provide a BIOS Setup interface. In this situation, if you require access to BIOS Setup, contact SEL for support.

The SEL-3355-2 contains an AMI UEFI-compliant BIOS, with a setup utility to configure hardware, I/O, peripheral, and boot options, and to check hardware status information. This section provides a brief description of the information and settings available in the BIOS setup. Detailed information about each setting is displayed on the BIOS setup main screen.

The factory-default BIOS configuration is optimal for most applications, so using the BIOS setup is typically not necessary. While it is usually safe to customize the BIOS settings to suit your application needs, it is possible to render the SEL-3355-2 inoperable with the wrong settings. If the system becomes inoperable after changing BIOS settings, refer to *Main Board on page 3.1* to use the BIOS reset system jumper to reset the BIOS to its factory-default settings.

The BIOS setup supports access control by requiring username and password authentication before it can be accessed. Access control is disabled by default, allowing full read/write access to the BIOS setup without authentication. SEL recommends using the access control feature to prevent unauthorized access to the critical system settings in the BIOS. See *Security Menu on page 4.4* for information on how to enable and configure access control. If you cannot access the BIOS setup because of a forgotten username or password, access control can be disabled via the Password Disable main board jumper (see *System Jumpers on page 3.2*).

To enter the BIOS setup, connect a keyboard and monitor and apply power to the SEL-3355-2, then immediately press **<F2>** before the operating system boots up. The BIOS setup main screen will appear within a few seconds.

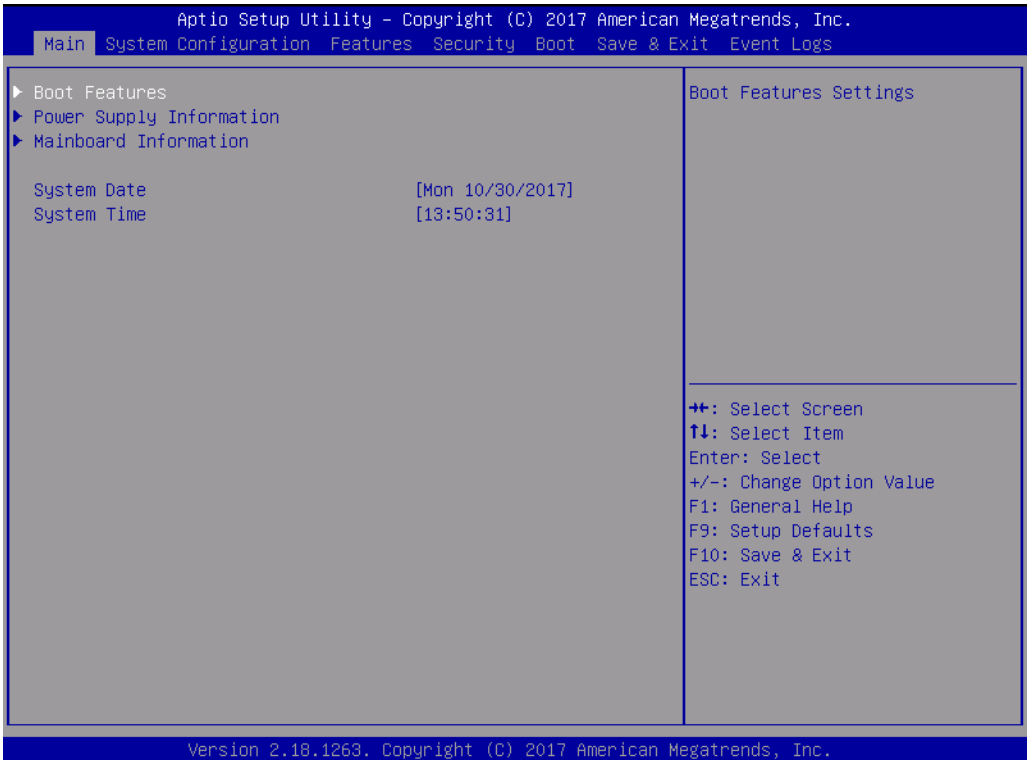


Figure 4.1 BIOS Setup Main Screen

Across the top of the BIOS setup main screen are top-level menu tabs. Under each menu tab are submenu items and setting values. Submenus are indicated by a triangle to the left of the item name. The right side of the screen displays item-specific help for the currently selected item. The bottom right of the screen displays the following information:

Left/Right Arrow	Navigate between top-level tabs
Up/Down Arrow	Select different settings and submenus in the current menu
+/–	Change the selected setting value
<Enter>	Enter the selected setting or submenu
<Esc>	Exit a submenu
<F1>	View the **General Help** screen
<F9>	Change all settings to factory defaults
<F10>	Save settings and exit setup

Main Menu

The **Main** menu tab is the first menu shown after entering the BIOS setup. The most commonly accessed BIOS features and options are accessible from this menu.

Boot Features

Boot Features contains settings related to startup behavior. The state of the Num Lock key and the system watchdog on startup can be configured here. Disabling the watchdog can be useful during initial operating system installation or troubleshooting. Note that the watchdog can be disabled by

using either the BIOS watchdog setting or the system jumpers (see *System Jumpers on page 3.2* and *Watchdog on page 3.8*). Legacy Mode can be enabled or disabled depending on whether your operating system (OS) supports UEFI or Legacy booting. Settings for the front-panel **LAMP TEST** and pinhole buttons enable them to behave like power and reset buttons. The default power state of the system can be configured to automatically start up when power is applied or to wait for the **LAMP TEST** button to be pushed.

Mainboard Information

Use the **Mainboard Information** submenu to view the BIOS and firmware versions, processor type and speed, installed memory modules, and total system uptime and boot count.

System Date and Time

The **System Date and System Time** settings are used for the SEL-3355-2 internal real-time clock (RTC). These are the same date and time settings used by the operating system after startup. Date and time adjustments in the BIOS setup affect the date and time in the operating system, and vice versa.

System Configuration Menu

The **System Configuration** menu tab contains submenus for configuring advanced chipset and peripheral features. These settings should typically be left at default values unless a specific application requires changes to the settings. Changing settings in this menu can render the SEL-3355-2 inoperable.

Intel Rapid Storage Technology

Intel Rapid Storage Technology (RST) provides access to view and modify the redundant array of independent drives (RAID) configuration of installed SATA drives. Use this menu to create a new RAID volume, delete an existing one, or reset SATA drives to non-RAID so the drives can be used elsewhere. Intel RST stores the RAID information directly on the SATA drives, so a drive or set of drives can be moved from one SEL-3355-2 to another without changing the RAID configuration of the drives.

Note that this section is only present when the Legacy Mode setting in the Boot Features section is set to Disabled. When Legacy Mode is enabled, the Intel RST configuration utility must be accessed by pressing **<Ctrl+I>** when prompted during initial bootup.

Intel Ethernet Connection

Intel Ethernet Connection displays details about the ETH1 network adapter, including MAC address and detailed chipset information. The NIC Configuration submenu provides link speed settings to disable autonegotiation and force a particular speed and duplex.

USB Configuration

USB Configuration contains settings for the eight USB ports on the SEL-3355-2 (six external and two internal). Legacy and Mass Storage Driver Support settings are available to improve compatibility with operating systems that may have limited or no support for USB. USB Port Disable Override can be enabled to restrict access to each individual USB port. Do not disable all USB ports, or you will lose the ability to connect a keyboard to access the system.

Graphics Configuration

Graphics Configuration allows you to set the primary video output when a PCIe graphics adapter is installed. You can set either the Integrated Graphics Device (IGD) or PCIe device (Auto) as the primary graphics controller.

HD Audio Configuration

HD Audio Configuration allows you to disable the integrated HD Audio codec, which may be useful when installing a PCIe audio device.

Expansion Board Configuration

Expansion Board Configuration provides the ability to enable or disable each expansion slot and force the interface speed to PCIe Generation-1 for compatibility with some PCIe cards.

Network Configuration

Network Configuration contains settings to enable or disable the ETH1 and ETH2 Ethernet controllers, and also to enable or disable Wake-on-LAN and PxE Network Boot for ETH1.

SATA Configuration

SATA Configuration provides settings that configure the SATA controller. The SATA Mode setting is set to RAID by default to enable Intel RST RAID functions. The SATA Mode can be set to AHCI for compatibility with operating systems that do not support Intel RST or the SATA controller can be disabled if a PCIe storage device is used instead of SATA drives. A list of the installed SATA drives is also provided on this menu.

Processor Configuration

Processor Configuration allows you to enable or disable advanced features built into the Intel Xeon processor. These features include the number of active CPU cores, Hyper-Threading, SpeedStep, Turbo Mode, and Speed Shift Technology.

Serial Port Configuration

Serial Port Configuration contains settings to disable the COM1 and COM2 ports, and to enable the +5 V power COM port feature (see *Serial on page 2.5*). Console Redirection can also be enabled, which transmits screen data out the serial port for viewing and control by using a remote serial-connected terminal.

Features Menu

The **Features** menu tab contains submenus for configuring the built-in Intel Active Management Technology (AMT) and Virtualization features of the Intel Xeon processor and chipset.

Manageability Settings

Manageability Settings provides settings to configure and manage the Intel AMT features of the Intel Xeon processor and chipset. See *Section 9: Intel Active Management Technology (AMT)* for more information.

Virtualization Configuration

Virtualization Configuration allows you to enable or disable advanced virtualization features of the Intel Xeon processor, such as Intel Virtualization Technology (VT), VT for Directed I/O (VT-d), and Single Root I/O Virtualization (SR-IOV).

Security Menu

The **Security** menu tab contains submenus for configuring the BIOS access control, Intel Software Guard Extensions, Secure Boot, and the Trusted Platform Module (TPM). SEL recommends using the access control feature to prevent unauthorized access to the critical system settings in the BIOS.

Intel Software Guard Extensions

Intel Software Guard Extensions (SGX) is a set of CPU instructions that can be used by application software to prevent other applications or malware from accessing that application's data in system memory. This setting defaults to Software Controlled and can be set to Enabled or Disabled.

Secure Boot

Secure Boot is a security mechanism that ensures the system boots using only software that is trusted by the system manufacturer or installer. From this menu, you can enable or disable Secure Boot and also perform key management.

TPM Settings

TPM Settings allows you to enable or disable the TPM and perform actions such as clearing the TPM. The TPM action selected is executed upon saving and exiting the BIOS Setup.

User Administration

User Administration allows you to set an Administrator password to prevent unauthorized access to BIOS Setup. When access control is disabled (i.e., no authentication is required), anyone can access BIOS Setup and save settings changes. Select **Administrator Password** to set an Administrator account password, which will enable access control. After enabling access control, you must save changes and exit the BIOS Setup. To disable access control, edit the Administrator password and set a blank (or empty) password.

Boot Menu

The **Boot** menu tab contains a prioritized list of all bootable devices currently installed on the SEL-3355-2. One configurable Boot Option is displayed for each bootable device detected during the last startup. You can move devices up or down in the list of Boot Options by using the **<+>** and **<–>** keys or prevent booting from a device by disabling the boot option.

Save & Exit Menu

The **Save & Exit** menu tab enables you to save or discard settings changes, load factory-default settings, and exit the BIOS setup (with or without saving changes). You can also quickly save and exit the BIOS setup from any screen by pressing **<F10>**.

Event Logs Menu

The **Event Logs** menu tab provides access to the SMBIOS Event Log, which is where BIOS stores information that can be useful in troubleshooting boot problems. Use the **Change SMBIOS Event Log Settings** submenu to enable, disable, or clear the SMBIOS Event Log. Set the Log System Boot Event setting to Enabled to create a log entry every time the system boots.

BIOS Updates

BIOS updates can be downloaded from the SEL-3355 product page on the SEL website at selinc.com. These updates can typically be installed using tools within the operating system or by using UEFI shell tools; they will require a reboot for the update to complete. The BIOS update package will include detailed installation instructions in a README.txt file. Read these instructions carefully before performing the BIOS update.

Recovery Mode

If the SEL-3355 system BIOS becomes corrupted, the SEL-3355 may fail to boot and become completely nonfunctional. If this happens, the BIOS recovery mode may be able to restore the BIOS to a working state. Setting the Recovery Mode jumper (see *System Jumpers on page 3.2*) enables the BIOS recovery mode. When recovery mode is enabled and you apply power, the SEL-3355 searches all attached USB drives for a BIOS CAP file (included with BIOS updates), then uses the file to reprogram the SEL-3355 system BIOS. The USB drive must be formatted with the FAT16 or FAT32 file system, the CAP file must be named B2081.cap and located in the root directory of the USB drive (not in a folder or subdirectory), and the version of the CAP file must be the same version or newer than the BIOS currently installed.

Section 5
SATA Drive RAID

Overview

The SEL-3355-2 SATA controller includes Intel Rapid Storage Technology (RST), which enables any SATA drives installed in the drive bay to be configured as a redundant array of independent disks (RAID). RAID configurations achieve higher performance and data reliability by using multiple physical SATA drives to form a single logical RAID volume. To use the RAID capabilities of the SEL-3355-2, the operating system must have the appropriate Intel RST RAID drivers and software installed. If you plan to install an operating system on a RAID volume, you may need the Intel RST RAID driver on a USB storage device to be able to provide the driver during the operating system installation. To determine whether Intel RST RAID drivers and software are available on your operating system, go to the SEL website and look at the SEL-3355-2 Product Support downloads page at https://selinc.com/products/3355/support/, or search the Intel website for the latest Intel RST RAID drivers and software.

RAID Types

A RAID volume is constructed using one of the RAID types discussed in this section. Each RAID type has advantages and disadvantages in terms of performance, fault tolerance, and capacity. In fault-tolerant configurations, performance will decrease when a drive fails, so consider application performance needs even when the RAID volume is in a degraded state. This section will help you select which RAID type best suits your needs.

RAID 0

A RAID 0 array stripes data across all drives in the array. This improves data throughput and achieves a storage volume size that is the sum of the capacities of all drives in the array. This RAID type has no fault tolerance, meaning that if any one of the drives in the array fails, all the data are lost.

Number of drives	2–4
Space efficiency	100%
Fault tolerance	0 drives (no fault tolerance)
Performance	2–4*x* read/write speed
Advantages	Highest performance and capacity
Disadvantages	Lowest data security
Applications	Temporary data requiring high performance and capacity

RAID 1

A RAID 1 array mirrors data across two drives. This improves data security by being able to survive a single drive failure. This RAID type also improves read performance, but only has the capacity of a single drive because of duplication of all data.

Number of drives	2
Space efficiency	50%
Fault tolerance	1 drive
Performance	2*x* read, 1*x* write speed
Advantages	High data security and improved read performance
Disadvantages	Lowest storage capacity
Applications	Smaller systems requiring high availability

RAID 5

A RAID 5 array stripes data and parity information across all drives in the array. This improves data security by being able to survive a single drive failure. This RAID type requires at least three drives, but is more space efficient because it only uses one drive worth of storage capacity. Write performance is lower than other RAID types because of the additional I/O and processing required for the parity calculations; particularly small random write operations can degrade performance to a fraction of the performance of a single drive.

Number of drives	3–4
Space efficiency	66–75%
Fault tolerance	1 drive
Performance	3–4*x* read, 1–2*x* write speed
Advantages	High data security and capacity
Disadvantages	Low write performance
Applications	Large systems requiring high availability

RAID 10

A RAID 10 array combines two RAID 1 mirrored arrays into a single RAID 0 striped array. This configuration provides maximum data security, because it can tolerate as many as two drive failures, as long as there is one functioning drive in each mirrored array. RAID 10 also offers the highest performance of any fault-tolerant configuration because both the mirrored set and the striped set are combined. This configuration requires four drives and has low space efficiency because of the data mirroring.

Number of drives	4
Space efficiency	50%
Fault tolerance	1–2 drives
Performance	4*x* read, 2*x* write speed
Advantages	Highest data security and high performance
Disadvantages	Low capacity
Applications	Systems requiring maximum availability

Configuring RAID Volumes

⚠CAUTION
Some operating systems sold by SEL are preconfigured with the system page file disabled by default. The Intel RAID driver relies on the page file, so it must be reenabled. Failure to do so will result in a system crash during a drive failure. See your operating system documentation for assistance with enabling the page file.

You need to have the Intel RST RAID drivers and software necessary for your operating system before configuring a RAID volume. Then you need to set the SATA controller to RAID mode in the BIOS setup (see *SATA Configuration on page 4.4*). For any RAID array type, all drives in the array should be the same type and storage capacity for optimal performance.

Creating a RAID Volume

A RAID volume can be created using either the **Intel Rapid Storage Technology** submenu in the BIOS Setup, or, for a compatible operating system that is already installed, by using the Intel RST software. Creating the RAID volume in BIOS Setup will erase all data stored on the drives that are assigned to the RAID volume. Using the Intel RST software, you can create a RAID volume that preserves the data from one of the SATA drives, allowing a live-migration of data on any drive to a RAID volume. For help creating a RAID volume through the use of the Intel RST Software, refer to the Intel RST software online help. To use the **Intel Rapid Storage Technology** submenu in BIOS Setup, see *Intel Rapid Storage Technology on page 4.3*.

Initializing a RAID Volume

A newly created RAID volume functions just like a new SATA drive, and must be partitioned and formatted before data can be stored on the drive. The operating system will have built-in tools to perform these tasks. For example, in Microsoft Windows use the **Disk Management** tool to initialize the disk, create a new partition, and format it with the appropriate file system. In addition to these normal tasks, any fault-tolerant RAID volumes must also be initialized to enable fault tolerance by using the Intel RST software.

To initialize the RAID volume, boot up the SEL-3355-2, log in to the operating system, and open the Intel RST software. Select the RAID volume, and under **Advanced**, select **Initialize**. The initialization process will take a few minutes, but you can continue to use the system normally while the volume is being initialized. Select the **Status** menu at any time to see the progress of the initialization.

Adding Hot Spares

A hot spare is a SATA drive that is installed in the SEL-3355-2 SATA drive bay and reserved for automatic repair of a fault-tolerant RAID volume. In normal conditions the hot spare sits idle and is not used by the system in any way. When a failure occurs, the Intel RST automatically adds the hot spare to the RAID volume and begins a rebuild process. This allows you to replace the failed SATA drive at your convenience, instead of having to rush to replace a failed drive to avoid data loss.

Because the SEL-3355-2 SATA drive bay can hold a maximum of four SATA drives, a hot spare can only be added to RAID volumes that use three drives or fewer. To configure a SATA drive as a hot spare, open the Intel RST software, select the drive, and select the option to mark it as a spare.

Monitoring RAID Volumes

It is important to constantly monitor the health of a RAID volume, so that users can detect drive failures and take appropriate actions to prevent data loss. To monitor a RAID volume, the Intel RST software must be installed and

configured to provide notification when maintenance is necessary. This section provides basic use and configuration information for the Intel RST software. For more detailed information, refer to the Intel RST software online help.

Checking Status

Open the Intel RST software to view the status of the RAID volume and each individual SATA drive. Select an individual item to view its status information and management options.

Scanning

To help ensure the health of the data stored on the RAID volume, perform verification and repair scans by using the Intel RST software. Scans are not required, but will help detect and repair integrity failures in data that are rarely accessed. Periodic scans can be configured to run at any interval from daily to yearly, and at a specific time of day, to minimize the impact on system performance. Schedule the scans to best fit the data reliability and performance demands of the application.

Notification of Status Change

The Intel RST software provides pop-up notifications from the Windows system tray anytime there is a RAID volume status change. The Intel RST software will provide additional notifications if you configure the email notification feature. To enable this feature, you must have an SMTP Host server available, and at least one recipient email address to receive the notifications.

Repairing RAID Volumes

When a fault-tolerant RAID volume suffers a drive failure or removal, the volume enters a degraded state. In this state, all data are still intact, but performance will be degraded and any additional drive failures or removals could result in complete data loss. If a hot spare SATA drive is available, the Intel RST will automatically use the spare to repair the RAID volume, allowing you to replace the failed SATA drive at your convenience. If a hot spare is not configured, a replacement SATA drive must be installed and an array rebuild must be performed as soon as possible to avoid data loss. Because the SEL-3355-2 supports hot-plugging of SATA drives, the repair can be performed without shutting down or otherwise interrupting the normal operation of the SEL-3355-2.

Replacing a SATA Drive

To replace a failed SATA drive, first determine which SATA drive has failed. Removing the wrong SATA drive from the RAID volume can result in complete data loss, so be extremely careful in determining which drive has failed.

⚠CAUTION
Removing the wrong SATA drive from the RAID volume can result in complete data loss, so be extremely careful in determining which drive has failed.

Open the Intel RST software and select the failed drive to determine its port number. The SEL-3355-2 SATA drive-bay slots are labeled SSD1–SSD4, with SSD1 being the bottom slot and SSD4 being the top. The SATA port numbers listed in the Intel RST software are offset from the SSD slot number by one, so SSD1 is connected to SATA port 2, SSD2 is port 3, SSD3 is port 4, and SSD4 is port 5. So if for example the Intel RST software indicates the SSD on SATA port 3 has failed, that corresponds with the SATA drive in the SSD2 slot. If the failed drive port shows as **unknown**, select each of the healthy drives to determine which port they are installed on and use the process of elimination to determine the port number of the failed drive.

Once you have determined which SATA drive has failed, remove it and install the replacement. The replacement SATA drive should be the same make, model, and size as the failed drive. If the same make and model SATA drive is not available, a different SATA drive can be used as long as its storage capacity is equal to, or greater than, the capacity of the failed drive. See *SATA Drives on page 3.6* for SATA drive removal and installation instructions.

Rebuilding the RAID Array

If the Intel RST used a hot spare to automatically repair the RAID volume, a manual rebuild is not required. In this case, open the Intel RST software and configure the replacement drive as a new hot spare. Otherwise, a rebuild operation must be performed to copy data to the replacement drive and restore fault tolerance. Open the Intel RST software, and select the degraded RAID volume. Select the option to rebuild to another disk, and select the replacement SATA drive to perform the rebuild. The rebuild operation will take a few minutes. When the operation is complete, the RAID volume will return to a good state.

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Section 6
Operating System and Software Installation

Overview

The initial installation of software on to the SEL-3355-2 may be accomplished several ways. This section describes the equipment and methods that can be used to install the operating system and software.

Operating System Installation

NOTE: The SEL Blueframe and SEL RTAC operating systems may install a restricted BIOS to enhance system security. If the system has had one of these operating systems installed and pressing **<F2>** during startup does not grant access to BIOS Setup, then the restricted BIOS is installed, which will not start non-SEL operating systems. In this situation, if you need to install a non-SEL OS, contact SEL for support.

To install the operating system, determine which 2.5-inch SATA drives you will use. The SEL-3355-2 can be ordered without any drives or with as many as four SATA drives. If you did not order SATA drives from the factory, see *Removal and Installation on page 3.7* for details on installing your own SATA drives.

Disable Watchdog

You will need to disable the watchdog functionality to ensure the system does not restart during the installation process. If the watchdog is enabled, the installation will be interrupted periodically by the watchdog resetting the system. After installing the operating system, drivers, and system software, re-enable the watchdog. See *Watchdog on page 3.8* for more information.

Set Legacy or EFI Boot Modes

If you need Legacy BIOS compatibility mode you may need to change the Legacy Mode setting in the BIOS to **Enabled**.

Boot Operating System Installation

USB Storage Device

The following steps describe how to install an operating system from a USB-connected hard drive, flash drive, or DVD drive that contains the operating system installation files.

Step 1. Plug the USB drive into a USB port on the SEL-3355-2.

Step 2. Connect a monitor, USB keyboard, and USB mouse to the SEL-3355-2.

Step 3. Apply power to the SEL-3355-2 and immediately press **<F5>** to display the `Boot` menu.

Step 4. Select the USB device from the list of boot options and press **<Enter>** to continue.

The SEL-3355-2 will now try booting from the USB device to begin the operating system installation.

Preboot eXecution Environment

The following steps describe how to install an operating system from a network-connected Preboot eXecution Environment (PXE) server you have configured with the operating system installation files. **Note:** To use this method, you must first set the PXE Network Boot setting in the BIOS setup to Enabled, see *Network Configuration on page 4.4*.

Step 1. Plug the network cable into an SEL-3355-2 Ethernet port. Plug the other end of the cable into the network switch configured to give you access to the PXE server.

Step 2. Apply power to the SEL-3355-2 and immediately press **<F5>** to display the boot menu.

Step 3. Select PCI LAN: from the list of boot options and press **<Enter>** to continue.

The SEL-3355-2 will now try booting from the PXE server to begin the operating system installation.

AMT

Make use of the Intel Active Management Technology (AMT) to install the operating system from media mounted in your laptop or another computer. See *Section 9: Intel Active Management Technology (AMT)* for information on how to enable console and boot redirection.

Driver Installation

Download the latest driver and system software installation files from the SEL-3355-2 product webpage at selinc.com. Save the driver files to a temporary directory on your SEL-3355-2 and run each installation file, following the instructions included with the installation files.

Software Installation

Start installing the software after you have successfully installed the operating system. There are many ways to install software. Three methods are described in this section.

USB Storage Device

Perform the following steps to install software by using a USB storage device.

Step 1. Copy the software installation package onto a USB storage device.

Step 2. Remove the USB storage device from your computer.

Step 3. Apply power to the SEL-3355-2 and log in to the operating system.

Step 4. Insert the USB storage device into the SEL-3355-2.

Step 5. Navigate to the USB storage device and launch the software installation package.

Network Share

Perform the following steps to install software from a network.

Step 1. Connect a network cable to one of the SEL-3355-2 Ethernet ports.

Step 2. Ensure that you have a valid IP address, gateway, and network mask.

See *Operational Issues on page 10.1* or refer to your operating system manual if you need assistance with this.

Step 3. Place the installation software on a network share or network drive.

Step 4. Access the network share from the SEL-3355-2.

Step 5. Launch the installation software from the network share, or copy installation software locally to a directory on the SEL-3355-2 and launch the software installation package locally.

AMT

Make use of the Intel AMT to install the software from media mounted in your laptop or another computer. See *Section 9: Intel Active Management Technology (AMT)* for information on how to enable console and boot redirection.

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Section 7
System Software and Settings

Overview

NOTE: Systems built prior to November 2022 included the legacy SEL SysMon software (see *Appendix B: Legacy SEL SysMon Software*). Newer systems include the new SEL SysMon software described in this section. You can install your preferred version of SEL SysMon on any SEL-3355-2. See the SEL-3355 webpage for downloads and installation instructions.

This section describes system software and device settings that are available on supported Microsoft Windows operating systems. For systems using SEL RTAC or SEL Blueframe operating systems, refer to the SEL-5033 ACSELERATOR RTAC or SEL Blueframe instruction manuals instead of this section.

The SEL-3355 provides a suite of system configuration, monitoring, and control features through SEL SysMon software. SEL SysMon is comprised of the SEL Management Interface (SEL MI), the SEL Alarm Service, SEL SysMon View software, an SNMP Agent Extension, and support utilities. While common devices like Ethernet ports and serial UARTs are configured and accessed through standard user interfaces, the SEL MI enables programmatic access to SEL-3355 specialized features like the auxiliary LEDs, hardware monitoring, and the system alarm through the Windows WMI interface. The SEL Alarm Service uses data from SEL MI and the operating system to control the system alarm. You can also use your own custom applications to monitor the system health and control the system alarm, contact I/O, and auxiliary LEDs by using the SEL MI and/or the support utilities.

SEL Alarm Service

The SEL Alarm Service is a Windows-based service that monitors system status information and controls the SEL-3355 system alarm. If any status information indicates that the SEL-3355 is out of normal operating range, the SEL Alarm Service activates the system alarm, illuminating the front-panel **ALARM** LED and de-activating the **ALARM** contact output.

The SEL Alarm Service creates Windows Event Logs for each alarm event, providing historical operational data for troubleshooting. To view the SEL Alarm Service event logs, open the Windows Event Viewer, expand the Applications and Services Logs category, and select the **SELAlarmService** event log.

You can use the SEL SysMon View software to check the SEL Alarm Service status information and also configure the service. See *SEL SysMon View on page 7.3* for details.

Configuration

Tailor each alarm to your specific application needs by adjusting the alarm thresholds and alert types in the SEL Alarm Service configuration file. The configuration file is located in the SEL SysMon installation directory, typically at the location below, and can be modified using either the SEL SysMon View software or any text editor, for example Notepad.

C:\Program Files\SEL\SysMon\
Alarm Service\SEL_SysMon_Configuration.ini

Each alarm listed in the configuration file has two settings: the threshold value and the alerting type. Comments in the configuration file provide descriptions for these settings, including the data types and min/max value for each alarm threshold, and the alerting types available. The alerting types are as follows:

log_only. Event log is generated, system alarm is not affected.

pulsed. Event log is generated, system alarm is pulsed for one second.

latched. Event log is generated, system alarm is set until alert condition ends.

persistent. Event log is generated, system alarm is set until the alarm service is restarted.

none. No Event log or system alarm.

You can modify the configuration file at any time; however, configuration changes will not take effect until you restart the SEL Alarm Service. If the configuration file contains invalid settings or is otherwise corrupt or invalid, the SEL Alarm Service will create an event log entry and a text file named SEL_SysMon_Configuration_Error_Log.txt to provide details to troubleshoot the configuration file error. If a configuration error cannot be resolved, removing the configuration file from the installation folder and then restarting the SEL Alarm Service will generate a new default configuration file.

Alarm Data Sources

The SEL Alarm Service does not provide a means to continuously monitor the alarm status data that could be useful for testing and troubleshooting. Because the SEL Alarm Service pulls all status data through the Windows WMI interface (from both the SEL MI and standard Windows WMI classes), you can read or monitor the same data through Windows WMI using Windows Powershell or a simple script (see the following Windows Powershell example). *Table 7.1* lists all the alarms in the SEL Alarm Service and the WMI classes and properties associated with them.

NOTE: All classes listed are accessed through the **root\CIMV2** WMI namespace (the default namespace for most scripting languages).

Table 7.1 SEL Alarm Service Data Sources (Sheet 1 of 2)

Alarm Name	WMI Class Name	Class Instance	Property	Notes
CPU TEMPERATURE[a]	SEL_Thermal	DeviceID = CPU	Temperature	Celsius = Kelvin – 273
AMBIENT TEMPERATURE[a]	SEL_Thermal	DeviceID = MAMB	Temperature	Celsius = Kelvin – 273
RAM [X] TEMPERATURE[a]	SEL_Thermal	DeviceID = RAM[X]	Temperature	Celsius = Kelvin – 273 [X] is 1 or 2
PCH TEMPERATURE[a]	SEL_Thermal	DeviceID = PCH	Temperature	Celsius = Kelvin – 273
CPU TOTAL UTILIZATION %[a]	Win32_PerfFormattedData_PerfOS_Processor	Name = _Total	PercentProcessorTime	Total for all CPU cores
RAM UTILIZATION %[a]	Win32_OperatingSystem	CreationClassName = Win32_OperatingSystem	TotalVisibleMemorySize FreePhysicalMemory	Utilization = (Total – Free) / Total
SYSTEM DRIVE USAGE %[a]	Win32_LogicalDisk	DeviceId = C:	Size FreeSpace	Usage = (Size – FreeSpace) / Total

Table 7.1 SEL Alarm Service Data Sources (Sheet 2 of 2)

Alarm Name	WMI Class Name	Class Instance	Property	Notes
SMART DISK STATUS[b]	Win32_DiskDrive	NA	Status	Monitors all drives
POWER SUPPLY [X] PRESENT[b]	SEL_PowerSupply	DeviceId = [X]	Present	[X] is A or B
POWER SUPPLY [X] STATUS[c]	SEL_PowerSupply	DeviceId = [X]	Good	[X] is A or B
TIME SYNCH STATUS[b]	SEL_Time	DeviceId = [X]	External0Good	[X] is all time device names
OVERCURRENT [G][c]	SEL_Ports	DeviceId = [X]	OverCurrent	[G] is a port group, [X] is a port name
JUMPER STATE JMP[X][b]	SEL_Jumper	DeviceId = [X]	Present	[X] is A through H

[a] Sampled on a 15-second interval.
[b] Sampled on a 60-second interval.
[c] Sampled on a 5-second interval.

The following is an example of Windows Powershell commands you can use to read status values:

Temperatures:

```
Get-CimInstance -ClassName SEL_Thermal
```

SMART Disk Status:

```
Get-CimInstance -ClassName Win32_DiskDrive | Select-Object -Property Status
```

Overcurrent:

```
Get-CimInstance -ClassName SEL_Ports | Select-Object -Property DeviceID, Overcurrent
```

SEL SysMon View

The SEL SysMon View software is a Windows-based application that provides a simple graphical user interface to display status data and settings for the SEL Alarm Service and the SEL MI. You can run SEL SysMon View from the Windows Start menu by selecting the **SEL SysMon View** shortcut in the SEL Applications folder.

NOTE: SEL SysMon View was added to the SEL SysMon software suite in June of 2025. To access SEL SysMon View you may need to update your SysMon software by installing the latest version of the SEL-3300 Driver Bundle for Windows. See the product webpage for your SEL-3300 device for downloads and installation instructions.

SEL SysMon View normally runs with Windows default application permissions. Most Windows systems run applications with basic user permissions, which enables SEL SysMon View to provide a read-only view of the system status data and settings. Some SysMon View functions require administrator permissions. For example, changing SEL Alarm Service settings requires writing to the configuration file stored under C:\Program Files\ and clearing persistent alarms requires permission to restart the SEL Alarm Service. These administrative functions are marked with an Admin icon (shield). If you initiate one of these functions when SEL SysMon View does not have Administrator permissions, Windows User Account Control will prompt you for permission to elevate (which may require you to enter an administrator username and password). If you require SEL SysMon View to run as Administrator without prompting, you must configure Windows User Account Control and application permissions to allow it.

User Interface

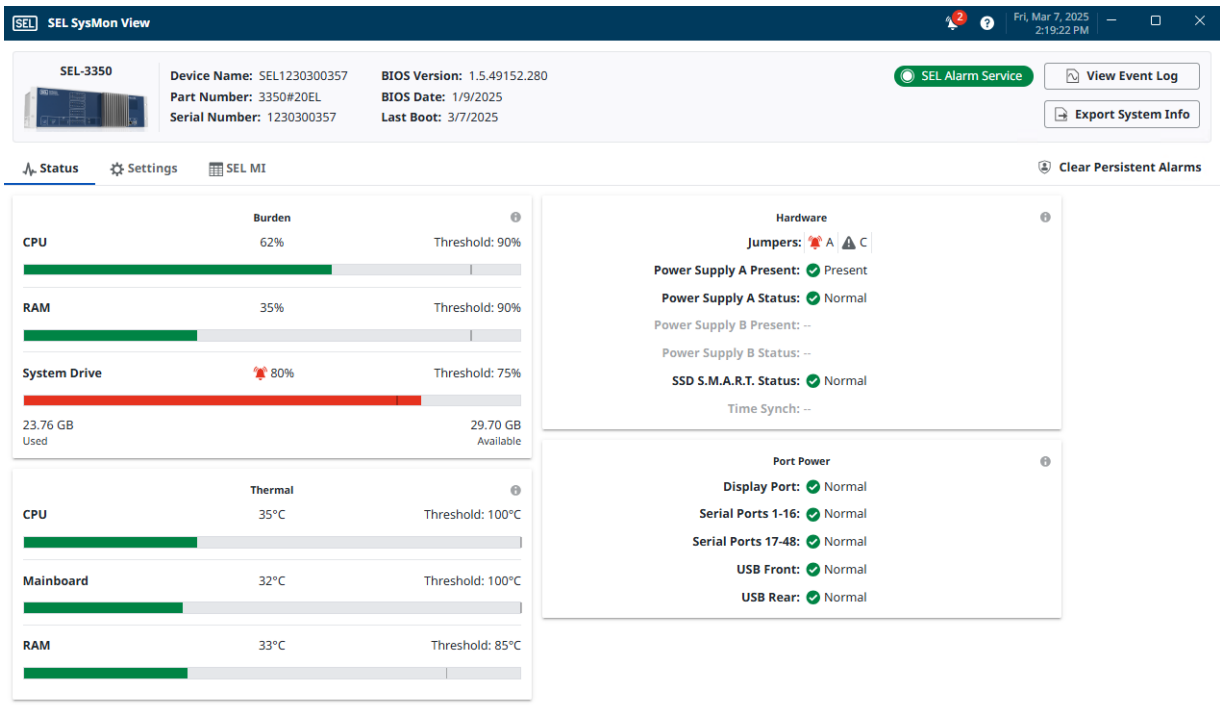

Figure 7.1 SEL SysMon View Overview

The SEL SysMon View user interface is composed of three main areas:

- The **Title Bar** at the top of the window displays the time and date, a help icon that displays the software version, and an alarm notification icon that indicates the number of currently active system alarms.
- The **System Information Pane** is below the Title Bar and displays system identification data, SysMon status notifications, and provides two buttons: the **View Event Log** button opens the SEL Alarm Service log in Windows Event Viewer and the **Export System Info** button runs the sel_support_info_utility.ps1 powershell script to save system information to a file that can be used for technical support (see *Support Utilities on page 7.7* for more information on this powershell script).
- The **View Pane** is below the System Information pane and provides a tabbed interface to display the Status, Settings, and SEL MI views described below.

Status View

The Status View displays a live view of alarm status data from the SEL Alarm Service (see *Figure 7.1*). This provides a simple way to view the overall system operating status and any conditions that are causing the system alarm to activate. The SEL Alarm Service updates each status value on a periodic interval of 5, 15, or 60 seconds. This means that when you initially run SEL SysMon View or restart the SEL Alarm Service, some status values will appear within 5 seconds while others may take as long as 60 seconds to appear. See *Table 7.1* for the sampling interval for each status value.

The colors and icons displayed for each status value indicate the alarm status and threshold type configured for that value. Status values that are not in alarm (below the alarm threshold) display green status bars and checkmark icons, while values that are in alarm (exceed the alarm threshold) display either red, orange, or gray status bars and alarm (bell) or warning (!) icons, depending on what alarm type is configured for that status value. Status values whose alarm type is set to None will be grayed out and display no live data. You can hover your cursor over the round (i) icons in the top-right corner of each status group to display a tooltip that defines the status indicator colors and icons.

Status values that have an alarm type of Persistent will continue showing an alarm indicator even after the alarm condition has cleared. Use the **Clear Persistent Alarms** button at the top-right of the Status View to restart the SEL Alarm Service, which will clear all persistent alarms. This operation requires administrator permissions, so if SEL SysMon View is not running as an Administrator then you will be prompted to elevate permissions when you select this button.

Settings View

The Settings View (see *Figure 7.2*) displays the current SEL Alarm Service settings and allows you to customize those settings and save them to the SEL Alarm Service configuration file. While the factory default settings are designed to provide ample system usability without encountering nuisance alarms, you should consider customizing the alarm settings to more closely match your application needs and expected operating conditions.

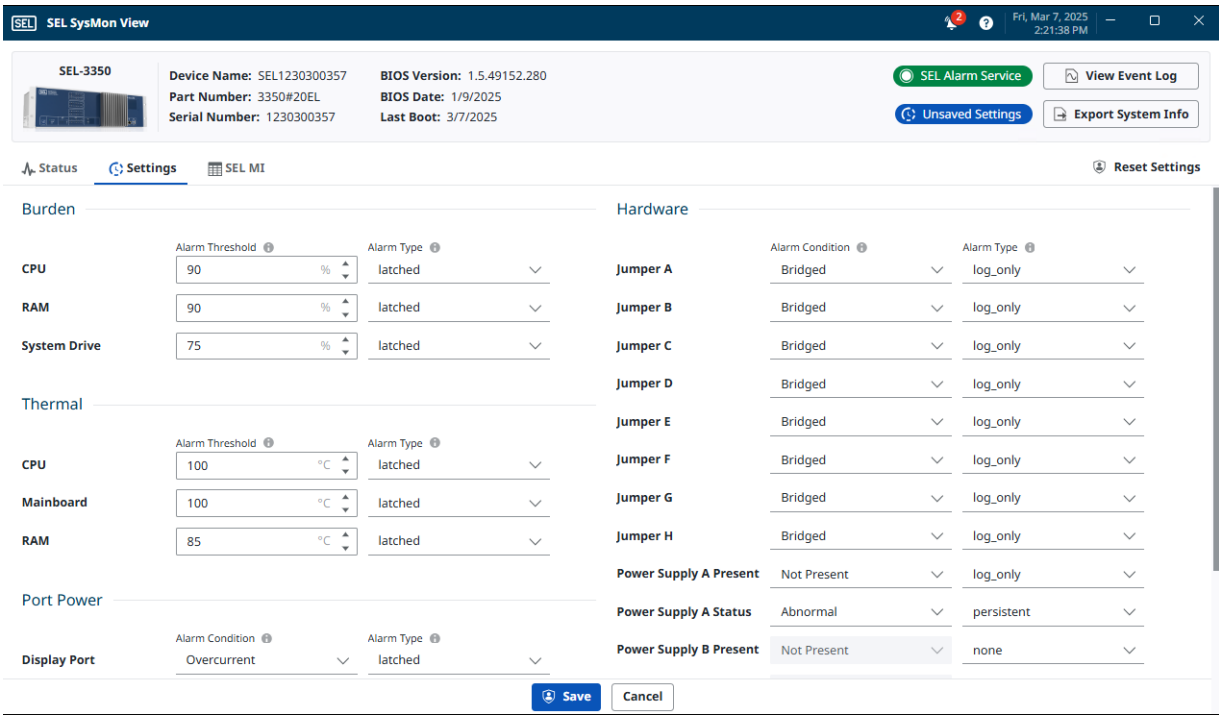

Figure 7.2 SEL SysMon View Settings View

Each status value has an associated Alarm Type and Alarm Threshold/ Condition. You can hover your cursor over the round (i) icons at the top of each setting group to display a tooltip that defines the setting values. For details about the alarm types and thresholds, see *Configuration on page 7.2*.

The Settings View has three buttons: the **Save** button writes your settings to the configuration file and restarts the SEL Alarm Service, the **Cancel** button discards all unsaved setting changes, and the **Reset Settings** button restores all settings to the factory default values. When you select **Reset Settings**, a confirmation prompt appears that has an option to export your current settings to a file in case you want to make a backup copy of the current settings file before loading the factory defaults. The Save and Reset Settings operations require administrator permissions, so if SEL SysMon View is not running as an Administrator then you will be prompted to elevate permissions when you select these buttons.

SEL MI View

The SEL MI View (see *Figure 7.3*) displays a tabular view of data from the SEL Management Interface classes. While the SEL MI classes are designed to be accessed through the Windows WMI system interfaces, the SEL MI View provides a quick and simple user interface to manually view this information. See *SEL Management Interface on page 7.9* to learn more about the SEL MI classes supported on this system.

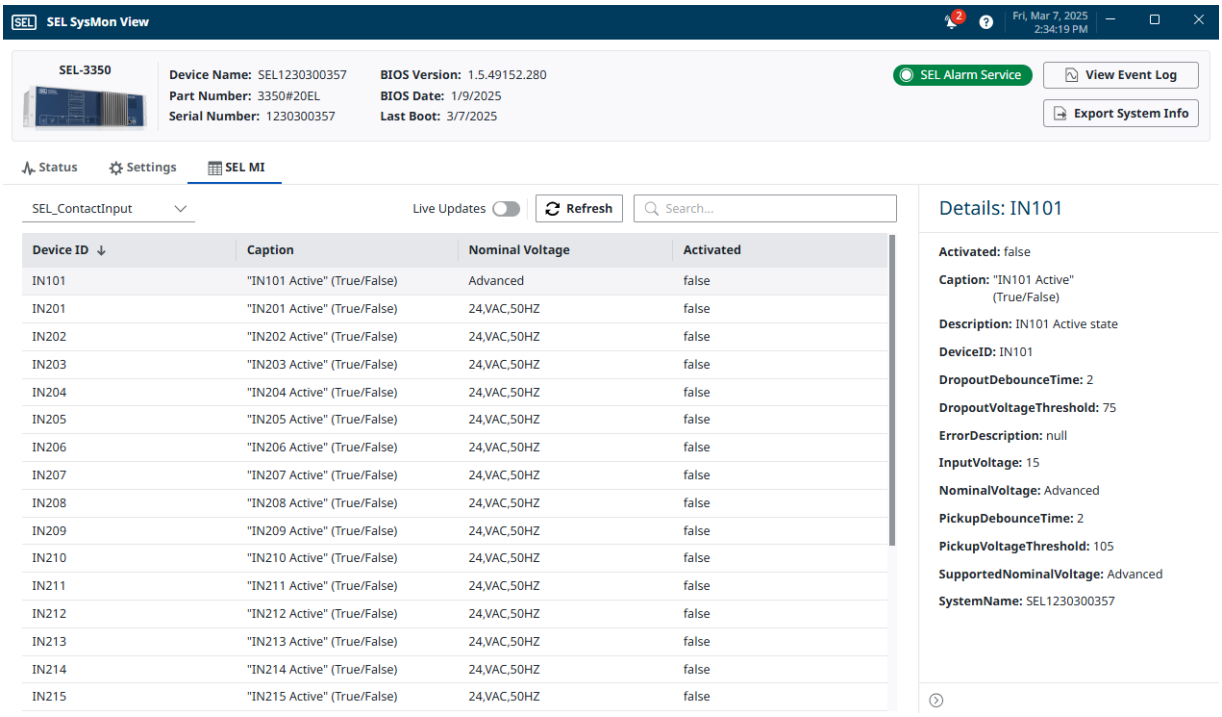

Figure 7.3 SEL SysMon View SEL MI View

Select an SEL MI class from the drop-down menu at the top-left of the SEL MI View. The table will display a summary of the data returned from the selected class, with each table row listing each class instance returned. Selecting a row/instance will display all property data for that instance in the Details pane to the right of the table. Select the **Refresh** button to update the table and details view with current data, or select **Live Updates** to enable automatic updates every few seconds. Type search terms into the **Search** bar to filter the table data down to only show class data that contains those terms.

SNMP Agent Extension

Simple Network Management Protocol (SNMP) is a widely used protocol for monitoring the health of network-connected devices. On systems running Microsoft Windows operating systems, the SEL SysMon SNMP Agent Extension provides additional hardware diagnostic information through the standard Windows SNMP Service.

SNMP data are addressed using a Management Information Base (MIB) system. A MIB is a hierarchical tree data structure where an object is identified by either a name or an Object Identifier (OID). Find the files containing the SEL Sysmon SNMP MIB definitions at the following location:

C:\Program Files\SEL\doc\

To configure the SEL SysMon SNMP Agent Extension, use the four files found at the following location:

C:\Program Files\SEL\bin\

SNMPAgentOff.reg: Disables the SEL SysMon SNMP Agent Extension by removing the path to the Agent DLL from the registry. The Agent DLL will remain installed but not active.

SNMPAgentOn.reg: Enable the SEL SysMon SNMP Agent Extension by adding the path to the Agent DLL in the registry.

SNMPAgentLoggingOn.reg: Enable detailed logging by the SEL SysMon SNMP Agent Extension, which are written to the Windows Event Log under Applications and Services Logs > SEL > SNMP > 3300ExtensionAgent.

SNMPAgentLoggingOff.reg: Disable detailed logging by the SEL SysMon SNMP Agent Extension DLL.

To apply any of these configuration files, double-click the file to import the setting into the Windows registry. Windows will display a warning for the registry change, select **OK** to allow the change. Then, restart the Windows SNMP service (or restart the computer) for the setting change to take effect.

To access SNMP data, configure the Windows SNMP Service, which is beyond the scope of this manual. For assistance, see SEL application guide "Introducing SNMP and Using It to Monitor SEL Computers" (AG2018-19).

Support Utilities

NOTE: On some operating systems, it is necessary to run the support utilities with administrator privilege for the programs to work properly.

On systems running Microsoft Windows operating systems, support utilities are provided to enable users, applications, and scripts to easily control the system alarm, contact outputs, and front-panel status LEDs. An SEL Support Info Utility is also provided to quickly gather system information that can forwarded to support personnel to aide in troubleshooting problems. You can initiate these programs manually on-demand or through a script or software application that can run executables. The support utilities can be found in the following location:

C:\Program Files\SEL\bin\

SEL_Output.exe: Use the command-line utility to control the system alarm. For usage instructions, run SEL_Output.exe with no arguments from a command prompt. Log messages, when specified, are written to the Windows Event Log under *Applications and Services Logs\SEL\Utility\Output\SEL-Output-Utility*.

SEL_LED.exe: Use the command-line utility to control the front-panel status LEDs (**ENABLED** and AUX 1–3). For usage instructions, run SEL_LED.exe with no arguments from a command prompt. Log messages, when specified, are written to the Windows Event Log under *Applications and Services Logs\SEL\Utility\LED\SEL-LED-Utility*.

sel_support_info_utility.ps1: Use this Windows Powershell script to gather important system information such as hardware configuration, firmware/software/driver versions, event logs, and Windows system information. The information is saved in a .zip file in the same folder as the script file, which you can send to support personnel to aid in troubleshooting. To run the script, open the Windows Powershell application and type the full path and name of the script file, or in Windows Explorer, right-click on the file and select **Run with PowerShell**.

Password Recovery

On systems running Microsoft Windows, the SEL SysMon software enables you to quickly recover from a lost or forgotten Windows account password by using the Password Disable system jumper (see *System Jumpers on page 3.2*). A Windows Scheduled Task named "SEL Password Recovery" is configured to run on system startup and check for the presence of the Password Disable jumper. When the jumper is detected, the task creates a temporary administrative user account that you can use to assign new passwords to your user accounts. Once you are finished and remove the jumper, the SEL Password Recovery task deletes the temporary account to prevent future unauthorized access. The SEL Password Recovery task logs activity in the SEL Output utility event log (see SEL_Output.exe under Support Utilities).

Perform the following steps to enable password recovery:

Step 1. Shut down and turn off the system.

Step 2. Install a shunt on the Password Disable system jumper (see *System Jumpers on page 3.2*).

Step 3. Turn the system on and allow Windows to start up.

Step 4. Wait a few seconds for the SEL Password Recovery task to finish creating the account, indicated by the front-panel **Alarm LED** turning on for one second and then back off.

Step 5. Sign in to Windows with the username **SELPasswordRecovery** and password **Asdf123$**.

Note: If the SELPasswordRecovery account is not available on the first attempt, restart the system once, then the account should be available for use.

The SELPasswordRecovery account is a member of the Administrators group, so it has full access to system settings, including the ability to change passwords for your user accounts. Set a new password for the user account

you lost access to, then sign out of the SELPasswordRecovery account and verify that you can sign in to your user account with the new password. Then perform the following steps to resume normal operation:

Step 1. Shut down and turn off the system.

Step 2. Remove the shunt from the Password Disable system jumper.

Step 3. Turn the system back on and allow Windows to start up.

Step 4. Sign in to Windows with your username and new password.

Note: If you see the SELPasswordRecovery account on the login screen, do not log in to that account, the SEL Password Recovery task is in the process of deleting it.

If you want to disable the Password Recovery feature, open Windows Task Scheduler and at the top left of the window select **Task Scheduler Library**. Then in the list of tasks in the center pane right-click on the task named **SEL Password Recovery** and select **Disable**.

SEL Management Interface

The SEL MI provides a simple standardized method for custom applications and scripts to monitor and control the SEL-3355 hardware. On Microsoft Windows operating systems, the SEL MI is accessible through Windows WMI; while on Linux operating systems, the SEL MI is accessible through SysFS. Commonly used scripting languages, such as PowerShell or VBScript on Windows or Python on Linux, provide quick and simple methods to access WMI and SysFS, in addition to most compiled languages if that level of application complexity is required. While explaining how to write scripts and programs to access Windows WMI and SysFS is outside the scope of this manual, some examples are given for Windows in *Examples on page 7.15* and Linux in *Examples on page 7.18*, and a wealth of knowledge and examples can be found on the internet.

The SEL MI groups the SEL-3355 components into classes. Each SEL MI class contains a set of properties that are either read-only (status information) or read/write (settings and controls). The organization of these classes and properties differs between the Windows and Linux versions of the SEL MI.

SEL MI Classes in Windows WMI

Each individual SEL-3355 component exposed through the SEL MI is accessed as an instance of a Windows WMI class. *Table 7.2* provides a list of properties that are present in most of the SEL MI classes in Windows WMI.

Table 7.2 Common Class Properties

Property Name	Read/Write Access	Description
Caption	read	A short textual description of the instance
Description	read	A detailed textual description of the instance
DeviceID	read	An address or other identifying information to uniquely name the instance
ErrorDescription	read	A string supplying information about any errors
SystemName	read	The computer system's name

Details for each class and their associated properties are provided in the following sections. Some examples for accessing class data are given in *Examples on page 7.15*.

Data Provider Class

The SEL Data Provider is the library that provides the system management data to the SEL_ContactOutput, SEL_Jumper, SEL_LED, SEL_Ports, SEL_PowerSupply, SEL_Thermal, and SEL_Time classes. The Data Provider class provides properties to track the name and version of the SEL Data Provider library. The Data Provider class includes all common properties listed in *Table 7.2* and the additional properties listed in *Table 7.3*.

WMI NameSpace: **root\CIMV2**

WMI Class Name: **SEL_DataProvider**

Table 7.3 Data Provider Class Additional Properties

Property Name	Read/Write Access	Description
Manufacturer	read	The manufacturer of this provider
SystemHeight	read	Value to indicate the height of the system chassis
Version	read	The version of this Data Provider

Contact Output Class

The Contact Output class provides access to the state of the SEL-3355 contact outputs. The contact output asserted/deasserted state is provided through the Activated property. The Contact Output class includes all common properties listed in *Table 7.2* and the additional property listed in *Table 7.4*.

WMI NameSpace: **root\CIMV2**

WMI Class Name: **SEL_ContactOutput**

Table 7.4 Contact Output Class Additional Property

Property Name	Read/Write Access	Description
Activated	read/write	The contact output state: TRUE = energized

Jumper Class

The Jumper class provides access to the state of the SEL-3355 mainboard jumpers. The jumper status is provided through the Present property. The Jumper class includes all common properties listed in *Table 7.2* and the additional property listed in *Table 7.5*.

WMI NameSpace: **root\CIMV2**

WMI Class Name: **SEL_Jumper**

Table 7.5 Jumper Class Additional Property

Property Name	Read/Write Access	Description
Present	read	Indicates if the jumper is installed: TRUE = installed

LED Class

The LED class provides access to the front-panel auxiliary and **ENABLED** LEDs. The LED illumination is controlled through the ActivationState property, and the LED color is controlled through the Color property. The LED class includes all common properties listed in *Table 7.2* and the additional properties listed in *Table 7.6*.

WMI NameSpace: **root\CIMV2**

WMI Class Name: **SEL_LED**

Table 7.6 LED Class Additional Properties

Property Name	Read/Write Access	Description
ActivationState	read/write	LED illumination: 2 = On, 3 = Blinking, 4 = Off
Color	read/write	LED color: 0 = Off, 1 = Green, 2 = Red
ControlMode	read/write	LED control type: 3 = Manual/software
DefaultActivationState	read	The default (boot-up) value for ActivationState
SupportedColors	read	List of colors this LED supports

Ports Class

The Ports class provides access to the overcurrent-protection status for the SEL-3355 USB, serial, and **DISPLAYPORT** ports. The overcurrent status is provided through the OverCurrent property. The Ports class includes all common properties listed in *Table 7.2* and the additional properties listed in *Table 7.7*.

WMI NameSpace: **root\CIMV2**

WMI Class Name: **SEL_Ports**

Table 7.7 Port Class Additional Properties

Property Name	Read/Write Access	Description
OverCurrent	read	Overcurrent protection status: TRUE = fault detected
Tag	read	Provides correlation with Win32_PortConnector class

Some ports are grouped to one overcurrent protection device, and thus an overcurrent on one of the ports will affect the status and operation of all in the group. For example both front USB ports (DeviceID values USB1 and USB2) use the same overcurrent protection device, so a short-circuit on one front USB port will cause both front USB ports to report an overcurrent and stop providing power to connected USB devices.

Power Supply Class

The Power Supply class provides access to the SEL-3355 power supply status. Power supply presence is reported by the Present property, and power supply health is reported by the Good property. The Power Supply class includes all common properties listed in *Table 7.2* and the additional properties listed in *Table 7.8*.

WMI NameSpace: **root\CIMV2**

WMI Class Name: **SEL_PowerSupply**

Table 7.8 Power Supply Class Additional Properties

Property Name	Read/Write Access	Description
Good	read	Power supply health: TRUE = healthy
Present	read	Power supply is detected: TRUE = present

Thermal Class

The Thermal class provides access to the SEL-3355 internal temperature sensors. The temperature of each sensor is reported in degrees Kelvin, which can be converted to Celsius by subtracting 273. The Thermal class includes all common properties listed in *Table 7.2* and the additional properties listed in *Table 7.9*.

WMI Namespace: **root\CIMV2**

WMI Class Name: **SEL_Thermal**

Table 7.9 Thermal Class Additional Property

Property Name	Read\Write Access	Description
Temperature	Read	Measured temperature in degrees Kelvin

Time Class

The Time class provides access to the Time Controller of any installed SEL-3390 PCIe cards to monitor the status of IRIG-B inputs and the hardware clock synchronization, configure the synchronization source, and enable or disable the IRIG-B outputs (see the SEL-3390 instruction manuals for additional information). Status indicators for IRIG-B inputs are separated into External, Internal, and Decoded groups. The External and Internal groups provide a PulseCounter property to indicate the presence of an electrical signal on the input, and Good and ParityGood properties to indicate the signal is a valid IRIG-B data stream. The Decoded group provides additional status indicators decoded from the selected source. The TimeQuality and ContinuousTimeQuality properties indicate the accuracy of time synchronization as reported by the source. The Time class includes all common properties listed in *Table 7.2* and the additional properties listed in *Table 7.10*.

WMI NameSpace: **root\CIMV2**

WMI Class Name: **SEL_Time**

Table 7.10 Time Class Additional Properties (Sheet 1 of 2)

Property Name	Read/Write Access	Description
DecodedContinuousTimeQuality	read	Continuous Time Quality indicator from the selected IRIG source's control flags, if present: Q = 0...7, inaccuracy < 10^(Q+1) nanoseconds (ns).
DecodedDSTActive	read	Daylight Saving Time Active indicator from the selected IRIG source's control flags, if present: TRUE = DST active.
DecodedDSTPending	read	Daylight Saving Time Pending indicator from the selected IRIG source's control flags, if present: TRUE = DST pending.
DecodedLeapSecondInsert	read	Leap Second Direction indicator from the selected IRIG source's control flags, if present: TRUE = insert second, FALSE = delete second.
DecodedLeapSecondPending	read	Leap Second Pending indicator from the selected IRIG source's control flags, if present: TRUE = leap second pending.

Table 7.10 Time Class Additional Properties (Sheet 2 of 2)

Property Name	Read/Write Access	Description
DecodedLocaltimeOffset	read	Local Time Zone Offset value from the selected IRIG source's control flags, if present, in hours and minutes ([–]HH:MM).
DecodedTimeQuality	read	Time Quality indicator from the selected IRIG source's control flags, if present: Q = 0...15, deviation from UTC < 10^(Q–1) nanoseconds (ns).
External0ContinuousTimeQuality	read	Continuous Time Quality indicator from the external IRIG input's control flags, if present: Q = 0...7, inaccuracy < 10^(Q+1) nanoseconds (ns).
External0Good	read	Overall status indicator for the external IRIG input: TRUE = healthy.
External0ParityGood	read	Parity status indicator for the external IRIG input: TRUE = good parity.
External0PulseCounter	read	Signal presence indicator for the external IRIG input: 32-bit counter that increments on each voltage pulse on the IRIG input.
External0TimeQuality	read	Time Quality indicator from the external IRIG input's control flags, if present: Q = 0...15, deviation from UTC < 10^(Q–1) nanoseconds (ns).
HardwareTime	read	The current time from the hardware clock, ISO-8601 format: YYYY-MM-DDTHH:MM:SSZ.
InternalContinuousTimeQuality	read	Continuous Time Quality indicator from the internal IRIG input's control flags, if present: Q = 0...7, inaccuracy < 10^(Q+1) nanoseconds (ns).
InternalGood	read	Overall status indicator for the internal IRIG input: TRUE = healthy.
InternalParityGood	read	Parity status indicator for the internal IRIG input: TRUE = good parity.
InternalPulseCounter	read	Signal presence indicator for internal IRIG input: 32-bit counter that increments on each voltage pulse on the IRIG input.
InternalTimeQuality	read	Time Quality indicator from internal IRIG input's control flags, if present: Q = 0...15, deviation from UTC < 10^(Q–1) nanoseconds (ns).
NumSecondsSinceLastJump	read	Elapsed time since the last time jump in seconds.
NumTimeJumps	read	Count of times the hardware clock was adjusted by a significant time jump.
OutputEnabled	read/write	The IRIG Output state, default is **TRUE**: TRUE = enabled.
Source	read	Indicates which source the hardware clock is presently synchronizing to. See SourceSelection.
SourceSelection	read/write	Configures the source that the hardware clock should synchronize to. The default is **AUTO**: AUTO = automatically select source based on priority EXTERNAL-0 = external IRIG-B input (AUTO priority 1) INTERNAL = internal IRIG-B input (AUTO priority 2) SYSTEM = system (CMOS) clock (AUTO priority 3) Check SupportedSourceSelection for valid source names at runtime.
SupportedSourceSelection	read	Provides a comma-separated list of source names that are valid to use for SourceSelection, e.g., AUTO, EXTERNAL-0, INERNAL, SYSTEM.
SyncError	read	The current synchronization error between the hardware clock and source in nanoseconds (ns).
Termination	read/write	Configures the termination impedance for the external IRIG-B input, default is **FALSE**: TRUE = low impedance, FALSE = high impedance.
TimeReferenceIsUtc	read/write	If IRIG-B input is B002 (no extensions), this setting specifies if incoming IRIG-B is UTC or local time, default is **TRUE**: TRUE = UTC, FALSE = local.

SFP Module Diagnostics Class

The SFP Module Diagnostics class provides access to the diagnostic data from any of the SFP modules plugged into any installed SEL-3390 PCIe cards (see the SEL-3390 instruction manuals for additional information). Some

properties are not supported on some SFP modules. The SFP Module Diagnostics class includes the Caption, Description, and DeviceID properties listed in *Table 7.2* and the additional properties listed in *Table 7.11*.

WMI NameSpace: **root\WMI**

WMI Class Name: **SEL_SFPDiag**

Table 7.11 SFP Module Diagnostics Class Additional Properties

Property Name	Read/Write Access	Description
Active	read	Device operational status; this value will always be TRUE
InstanceName	read	Hardware ID from the operating system
RxPower	read	Receiver optical power in nanowatts (nW)
SupplyVoltage	read	SFP module supply voltage in microvolts (µV)
Temperature	read	SFP module temperature in degrees Celsius (°C)
TxBiasCurrent	read	Transmit laser bias current in microamperes (µA)
TxPower	read	Transmit laser optical power in nanowatts (nW)

SFP Module Identification Class

The SFP Module Identification class provides access to the identification data from any SFP modules plugged into any installed SEL-3390 PCIe cards (see the SEL-3390 instruction manuals for additional information). Some properties are not supported on some SFP modules. The SFP Module Identification class includes the Caption, Description, and DeviceID properties listed in *Table 7.2* and the additional properties listed in *Table 7.12*.

WMI NameSpace: **root\WMI**

WMI Class Name: **SEL_SFPId**

Table 7.12 SFP Module Identification Class Additional Properties

Property Name	Read/Write Access	Description
Active	read	Device operational status; this value will always be TRUE
DateCode	read	Manufacturer's SFP module build date
InstanceName	read	Hardware ID from the operating system
Length50umOM2	read	Max length with 50 µm multimode OM2 fiber in meters (m)
Length50umOM3	read	Max length with 50 µm multimode OM3 fiber in meters (m)
Length62p5umOM1	read	Max length with 62.5 µm multimode OM1 fiber in meters (m)
LengthCopper	read	Max length with copper cable in meters (m)
LengthSingleMode	read	Max length with single-mode fiber in meters (m)
Manufacturer	read	Manufacturer's name
Part Number	read	Manufacturer's part number
SELPartNumber	read	SEL part number
SELSerialNumber	read	SEL serial number
SerialNumber	read	Manufacturer's serial number
Version	read	Manufacturer's version ID
Wavelength	read	Laser wavelength in nanometers (nm)

Examples

You can access Windows WMI from most programming environments and scripting languages. The following examples can be run in Windows Powershell by either typing the command into a Windows Powershell window or incorporating the commands into a Powershell script file. Note that you may have to run Powershell as an Administrator to access some classes or properties.

Display all property values for all instances of a class:

```
Get-CimInstance -NameSpace [namespace] -ClassName [class]
```

Example for LED class:

```
Get-CimInstance -NameSpace root\CIMV2 -ClassName SEL_LED
```

Display only specific property values for all instances of a class:

```
Get-CimInstance -NameSpace [namespace] -ClassName [class] |
Select-Object -Property [property1], [property2], ...
```

Example for Port class overcurrent status:

```
Get-CimInstance -NameSpace root\CIMV2 -ClassName
SEL_Ports | Select-Object -Property DeviceID, Overcurrent
```

Display all property values for a specific instance of a class:

```
Get-CimInstance -NameSpace [namespace] -Query "Select * from
[class] where [Property] like '[value]'"
```

Example for LED class AUX1 status:

```
Get-CimInstance -NameSpace root\CIMV2 -Query "Select * from
SEL_LED where DeviceID like 'AUX1'"
```

Set a property value for a specific instance of a class:

```
Set-CimInstance -NameSpace [namespace] -Query "Select * from
[class] where [Property] like '[value]'" -Property
@{[Property1]=[value1];[Property2]=[value2]...}
```

Example for LED class AUX1 set to the color green:

```
Set-CimInstance -NameSpace root\CIMV2 -Query "Select * from
SEL_LED where DeviceID like 'AUX1'" -Property @{Color=1}
```

Example for ContactOutput class ALARM set to activated:

```
Set-CimInstance -NameSpace root\CIMV2 -Query "Select * from
SEL_ContactOutput where DeviceID like 'ALARM'" -Property
@{Activated=$TRUE}
```

SEL MI Classes in Linux SysFS

In the Linux SEL MI, each SEL-3355 component exposed through the SEL MI is accessed through Linux SysFS. Each SEL MI class consists of one or many SysFS files, allowing read and write access to status data and settings by using the same methods that are used to access plain text files. Details for each class and their associated properties are provided in the following sections.

Changes to SysFS file contents/settings take effect immediately but are not persistent; all SysFS files revert to default values on each startup. For settings to persist through a restart, you must run a configuration script on each startup. See *Examples on page 7.18* for assistance on modifying SysFS files and configuring startup scripts.

LED Class

The LED class provides access to the front-panel **ALARM**, **AUX**, and **ENABLED** LEDs. The LED illumination is controlled through the brightness property, with any value greater than zero illuminating the LED. The LED class is the

directory at the following path, with a subdirectory for each LED, and the property listed in *Table 7.13* is a plain text file in that subdirectory that contains the property value.

Linux SysFS Path:

/sys/class/leds/

Table 7.13 LED Class Properties

Property Name	Read/Write Access	Description
brightness	read/write	The LED illumination state: 0 = off, 1 = on

Power Supply Class

The Power Supply class provides access to the SEL-3355 power supply status. Power supply presence is reported by the present property, active status is reported by the online property, and overall status is reported by the health property. The Power Supply class is the directory at the following path, with a subdirectory for each power supply, and each property listed in *Table 7.14* is a plain text file in that subdirectory that contains the property value.

Linux SysFS Path:

/sys/class/power_supply/

Table 7.14 Power Supply Class Properties

Property Name	Read/Write Access	Description
current_now	read	Output current in microamps (1,000,000 = 1 amp)
health	read	Power supply overall status: Good = present and online, Unspecified failure = present and offline, Unknown = not present
manufacturer	read	Power supply manufacturer
model_name	read	Power supply model number
online	read	Power supply is active: 1 = online
present	read	Power supply is detected: 1 = present
serial_number	read	Power supply serial number
temp	read	Temperature in tenths of a degree Celsius (10 = 1°C)
type	read	Power supply type (Mains = high power source)
uevent	read	Lists all property names and current values
voltage_now	read	Peak input voltage in microvolts (1,000,000 = 1 volt)

Mainboard Hardware Monitor Class

The Mainboard Hardware Monitor class provides access to the SEL-3355 mainboard voltage and temperature measurements. Each measurement is represented by two properties: the _label property provides a name for the source of the measurement, and the _input property provides the measured value. This format was chosen for compatibility with the Linux **sensors** command. Because the measurements use similar property names, they have been consolidated to single table rows in *Table 7.15*, with the variation of property names indicated by the values in brackets. For example, in[0-15]_label indicates that there are sixteen instances of this property, with the first one having the name in0_label. The Mainboard Hardware Monitor class is the directory at the following path, with each property listed in *Table 7.15* is a plain text file that contains the property value.

Linux SysFS Path:

/sys/class/selb2071/selb2071/device/hwmon/hwmon3/

or

/sys/class/hwmon/hwmon3/

Table 7.15 Mainboard Hardware Monitor Class Properties

Property Name	Read/Write Access	Description
in[0–15]_input	read	Voltage measurement value in millivolts (1,000 = 1 volt)
in[0–15]_label	read	Voltage measurement source name
temp[1–4]_input	read	Temperature measurement value in millicelcius (1,000 = 1°C)
emp[1–4]_label	read	Temperature measurement source name

General Purpose I/O Class

The General Purpose I/O (GPIO) class provides access to the SEL-3355 mainboard jumpers and port overcurrent status. Unlike the other SEL classes that are accessed through SysFS, the GPIO class is accessed through the Linux gpiod package, which provides a standardized set of libraries and terminal commands to access system GPIO. Some example gpiod terminal commands are provided after *Table 7.16*. For additional information, see the online documentation for the Linux gpiod package.

The GPIO class properties that have similar names have been consolidated to single table rows in *Table 7.16*, with the variation of property names indicated by the values in brackets. For example, jumper_[a-h] indicates that there are eight instances of this property, with the first one having the name jumper_a.

Table 7.16 General Purpose I/O Class Properties

Property Name	Read/Write Access	Description
expansion_usb_overcurrent	read	PCIe Expansion board USB overcurrent status: 1 = fault detected
front_usb_overcurrent	read	Front USB port overcurrent status: 1 = fault detected
internal_usb_overcurrent	read	Internal eUSB header overcurrent status: 1 = fault detected
jumper_[a-h]	read	Mainboard jumper status: 1 = installed
rear_usb_overcurrent	read	Rear USB port overcurrent status: 1 = fault detected
serial_overcurrent	read	COM1/2 +5v power overcurrent status: 1 = fault detected
video_overcurrent	read	DisplayPort overcurrent status: 1 = fault detected

Example gpiod commands:

List all GPIO chips and lines by using gpioinfo and piping to grep to filter out unnamed lines:

sudo gpioinfo | grep -vi unnamed

Find the chip and line number for the property name jumper_a:

sudo gpiofind jumper_a

Display the status of jumper jumper_a by using gpioget with the chip and line number of jumper_a:

sudo gpioget gpiochip0 6

Display the status of jumper jumper_a by using gpioget and gpiofind:

sudo gpioget $(sudo gpiofind jumper_a)

Examples

The Linux **sensors** command can be used to quickly view data from the Power Supply and Mainboard Hardware Monitor classes, along with sensor data from other system components.

To view the contents of a file in SysFS use the **cat** command. For example, the following command displays the state of the Alarm LED:

cat /sys/class/leds/sel:red:alarm/brightness

The brightness file contains a one-character string, representing the state of the LED (0 = off, 1 = on). You can change the LED state by using the echo command to write a new value in the file. Root privilege is required to write to these files. For example, to turn the Alarm LED on:

echo "1" > /sys/class/leds/sel:red:alarm/brightness

Section 8

Software Backup and Failure Recovery

Overview

The term “backup” refers to either a copy of important files on the system or the process of creating that copy to be used to recover from failure or corruption of the files on the system. Backups can be created once or periodically, depending on the method of backup and the frequency of changes to system files and data. Backups should be stored on physically separate storage media to allow recovery from a physical drive failure.

Who Needs Backups

Disaster recovery is important to consider for all systems. The SEL-3355-2 is designed to minimize the frequency and impact of various system failures. However, failures still can occur, especially with system files and data, because they can be adversely affected by hardware failures, software errors, and human error. Everyone should use backups because they greatly reduce the time and effort needed to recover from these types of failures.

What To Back Up

Ideally, a backup should contain a complete copy of all files and data on the system. This type of backup is typically called a *system image* or *drive image*. These backups are the most useful because they allow relatively quick recovery from any type of failure, including unintentional user changes, file system errors, and drive failures. The disadvantage to system image backups is that they typically require you to perform the backup offline (requiring a shutdown or restart of the system).

If a system image backup is not possible, the next best method is to perform a file backup, creating copies of all software and system settings files and any critical data files. This method can typically be done online (without shutting down or restarting), making it possible to perform backups periodically without interrupting normal operation.

When To Back Up

The most valuable backup is one that represents the system in its fully configured and operational state. Performing a backup as the last stage of commissioning a system will allow it to be returned to that fully commissioned state when recovering from a failure. Backups should also be performed any time an update or configuration change is made to the system to ensure that the system will always be restored to its most recent state.

A backup can also be created of the system as it was delivered from the factory, before any changes were made. This backup can be useful during the initial configuration process in case an unintentional change puts the system into an undesirable or failed state. Once the system is fully configured, and an updated backup is created, the factory backup is typically not useful and can be discarded.

Backup Storage Options

Backups can be stored on the installed SATA drives, on removable USB mass storage devices, and on other computer systems and corporate file servers.

Backups stored locally on the installed SATA drives allow quick and convenient access. However, locally stored backups are less secure because drive failures, software errors, and user error can destroy both the system files and the backup.

Backups stored on removable storage devices physically separate the backups from the system so that they do not fail simultaneously. However, external storage devices such as USB flash drives can corrupt data in as little as a few months, especially if stored in the hot environments the SEL-3355-2 may be used in.

Corporate file servers are the most reliable location to store backups. Most corporate file servers have redundant systems and backups of their own, so they have very good data security. This location is usually less convenient because most backup methods cannot create or restore backups directly to or from a remote file server. In this case, an intermediate step is required to transfer the backup to and from the file server.

Storing backups in multiple locations can improve the security and usability of the backups. For example, keep a local copy on a USB mass storage device for convenience, and a copy on a corporate file server in case the local copy fails. When storing backups in multiple locations, establish processes to ensure that the versions in each location remain in agreement. For instance, do not update the local copy without also updating the copy on the file server.

Why Use Backups

If no backup is available when file or data loss happens, it can take anywhere from hours to weeks to restore the system to an operational state. If configurations and settings have to be manually recreated, mistakes can be made that affect system operation. Backups reduce this restoration time to hours or possibly minutes, and help guarantee the system is configured exactly as it was before the failure.

Backup and Recovery Methods

From a functionality and usability standpoint, the SEL-3355-2 is very similar to a personal computer (PC). Most methods of backup and recovery that can be performed on a standard PC can also be performed on the SEL-3355-2. This section briefly describes a few common backup methods that can be used on the SEL-3355-2.

SEL Backup and Recovery Tool

The SEL Backup and Recovery Tool (SEL BaRT) was developed to enable customers to quickly and easily create system image backups of SEL automation controllers. Features specific to SEL automation controllers are incorporated into SEL BaRT, such as system monitoring and watchdog support. SEL BaRT was developed by SEL by using open-source technology, and it is provided free of charge.

The SEL BaRT is available on the SEL website at selinc.com/BaRT/. Create an SEL BaRT drive by using a CD-R/DVD-R or USB flash drive for ultimate portability. To start the SEL BaRT, plug the drive into the SEL-3355-2, restart, then select the drive in the **BIOS > Boot** menu.

In the SEL BaRT menu, options are available to create, restore, and validate backup images, as well as select alternate locations for the backup images to be stored. If SEL BaRT is on a writable drive (such as a Flash drive or hard drive), the images can be stored directly on the drive. If SEL BaRT is on read-only media (such as a CD or DVD), backup images must be stored on an additional USB storage device, SATA drive, or a network location. Once the backup image is created, it can be stored permanently on the SEL BaRT drive, or copied to another location by plugging the SEL BaRT drive into a desktop computer or laptop.

Windows Backup

Most Microsoft Windows operating systems include a built-in backup feature that can create a system image while the system is running without interrupting normal operation. The backup feature can be used to create a system image manually, or to schedule periodic system backups. A system repair disk must be created for the SEL-3355-2 to be able to boot up and restore the system image when a failure has occurred.

Because the Windows system repair disk does not incorporate support for the SEL-3355-2 watchdog, when booting the system repair disk you must first disable the watchdog. See *Section 4: BIOS Setup* to enable or disable the watchdog in the **Boot Features** menu.

Other Methods

Numerous third-party tools and software are available for creating backups of PCs, laptops, and servers. Most of these tools and software can be used to create backups of the SEL-3355-2.

Bootable or online methods enable you to create backups without removing the SATA drives from the SEL-3355-2. These methods are similar to the SEL BaRT and Windows backup methods, requiring little or no system downtime to perform a backup. One disadvantage to these methods is that they may require booting into an alternate operating system to perform the backup or restore operation. In that case, the SEL-3355-2 watchdog must be disabled first to avoid periodic restarts during the process. Once the backup or restore operation is complete, the watchdog should be reenabled. See *Section 4: BIOS Setup* to enable or disable the watchdog in the **Boot Features** menu.

Offline backup methods use a separate PC to create a backup from the SEL-3355-2 SATA drive. These methods require removing the SATA drives from the SEL-3355-2 and plugging them into a PC via eSATA or a USB SATA drive dock. An image can then be created using software running on the PC. Offline methods are usually simple to use, because they only require software installed on the PC, and the backup image is stored on the PC where it can be easily transferred to other locations. However, offline methods also typically involve greater downtime, and you must ensure that the SATA drives are reinstalled into the SEL-3355-2 in the correct slots.

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Section 9

Intel Active Management Technology (AMT)

Overview

NOTE: Intel AMT is only accessible through the ETH1 Ethernet port.

NOTE: The SEL Blueframe and SEL RTAC operating systems may install a restricted BIOS to enhance system security. If the system has had one of these operating systems installed and pressing **<F2>** during startup does not grant access to BIOS Setup, then the restricted BIOS is installed, which disables Intel AMT completely. In this situation, if you need to enable Intel AMT, contact SEL for support.

Intel Active Management Technology (AMT) is a subset of the Intel vPro Technology present in the CPU of the SEL-3355-2. It provides out-of-band access and management of the SEL-3355-2 through the **ETH1** Ethernet port, even when the system is turned off. With integration into existing vPro/AMT-aware asset management systems, you can have complete access to the SEL-3355-2 from any remote location. This access includes power state management, disk redirection, and serial console access via Ethernet.

AMT Features

This section describes the most common features of AMT. See the Intel website for a complete description and support resources.

Web Interface

The Intel AMT has the ability to share the Ethernet interface of the SEL-3355-2, which is how all out-of-band management is performed. After AMT provisioning (see *Enabling AMT on page 9.2*) you can use a web browser to reach the AMT web interface of the SEL-3355-2 from another workstation.

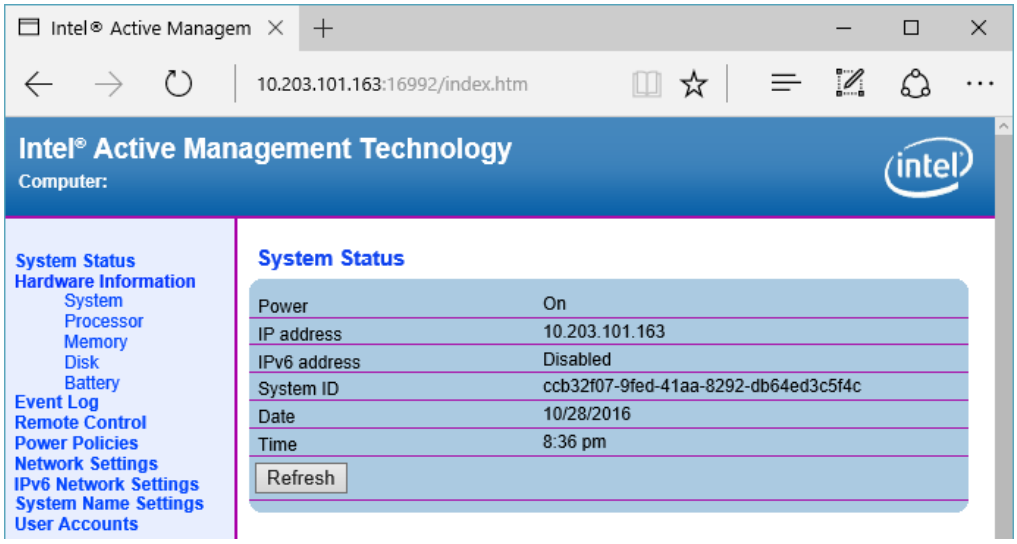

Figure 9.1 Intel AMT Web Interface

You can view system status, hardware information (including main board, CPU, RAM, and disk status), and the AMT event log in the web interface. You can also configure power policies, network settings, and AMT user account settings. You can also turn the system on and off through the **Remote Control** menu.

Remote Control

One of the most useful features of AMT is the ability to have complete remote access to the SEL-3355-2. This includes starting or restarting the system and redirecting disks (including CD drives or CD image ISO files) from your local workstation to the remote SEL-3355-2. It also includes an IP KVM feature that allows you to see the display and control the keyboard and mouse of the SEL-3355-2, even when no operating system is installed.

Remote Monitoring

AMT allows a remote user or control system to query the SEL-3355-2 for statistics and device status.

Enabling AMT

Use the BIOS setup to enable AMT on the SEL-3355-2. Enter the BIOS setup by pressing **<F2>** at the startup screen when you initially start the SEL-3355-2, then perform the following steps to enable AMT.

Step 1. Select the **Features** tab, then select **Manageability Settings** and press **<Enter>**.

Step 2. To enable AMT, set the **Intel AMT** setting to **Enabled**.

It is safe to ignore most of the other settings because they are all accessible through the main AMT configuration interface.

Step 3. To open the AMT configuration interface, set **Intel AMT Setup** to **Enabled**.

Step 4. Press **<F10>** and select **Yes** to save your changes and restart the system. When the system performs its normal boot process the AMT main menu will appear as shown in *Figure 9.2*.

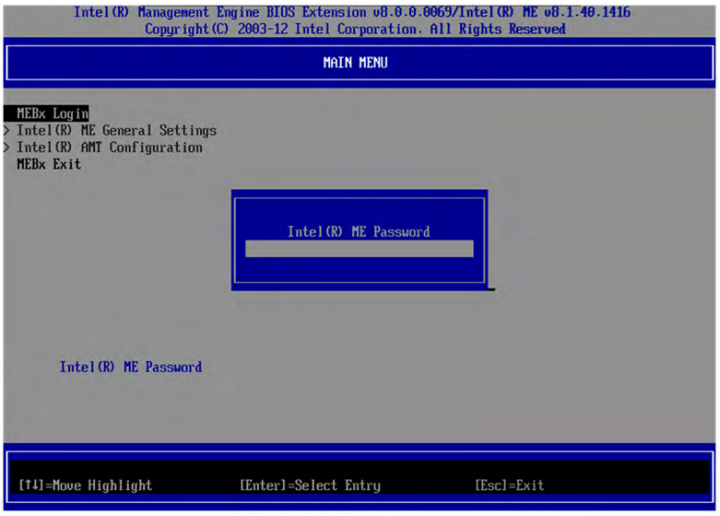

Figure 9.2 Intel AMT Main Menu

NOTE: Choose a unique and sufficiently complex password.

Step 5. Select **MEBx Login** and press **<Enter>**. You will then be prompted for a password.

Step 6. Type the AMT default password **admin**. You will then be prompted to create a new password and confirm it.

Once you type in and confirm your new password you will be brought back to the AMT main menu, but the **MEBx Login** option will no longer appear.

Step 7. Select **Intel (R) AMT Configuration** and press **<Enter>** to navigate to the AMT configuration menu.

Step 8. Set the **Manageability Features Selection** setting to **Enabled**.

Step 9. To enable remote access without a local user present for consent, select **User Consent**, then select **User Opt-in** and change the value to **None**.

Step 10. Select **Network Setup > TCP/IP Settings > Wired LAN IPV4 Configuration**. Here you can set a static IP address. If you prefer Dynamic Host Configuration Protocol (DHCP), leave the **DHCP Mode** set to **Enabled**.

Step 11. Once you have configured the IP information, press **<Esc>** *twice* to go back to the main AMT network configuration menu.

Step 12. Select **Intel (R) ME Network Name Settings** to choose a host name for the system and to specify whether you would like to share these settings with an operating system.

You can also choose to enable **Dynamic DNS Updates** so compatible DNS servers will automatically update the host name to IP address mapping without the need to specify a static IP address.

With AMT now configured, you can use any of the available AMT tools to exercise complete out-of-band management with the SEL-3355-2.

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Section 10
Troubleshooting

Overview

This section includes troubleshooting information for common questions and problems related to the SEL-3355-2.

Operational Issues

Blank Monitor

The SEL-3355-2 is compatible with most computer monitors. Video selections are available as high as 1920 x 1200 for all three video interfaces. *Table 10.1* lists possible causes and solutions for a blank monitor.

Table 10.1 Blank Monitor Troubleshooting

Symptoms/Possible Cause	Diagnosis/Solution
Power saver is activated	➤ Move the mouse or press a keyboard key to ensure that the screen saver is not activated.
Monitor is off	➤ Verify the monitor is connected to a power source that meets the monitor's input ratings. ➤ Locate the monitor power button and press to turn the power on. ➤ If the monitor has multiple video inputs, verify the correct input is selected. ➤ Verify that the monitor brightness is not turned all the way down.
SEL-3355-2 power is off	➤ Ensure that BIOS defaults are correct. Reset the BIOS to defaults as shown in *Section 4: BIOS Setup*. ➤ Verify the SEL-3355-2 is connected to a power source that meets the input ratings stenciled on the back of the power supplies.
Equipment failure	➤ Contact your system administrator if you cannot determine the cause.

Unexpected Rebooting

Unexpected system reboots can be caused by various conditions and can be very difficult to diagnose. *Table 10.2* lists several causes of reboots and how to troubleshoot them.

Table 10.2 Unexpected Rebooting Troubleshooting (Sheet 1 of 2)

Symptoms/Possible Cause	Diagnosis/Solution
OS or application crashing	Check the OS Application and System logs for events that happened prior to the reboot. Verify that recent patches and updates installed successfully. Use OS diagnostic tools (e.g., Windows Task Manager) to check for high or increasing system resource usage (memory, CPU, disk space, etc.).
Power quality	Check the power supply wiring for loose connections and damaged wires. Verify that the source can provide enough power for the system. If dual power supplies are installed, check that both are connected to a power source. Check if other devices that are connected to the same sources have also logged a power loss/reboot, indicating a fault in the source.

Table 10.2 Unexpected Rebooting Troubleshooting (Sheet 2 of 2)

Symptoms/Possible Cause	Diagnosis/Solution
System Watchdog	Check the SEL SysMon Service logs for events indicating that the system was reset by the Watchdog. If the Watchdog reset the system, it is likely that a software issue caused the OS to crash (see OS or application crashing above).
Outdated SysMon software	If the system has SEL SysMon Service version 3.x, a rare condition can cause the system to begin rebooting unexpectedly. If this happens, a full shutdown and power cycle of the system will stop the unexpected rebooting. To prevent this condition from occurring, upgrade the SEL SysMon software to the latest version, which is included in the SEL-3300 Driver bundle. When upgrading from SEL SysMon version 3.x, you must uninstall all SEL SysMon components and disable the system Watchdog before installing the new version. Instructions are provided in the Known Issues section of the Readme.txt file included with the SEL-3300 Driver bundle.

Fails to Start Windows

Undesirable operating conditions, such as sudden loss of power, system lockup, or failed software installations, may adversely affect Microsoft Windows, preventing the system from starting up and running properly. Often the system can be restored to a workable state by using the recovery options presented by Windows after a failed startup. If recovery options are not available or do not fix the problem, you must reinstall Windows either through use of an installation DVD or a previously created backup image.

Fails to Start New OS or USB Media

If you are unable to boot up a newly installed operating system or bootable USB media, enter BIOS Setup and verify that the drive you are attempting to start from is listed in the **Boot Order** menu. If it is not listed, verify that it is installed correctly, and that it operates correctly when installed in a different system. If the boot drive is listed but the system will not boot from it, it is possible that either Secure Boot is not supported or that Legacy Mode is required. First, in the **Security** menu in the BIOS Setup, set **Secure Boot** to **Disabled**. If that does not resolve the problem, open the **Boot Features** menu and set **Legacy Mode** to **Enabled**. See *Section 4: BIOS Setup* for more information.

100 Percent CPU Burden

To determine which application is responsible for consuming all CPU time, launch Windows Task Manager by pressing **<Ctrl+Shift+Esc>**. In Task Manager, view the **Processes** tab and select the **CPU** column header to sort by CPU usage. Select the process showing high CPU usage and select **End Process** if it appears to be locked-up. Otherwise, evaluate the configuration of the application to determine if the CPU burden can be decreased.

Networking

Although proper system networking is an extremely broad topic, there are a few steps that can help with simple network troubleshooting.

Step 1. Ensure that the Ethernet hub, switch, or router is compatible with the SEL-3355-2. See *Ethernet on page 2.4* to determine compatible network interfaces.

Step 2. Verify that the SEL-3355-2 and the network are communicating by observing the LEDs associated with the Ethernet network switch or hub.

Step 3. If the LEDs display no activity, then verify that the proper cabling has been used.

Step 4. If you are sure the Ethernet cabling is correct, then try temporarily disabling the operating system firewall, if present, and ping the SEL-3355-2 from a computer or laptop. As a basic rule, nothing will work if pinging does not work. When

pinging, use an IP address or host name. Ensure that each physically separate network is configured for a different IP range/subnet.

System Clock Behaving Erratically

Ensure that no software programs are trying to set or synchronize the system time. Examples of some programs that frequently set the system clock on a regular basis are SEL-5860 and Subnet SubSTATION Server. In SubSTATION Server slave protocols like DNP3, IEC 60870-5-101/104, and Harris 5000/6000 have the ability to synchronize system time based on the time provided by the master protocols.

Blinking Cursor After BIOS Screen

If the operating system fails to boot and instead you see a black screen and blinking white cursor, then the SEL-3355-2 probably attempted to boot from a drive that does not have an operating system installed. To fix this problem, enter the BIOS setup and verify that the boot order is configured with the correct SATA drive as Boot Option #1 (see *Boot Menu on page 4.5*). Press **<F10>** to save changes and try booting again. The system should restart from the correct drive.

SATA Drive Failures

Problems with SATA drives can cause the system to intermittently lock up or restart without warning. If these problems only occur during periods of high SATA drive activity, the cause may be related to the drive operating temperature or power consumption. Most SATA drives have temperature sensors that can be monitored using third-party Self-Monitoring, Analysis and Reporting Technology (S.M.A.R.T.) monitoring software. The S.M.A.R.T. software also reports diagnostic data from the SATA drive, which can help you determine if the drive is failing. If the SATA drive temperature and diagnostic data do not indicate a problem, try removing one SATA drive from the system to reduce the SATA power consumption. If removing a drive resolves the problem, then you will need to change to different SATA drives that use less power. See *Requirements on page 3.7* for guidelines on selecting suitable SATA drives.

Forgotten Password

If you have forgotten the password for the BIOS setup, SEL RTAC operating system, or SEL Blueframe operating system, use the Password Disable jumper to allow you to reset the system password. See *System Jumpers on page 3.2* for instructions on how to set system jumpers.

If the forgotten password is for a Microsoft, Linux, or another third-party operating system, the operating system may have built-in reset features. If the operating system does not provide a reset feature, commercial and open-source tools may be available to do this. Refer to the security policies for how your company handles forgotten passwords.

IRIG Time Synchronization

If you have an IRIG-B time source properly connected to COM1 or an installed SEL-3390 card and the system clock is not synchronized to the time source, open the **Services** control panel in Windows and verify that the Windows Time service is running and is also set to start automatically on system boot.

If the Windows Time service is configured properly and running, try restarting the Windows Time service. Doing this should force a time synchronization. If time is still not synchronized, open an administrator command prompt and run the following command:

w32tm /query /status

The response to the above command should indicate the source is SEL3390TimeProvider.

If a different time source is indicated (such as Free-Running System Clock), open the **Windows Device Manager**, and from the **View** menu select **Show hidden devices**, then expand the SEL Controllers category and verify an "SEL Time" or "SEL(R) 3390 Time" device is present. If the device is missing, install the latest device driver, available from the SEL website. If the driver is installed properly and time synchronization is still not working, contact SEL technical support.

Application Guides

Please see the SEL-3355 product webpage and SEL literature webpages for application guides to assist you with troubleshooting and setup steps for various features of the SEL-3355-2.

Technical Support

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

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Appendix A
Manual Versions

Table A.1 lists the instruction manual release dates and a description of modifications. The most recent instruction manual revisions are listed at the top.

Table A.1 Instruction Manual Revision History (Sheet 1 of 3)

Date Code	Summary of Revisions
20250730	**Section 1** ➤ Updated *Supported Third-Party Operating Systems* in *Specifications*. **Section 7** ➤ Updated SEL Management Interface. ➤ Added *SEL MI Classes in Linux SysFS* in *SEL Management Interface*. **Section 10** ➤ Added *Unexpected Rebooting* in *Operational Issues*.
20250613	**Section 3** ➤ Updated *Table 3.1: System Jumper Descriptions.* **Section 7** ➤ Updated *Overview* and *SEL Alarm Service*. ➤ Updated *Table 7.1: SEL Alarm Service Data Sources*. ➤ Added *SEL SysMon View*. ➤ Added *Password Recovery*.
20241218	**Section 1** ➤ Updated SATA Drives in *Options.* ➤ Updated Optional SATA Drives under *Mass Storage* in *Specifications*.
20241105	**Section 1** ➤ Updated *Expansion Cards* in *Specifications*. **Section 2** ➤ Updated *Physical Location* and *Power*. **Section 3** ➤ Updated *PCI Expansion Slots*.
20240927	**Section 1** ➤ Updated *Specifications*.
20240815	**Section 1** ➤ Updated *Specifications*.
20240321	**Section 1** ➤ Updated *Specifications*.
20240227	**Section 1** ➤ Updated *Specifications*.
20230707	**Appendix C** ➤ Added new cybersecurity appendix.
20230623	**Section 1** ➤ Updated *Specifications*. **Section 2** ➤ Updated *Grounding* in *Rear Panel*.

Table A.1 Instruction Manual Revision History (Sheet 2 of 3)

Date Code	Summary of Revisions
20221221	Section 1 ➤ Added UKCA Mark to *Specifications*.
20221103	Preface ➤ Updated *Manual Overview*. Section 1 ➤ Updated *Features* and *Specifications*. Section 2 ➤ Updated *Alarm Contact*. Section 3 ➤ Updated *Table 3.2: Watchdog Settings*. Section 7 ➤ Updated entire section and renamed it to *System Software and Settings*. Section 10 ➤ Updated *Forgotten Password*. Appendix B ➤ Moved previous content from *Section 7: SysMon* to this new appendix.
20220624	Section 1 ➤ Updated *Specifications*.
20211229	Section 1 ➤ Updated *Models and Options*. ➤ Updated *Specifications*. Section 2 ➤ Updated *Figure 2.2: Front Rack-Mount Diagram* and *Figure 2.3: Rear-Panel Diagram*. Section 3 ➤ Updated *Table 3.1: System Jumper Description*. ➤ Updated *Real-Time Clock* and *BIOS Battery*. ➤ Updated *SATA Devices*. ➤ Added *Watchdog*. Section 4 ➤ Updated *System Configuration Menu*. ➤ Added *BIOS Update* and *Recovery Mode*. Section 5 ➤ Updated *Repairing RAID Volumes*. Section 6 ➤ Updated *Operating System Installation*. ➤ Updated *Driver Installation*. ➤ Updated *Software Installation*. Section 10 ➤ Updated *Operational Issues*. Appendix B ➤ Removed *Appendix B: Microsoft Windows System Configuration*.
20210730	General ➤ Reduced the use of “automation controller” throughout the manual to improve readability. ➤ Added references to the SEL-3390T expansion card throughout the manual. Section 1 ➤ Updated Ethernet, Serial Ports, and Time-Code Input/Output in *Specifications*. ➤ Updated *Table 1.1: System Power Consumption*.

Table A.1 Instruction Manual Revision History (Sheet 3 of 3)

Date Code	Summary of Revisions
20210720	**Preface** ➤ Updated *Manual Overview*. **Section 1** ➤ Updated *Conducted and Radiated Emissions* in *Specifications*. **Section 2** ➤ Updated *Serial* under *Rear Panel.* ➤ Updated *Alarm Contact* under *Rear Panel*. **Section 4** ➤ Updated *Overview* under *BIOS Setup*.
20210601	**Section 3** ➤ Updated *Requirements* in *SATA Drives*.
20201210	**General** ➤ Changed product name throughout the manual to SEL-3355 Automation Controller. **Section 1** ➤ Updated Supported Operating Systems in *Specifications*. ➤ Updated Power Supply in *Specifications*. **Appendix B** ➤ Updated *Security*.
20200805	**Preface** ➤ Updated battery information in *Safety Information*. **Section 1** ➤ Updated battery information in *Specifications*. **Section 3** ➤ Updated battery information in *Main Board*.
20190924	**Section 1** ➤ Updated *Specifications.*
20190815	**Section 1** ➤ Updated *Specifications.* **Section 2** ➤ Updated *Serial* under *Rear Panel*.
20180212	➤ Initial version.

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Appendix B
Legacy SEL SysMon Software

Overview

NOTE: Systems built prior to November 2022 included the legacy SEL SysMon software described in this section. Newer systems include the new SEL SysMon software (see *Section 7: System Software and Settings*). You can install your preferred version of SEL SysMon on any SEL-3355-2. See the SEL-3355 webpage for downloads and installation instructions.

The SEL SysMon software is used to configure, monitor, and display system health information including system application load, drive health, temperatures, supply rails, and system alarm status. When SEL SysMon determines the system is in an unhealthy or failed state, it reports this condition by asserting the system alarm contact and front-panel LED, providing visual feedback through the SEL SysMon graphical user interface (GUI), and creating detailed log entries in the event log.

SEL SysMon is composed of a Microsoft Windows service to monitor the SEL-3355-2 hardware and operating system status, and a GUI to allow users to configure SEL SysMon and view status information. The service starts automatically on system startup, while the GUI starts and places an icon in the system tray when you log in.

Figure B.1 shows an overview of how SEL SysMon collects status data from the SEL-3355-2 hardware and Windows performance counters, and provides status monitoring and event reporting via the SEL SysMon GUI, Windows event logs and performance counters, and alarm contact. The alarm contact can be hardwired to external equipment to detect alarm conditions, and Windows event logs and performance counter data can be monitored for detailed failure data.

Figure B.1 SEL SysMon Overview

SEL SysMon is factory-installed on SEL-3355-2 automation controller platforms that include a Microsoft Windows operating system. If you install your own custom operating system on the SEL-3355-2, see *Installing and Updating SEL SysMon on page B.10*.

SEL SysMon Service

The SEL SysMon Service provides most of the core functionality of SEL SysMon. The SEL SysMon Service runs constantly in the background as a Windows service, collecting status information from the hardware and operating system, providing those data through a variety of interfaces, and servicing the system watchdog.

To configure the startup and recovery of the SEL SysMon Service, open the **Windows Services** control panel and double-click on **SEL SysMon Service** in the **Name** column to view the service properties.

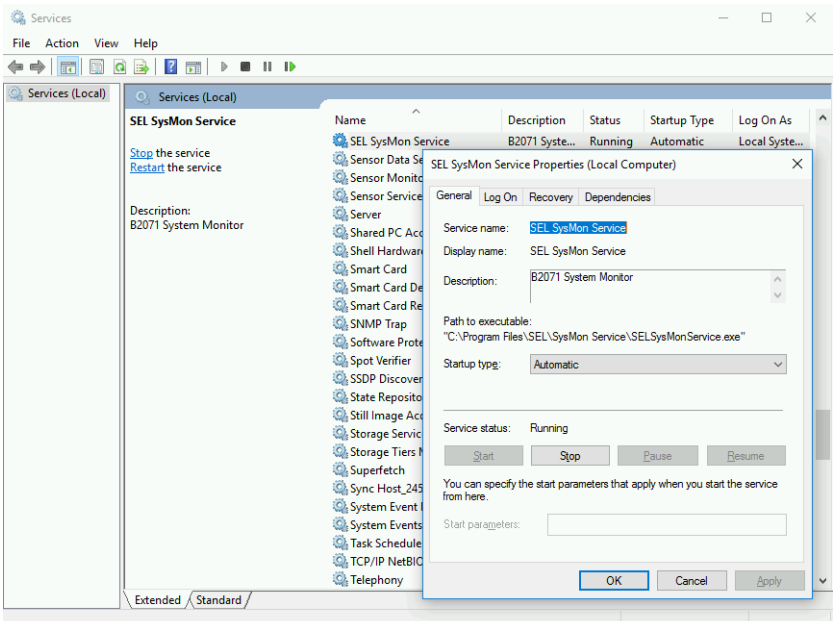

Figure B.2 SEL SysMon Service in Windows Services Control Panel

The SEL SysMon Service should always be configured to start automatically, to prevent the watchdog from resetting the system. The bottom of the SEL SysMon GUI window contains a status indicator for the SEL SysMon Service to indicate when it is running normally.

System Monitoring

The SEL SysMon Service collects status information from two main sources: the SEL-3355-2 main board device driver and the Windows performance counter interface. The SEL-3355-2 main board device drivers provide information on CPU and other thermal sensors, voltage readings from the main board supply rails, overcurrent status on the USB, serial, and video connections, and SATA drive health status. The Windows performance counter provides information on CPU burden, memory (RAM) usage, and disk space usage on the operating system drive.

Alarming

If any status data indicate the system is out of normal operating range, the alarm is asserted, energizing the rear-panel alarm contact and illuminating the front-panel **Alarm** LED. The normal operating range for some of the status data can be customized through the SEL SysMon GUI and tailored to your specific application needs.

Watchdog

The SEL SysMon Service is responsible for servicing the system watchdog periodically, to prevent the watchdog from restarting the system. If the SEL SysMon Service stops servicing the watchdog because of a system lockup or other failure, the watchdog automatically resets the SEL-3355-2 in an attempt to recover to an operational state. See *Watchdog on page 3.8* for more information.

Password Recovery

Windows operating systems have a built-in mechanism to recover from a lost or forgotten password, but it requires the creation of a recovery disc ahead of time. When a password is lost and no recovery disc is available, the most common way to recover is to reinstall the operating system, which can be very time consuming and cause data loss. The SEL SysMon software enables you to quickly recover from a lost or forgotten password by using the Password Reset System Jumper.

NOTE: **No factory-default accounts exist by default!** Instead, if SEL SysMon Service observes at startup that the password reset jumper has been set, it creates a temporary Edison account. If the jumper is no longer set, SEL SysMon Service removes the temporary Edison account upon startup. Operating event logs are created indicating the date and time the password reset feature was used.

Perform the following steps to use the password recovery:

Step 1. Shut down and turn off the SEL-3355-2.

Step 2. Install a shunt on the Password Reset System Jumper (see *System Jumpers on page 3.2*).

Step 3. Turn the SEL-3355-2 on and boot up the operating system.

Step 4. Wait for the front-panel **ENABLED** LED to illuminate green, indicating the SEL SysMon Service is running.

Step 5. Log in to the operating system with the username **Edison** and password **Asdf123$**.

If the system reaches the login screen before the SEL SysMon Service adds the Edison account, you may be unable to select the Edison account and will have to restart the SEL-3355-2 for it to become available. The Edison account is a member of the Administrators group, so it has full access to system settings, including the ability to change passwords for other user accounts.

Once you have set a new password for the user account, log off of the Edison account and verify that you can log in to the user account with the new password. Perform the following steps to resume normal operation:

Step 1. Shut down the SEL-3355-2.

Step 2. Remove the shunt from the Password Reset System Jumper.

Step 3. Turn the SEL-3355-2 back on.

On the first boot up after turning Password Reset OFF, if the system reaches the login screen before the SEL SysMon Service deletes the Edison account, the Edison account may appear on the login screen. Do not log in to the Edison account at this time because the SEL SysMon Service will delete the Edison account once the service has started, to prevent unauthorized access.

SEL SysMon GUI

The SEL SysMon GUI provides a simple-to-use graphical interface to the system health status and for configuring alarm settings. The SEL SysMon GUI automatically starts when you log in to the system and is accessible through its system tray icon in the bottom right corner of the screen. The tray icon will pop up notifications when status changes occur, such as system alarms and loss of connection to the SEL SysMon Service.

To view SEL SysMon GUI, double-click on the **SEL** icon. The icon may be hidden because of inactivity; if this is the case, select the up-arrow to show all hidden tray icons (see *Figure B.3*).

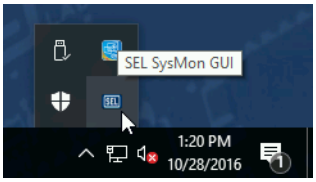

Figure B.3 SEL SysMon GUI Tray Icon

There are three main tabs in SEL SysMon GUI: **Status**, **Alarms/Watchdog**, and **Alarm Settings**. The tabs and their functions are described in detail later in this section.

Selecting the close button (**X**) in the top right corner of the application minimizes the application back to the tray, so that it continues running and can notify you of system health status changes.

Status Tab

The **Status** tab contains all status information available in the SEL SysMon GUI, with the information broken out into the groups (see *Figure B.4*).

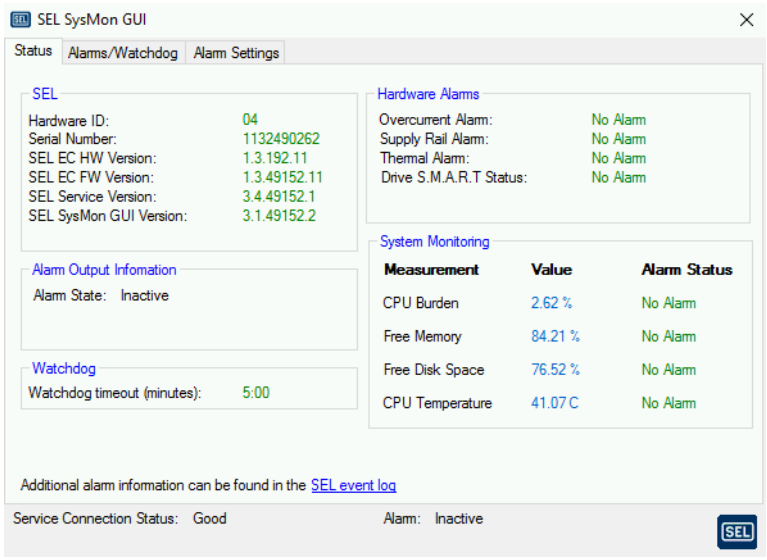

Figure B.4 SEL SysMon GUI Status Tab

SEL Group

The SEL group displays the main board hardware ID, SEL-3355-2 serial number, Embedded Controller (EC) hardware and firmware versions, and SysMon Service and GUI versions. This information is useful when upgrading your system or determining the applicability of a service bulletin.

Alarm Output Information

The Alarm Output Information displays the current state of the alarm.

Watchdog

The Watchdog group displays the current Watchdog Timeout period.

Hardware Alarms

The SEL-3355-2 supplies power to the serial, USB, and video ports. These power outputs have overcurrent protection to prevent equipment damage or other adverse effects in the event of a short circuit or excessive load. Exceeding the limits shown in *Table 1.2* causes the Overcurrent Alarm to activate.

SEL SysMon also monitors voltages for all supply rails on the SEL-3355-2 main board, and thermal sensor data from various main board components. It activates the Supply Rail Alarm or Thermal Alarm, or both alarms, if any of these values are outside their acceptable range.

SEL SysMon uses Self-Monitoring, Analysis and Reporting Technology (S.M.A.R.T.) to monitor the health of all installed SATA drives. If any installed SATA drive reports bad S.M.A.R.T. status, the Drive S.M.A.R.T. Status Alarm activates.

System Monitoring

The System Monitoring group includes status values related to operating system and application load. The CPU Burden, Free Memory, and Free Disk Space are all collected from the performance counter interface built into Windows operating systems. The CPU Temperature is collected from the SEL-3355-2 hardware, and is displayed in this group because the CPU temperature correlates with application load. Note that the CPU Burden displayed is the averaged CPU burden over time, as specified by the Average Windows Size setting (see *Alarm Settings Tab on page B.6*).

Alarms/Watchdog Tab

The **Alarms/Watchdog** tab provides controls for testing and muting the alarm output, for setting the watchdog timeout value (see *Figure B.5*).

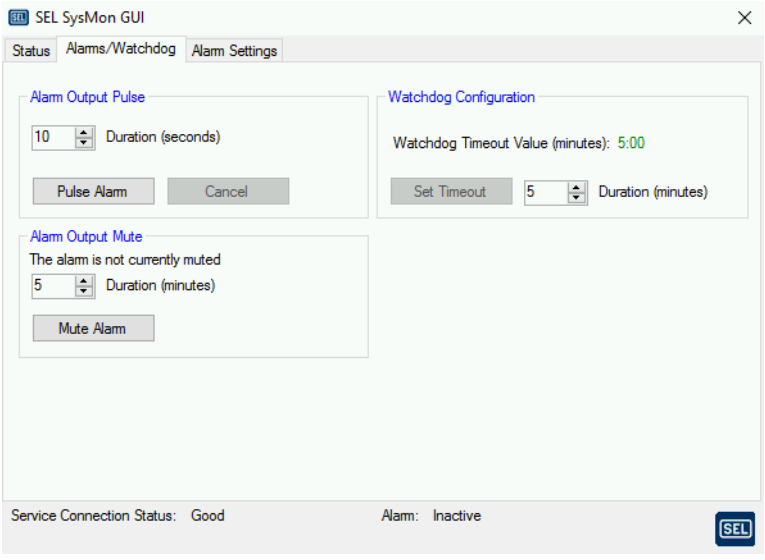

Figure B.5 SEL SysMon GUI Alarms/Watchdog Tab

Alarm Output Pulse

Use the Alarm Output Pulse group to generate an alarm of the configured time in seconds, to test the alarm contact output, or for other alarm reporting.

Alarm Output Mute

The alarm can be muted (disabled) for a configurable time to help with testing and troubleshooting. When the **Mute Alarm** button is pressed, the alarm will mute for the time specified in the **Duration** box, and the button will change to **UnMute Alarm**. While the alarm is muted, SysMon will continue to detect and process alarms, but the alarm light will not turn on and the alarm contact will not latch. The alarm will return to normal operation when the alarm mute duration has elapsed, or when you select the **UnMute Alarm** button.

Watchdog Configuration

The SEL SysMon Service normally services the watchdog once a second. If SEL SysMon Service fails to service the watchdog for a period equal to the Watchdog timeout value specified in the Watchdog Configuration group, the watchdog will reset the SEL-3355-2 in an attempt to automatically return the system to a good operating state. The default watchdog timeout on startup is hardcoded to five minutes to allow the system ample time to start the operating system. Once the operating system has started and SEL SysMon is running, the custom timeout duration set in SEL SysMon is applied. You can configure the timeout from a minimum of one minute for fast crash recovery to a maximum of eight minutes for applications that may tolerate long periods of kernel-mode activity, then usually recover automatically.

Alarm Settings Tab

The **Alarm Settings** tab contains settings for the configurable alarms and for enabling or disabling all alarms except the Supply Rail and Overcurrent alarms, (see *Figure B.6*).

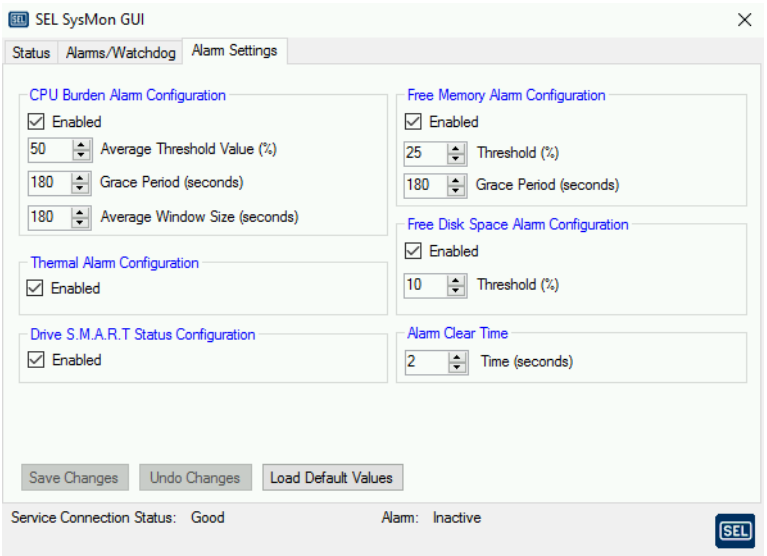

Figure B.6 Alarm Settings Tab

When an alarm is disabled, the corresponding alarm section remains grayed-out, and the **Status** tab indicates Alarm Disabled as the alarm status.

CPU Burden Alarm Configuration

CPU Burden is a measure of the percentage of time the CPU is performing work for an application versus when it is in idling mode. On a multicore CPU, this value is the average burden on all CPU cores. To prevent false or nuisance alarms, the CPU burden is averaged over the Average Windows Size period of

time, and the Grace Period allows the average burden to exceed the Average Threshold Value for a limited amount of time before triggering the CPU Burden alarm. The CPU Burden Alarm clears when the average CPU burden becomes lower the CPU Load Average Threshold.

For applications that are time critical, decrease these settings to detect brief periods of high CPU usage that can cause processing delays. For applications that have intermittent periods of high CPU load, increase the settings to prevent nuisance alarms.

Thermal Alarm Configuration

The Thermal Alarm can be disabled if nuisance alarms are being generated such as by defective thermal sensors or operating conditions that exceed the ratings of the SEL-3355-2. However, we highly recommended that you do not disable the Thermal Alarm, because the Thermal Alarm should only activate when a thermal sensor detects that a component has exceeded its rated maximum operating temperature. If the Thermal Alarm activates during normal operating conditions, contact your SEL representative for support.

Drive S.M.A.R.T. Status Configuration

The Drive S.M.A.R.T. Status Alarm can be disabled if nuisance alarms are being generated, such as by a defective SATA drive or other system problems. However, we highly recommend that you do not disable the Drive S.M.A.R.T. Status Alarm, because it should only activate when a drive reports a bad S.M.A.R.T. status, indicating drive failure may be imminent. If the Drive S.M.A.R.T. Status Alarm activates during normal operating conditions, contact your SEL representative for support.

Free Memory Alarm Configuration

The operating system must always have some free memory to prevent application errors and system crashes during brief periods of increased memory usage. When the free memory drops below the Threshold for longer than the Grace Period, the Free Memory Alarm activates. Once the Free Memory Alarm activates, it remains in the alarm state until the amount of free memory increases and stays higher than the Free Memory Alarm Threshold for the duration of the Alarm Clear Time.

For systems that have very predictable workloads, set the Free Memory Alarm Threshold to a value that is 10–20 percent lower than the typical memory usage to detect possible memory leaks or other memory issues and have time to respond before a system crash. For systems that have a more dynamic workload or significant user interaction, set the Free Memory Alarm Threshold to a value of 5–10 percent to receive alarms only when the system is almost out of memory.

Free Disk Space Alarm Configuration

The operating system and applications usually require some free space on the operating system drive for intermittent temporary files and other activities. If the system runs out of free disk space, the operating system or application will likely generate an error and crash. The Free Disk Space Alarm activates when free space on the operating system drive becomes lower than the Disk Space Alarm Threshold.

Set the threshold higher on systems that are archiving data and are constantly consuming disk space, to allow ample time to respond to a disk space alarm before losing data. Set the threshold to a lower value on systems that do not archive data and just need disk space for normal runtime, to activate alarms only when the system needs cleanup or possibly upgrade to a larger disk.

Alarm Clear Time

To avoid very short alarm pulses that may go undetected by connected monitoring equipment, SEL SysMon latches all system alarms on for a minimum clear time. The alarm will only clear once no alarms have been active for the Alarm Clear Time.

Save Changes, Undo Changes, and Load Default Values

At the bottom of the Alarm Settings tab are three buttons labeled Save Changes, Undo Changes, and Load Default Values.

If no settings changes have been made, the Save Changes and Undo Changes buttons will be grayed out. Any settings changes on the **Alarm Settings** tab will cause these buttons to become active. Select **Save Changes** to permanently save the new settings. The new setting values will take effect immediately after being saved. If you want to revert back to the previously saved settings, select the **Undo Changes** button. Selecting the **Load Default Values** button will change all settings to factory defaults, at which point you can select either **Save Changes** or **Undo Changes** to keep or discard the changes.

Default Settings

SEL SysMon permanently stores configuration settings to a disk so that your custom settings are loaded on startup and displayed in the SysMon GUI. In the event that the custom settings are lost or corrupted, SEL SysMon will use hardcoded default settings to maintain reliable system operation.

System Integration

The SEL SysMon software provides integration with other applications by providing status and alarm data through Windows Performance Counters, and control of the **ALARM** and Auxiliary LEDs through command-line programs.

Windows Performance Counters

Windows Performance Counters are a standard Windows interface used to monitor numerous aspects of the health and status of the operating system and installed applications. Performance counters can be monitored and logged both on the local machine and remotely over the network, using either the standard Windows Performance Monitor application (perfmon.exe) or other third-party software that has Windows Performance Counter integration.

SEL SysMon makes all of its status information available through custom SEL performance counters. *Table B.1* lists all performance counters and objects that SEL SysMon provides.

Table B.1 SEL SysMon Windows Performance Counters

Counter Objects	Values	Description
SEL Alarm Counters ➤ CPU Burden ➤ Drive Health ➤ Filesystem ➤ Global ➤ Jumper ➤ Memory ➤ Overcurrent ➤ Power Supply Health ➤ Supply Rail ➤ Thermal	0: inactive 1: active	These counters indicate the state of all individual alarms, as well as a global counter to indicate the state of the system alarm contact and LED.
SEL Drive Health Measurements ➤ Health	0: healthy 1: failing 2: unknown	This counter contains one instance for each SATA drive installed in the SEL-3355-2, reporting the health from the S.M.A.R.T interface. A value of 2 (unknown) could indicate a SATA drive that does not support S.M.A.R.T. reporting.
SEL Overcurrent Measurements ➤ Alarm State	0: inactive 1: active	This counter contains one instance for each overcurrent sensor in the SEL-3355-2. While each serial, USB, and video port have individual current limiters, some current limiter status may be aggregated to a single sensor.
SEL Standard Measurements ➤ CPU Burden ➤ Filesystem Usage ➤ Memory Usage	Percent used (0–100)	These counters report the percent usage of the CPU, operating system drive, and memory. Note the Filesystem and Memory values are usage, as opposed to Free Space that is displayed in SEL SysMon GUI.
SEL Supply Rail Measurements ➤ Voltage (mV)	voltage in mV (1000 = 1.00 V)	This counter contains one instance for each supply rail on the SEL-3355-2 main board. Some rails such as CPU core voltage vary greatly because of power management. Acceptable ranges for each rail are not provided, so monitor the Supply Rail Alarm counter to detect of out-of-range conditions.
SEL Thermal Measurements ➤ Temperature	degrees in Kelvin (273 = 0 Celsius)	This counter contains one instance for each temperature sensor in the SEL-3355-2. Because performance counters are unsigned (positive) values, the temperatures are reported in degrees Kelvin (K) to allow reporting of temperatures lower than 0 on the Celsius or Fahrenheit scale.

Command-Line Programs

SEL SysMon provides command-line programs to enable users, applications, and scripts to activate the system alarm and control the front-panel Auxiliary LEDs. You can initiate these programs from a command prompt, or through a script or software application that can run executables.

NOTE: On some operating systems, it is necessary to run selalarm.exe and selauxled.exe with administrator privilege for the programs to work properly.

SELalarm is used to pulse the alarm contact for a specified time. SELalarm initiates the alarm pulse through the SEL SysMon Service, so the service must be running properly for SELalarm to work. The location of SELalarm, along with command-line syntax and an example, follows:

Location:

C:\Program Files\SEL\bin\selalarm.exe

Usage:

selalarm.exe [--query] [--pulse <s>] [--log-message <severity> <message>] [--version]

–p,––pulse <s>	Pulse alarm for <s> seconds
–l,––log-message <severity> <message>	Defines the <severity> and <message> of the log entry to be made
–q,––query	Queries the current alarm state
–v, ––version	Displays all available version information

Example:

selalarm.exe –p 5 –e “HMI failure”

SELAuxLED is used to set the front-panel Auxiliary LEDs. The Auxiliary LEDs are useful for quick at-a-glance checking of critical system processes, even in embedded applications where no monitor is attached to the SEL-3355-2. The location of SELAuxLED, along with command-line syntax and an example, follows:

Location:

C:\Program Files\SEL\bin\selauxled.exe

Usage:

selauxled.exe <Aux LED#> <Color>

<Aux LED#>	Numerical ID of the Auxiliary LED to be controlled
<Color>	LED state (o = off, r = red, g = green)

Example:

selauxled.exe –n 1 –s g –e “communication established”

Installing and Updating SEL SysMon

SEL SysMon is factory-installed on SEL-3355-2 automation controller platforms that include a Microsoft Windows operating system. If you install your own custom operating system on the SEL-3355-2, it is recommended that you install all SEL drivers and SEL SysMon software for maximum reliability. The installation files for SEL SysMon are available for download from the SEL-3355 product support page, selinc.com/products/3355/support/, under **SEL-3355-2 Drivers and Software, All**. To upgrade to a newer version of SEL SysMon, refer to the installation instructions included with the upgrade.

If you choose not to install SEL SysMon, or are using an operating system that is not compatible with SEL SysMon, you must disable the watchdog to prevent it from resetting the system automatically. See *Watchdog on page 3.8* for information on how to disable the watchdog.

Appendix C
Cybersecurity Features

Introduction and Security Environment

Product Function

The SEL-3300 product line consists of the SEL-3350, SEL-3355, and SEL-3360 platforms, as well as SEL-3390E4, SEL-3390S8, and SEL-3390T PCIe expansion cards. These products provide powerful and flexible automation and computing platforms and peripherals that you can configure with a wide range of SEL and third-party operating systems (OS) and applications. The rugged hardware of SEL-3300 devices enables you to deploy fully customized automation and computing solutions into industrial environments that are not suitable for general purpose automation controllers, computers, and servers.

This appendix focuses on the security features and attributes of the base system components inherent to SEL-3300 devices. The wide range of OSs and applications that can be used with the SEL-3300 devices, such as SEL Blueframe, SEL RTAC, Microsoft Windows, and Linux variants, each have their own sets of security features and requirements that are too broad to cover in-depth in this appendix. For additional details on your OS and applications, refer to their instruction manuals or online resources.

Security Requirements

SEL-3300 devices do not have a fixed role or application—they are open platforms designed to run an extremely broad range of your custom-designed and configured OSs and applications. Additionally, the external physical interfaces can be configured to include multiple Ethernet connections, serial connections, USB devices, and keyboard/mouse/video user interfaces, depending on the needs of a given installation. To secure the applications and interfaces used in your installation, you must be familiar with their features and capabilities.

A defense-in-depth strategy uses security controls not only on the SEL-3300 device but also other attached devices. To minimize servicing needs and attack vectors, the SEL-3300 device should be configured with the minimum set of applications and features required. External devices should be used to monitor the health of the system, such as collecting system logs and monitoring the system alarm. Many of the best practices applicable to SEL-3300 devices parallel those used in the information technology (IT) and services (IS) professions. These practices include, but are not limited to, user access controls, network and internet security, firewalls, antivirus, remote access, OS and application patch management, and firmware/BIOS/UEFI management. If you are unfamiliar with these technologies, it may be beneficial to solicit help from the IT/IS professionals within your organization, as they may have an established set of security best practices that fit your organization's needs and requirements.

The Center for Internet Security (CIS) provides resources that can help secure your devices and infrastructure. The CIS is a community-driven nonprofit organization that provides globally recognized best practices for securing IT

systems and data. They include a global community of IT professionals working to continuously evolve security standards and to safeguard against current and new threats. For more information, visit https://www.cisecurity.org/.

Version Information

Obtaining Version Information

The SEL RTAC or Blueframe OSs manage all updatable components (including BIOS and device firmware) within the OS itself; the individual SEL-3300 components are not updated separately from these OSs. For these SEL OSs, the only version information needed is the top-level OS version (referred to as the firmware version in the case of RTAC). Refer to the SEL RTAC and Blueframe documentation for details on how to obtain the OS version.

On SEL-3300 devices with third-party OSs like Microsoft Windows and Linux, there are many user-serviceable components that can each have multiple methods to obtain the version information. *Table C.1* provides a list of SEL-3300 components and one simple method to view the version information for each component within most versions of Windows, Linux, and BIOS Setup (if applicable). Additional methods may be available depending on the OS. Refer to the respective OS instruction manuals or online resources.

Table C.1 View Version Information in SEL-3300 Series Components

Component	Windows	Linux	BIOS Setup
BIOS/UEFI	msinfo32.exe	dmidecode -s bios-version	Main > Mainboard Information
Embedded Controller (SEL-3355/ SEL-3360 only)	N/A	N/A	Main > Mainboard Information
Intel Management Engine (ME) Firmware (SEL-3355/SEL-3360 only)	MEInfo (included with ME firmware update package)	MEInfo (included with ME firmware update package)	Features > Manageability Settings
Operating System	winver.exe	cat /etc/os-release	N/A
Device Drivers	appwiz.cpl	Package manager (apt, dpkg, rpm, yum, etc.)	N/A
Application Software	appwiz.cpl	Package manager (apt, dpkg, rpm, yum, etc.)	N/A

The SEL-3300 device component update packages can be obtained directly from SEL (see *Product Updates on page C.8* for details). These update packages contain a readme.txt file that provides instructions for installing the update and may include instructions for checking the version information if there is not a standard method supported by the OS.

Commissioning and Decommissioning

Commissioning

Commissioning SEL-3300 devices includes setting up the hardware and BIOS settings, the OS, and the applications into the final functioning state before the system is put into service. For assistance configuring any OSs or application features discussed in this section, refer to their instruction manuals or online resources.

BIOS Setup contains security-related settings and features like Secure Boot, USB port enable/disable, and Administrator password to prevent unauthorized BIOS setting changes. The SEL-3355 and SEL-3360 also have Intel Active Management Technology (AMT), which is disabled by default but can be enabled and provisioned through BIOS Setup. Intel AMT security features like user accounts and TLS encryption can be enabled through the remote management software.

User accounts and access controls are supported on all OSs that can be run on SEL-3300 devices. If you install your own OS, ensure it is installed using UEFI boot to support security features like Secure Boot. At a minimum, configure the administrator/root accounts for system management use only, and set up a separate user account with limited access to only the applications and features necessary for the system's roles/applications. If possible, rename and/or disable any default accounts (such as the Administrator account on Windows). Active Directory or LDAP servers should be used whenever possible for centralized user management and access controls instead of locally managed user accounts.

Disk encryption is enabled automatically on SEL RTAC and Blueframe OSs to secure user data. If your SEL-3300 device is running Windows or Linux, disk encryption is usually disabled by default but can be enabled on most OSs.

Malware/virus protection is built into the SEL Blueframe and RTAC OSs through whitelisting technologies. Windows and Linux OSs may have built-in malware/virus protection features and support for third-party malware/virus protection software. Ensure your SEL-3300 device always has some form of malware/virus protection active and up to date.

Firewalls and other network security features are built into most OSs. Verify the firewall is enabled and that the set of allowed ports and services is minimized to only include what is necessary for each network connection. The documentation for your OS and applications may provide information on the ports and services necessary for proper operation.

Once the system configuration is complete, review OS and application event logs for any warnings, errors, or unexpected activity. Then create an audit of all running applications and services to verify all is as expected and be used as a baseline that can be referenced for future system audits. The audit should include a list of all services and applications installed, including:

- Service/application name and version
- Associated user/service accounts
- When it runs (startup type, schedule, etc.)
- Ports used (network address, TCP/IP ports, serial ports, etc.)
- Purpose and high-level protocols used
- List and describe any additions to the startup task list (autorun additions)

Always create a full backup of all system and application configuration files once commissioning is complete (see *Section 8: Software Backup and Failure Recovery*).

Secure Operation Recommendations

Monitor and maintain the operational health of the SEL-3300 device at regular intervals. Collect or forward system logs to a central logging device or repository so that they can be monitored for unexpected events. Monitor the

overall health of the SEL-3300 device by connecting the system alarm contact output to a local monitoring device that can report and/or take action on the alarm.

Check for firmware, OS, and software updates periodically (see *Product Updates on page C.8*). SEL provides a security notifications service that will alert you about any security-related updates to the SEL components in your SEL-3300 device, which you can sign up for at https://selinc.com/support/security-notifications/. Review update release notes to determine if the updates are applicable to your use of the SEL-3300 device. Install necessary updates, then verify proper system operation and review event logs for any warnings, errors, or unexpected activity. Create a new audit of the services and applications to check against previous baseline audits (see *Commissioning on page C.2*).

Verify the system components are still supported and being updated by the original manufacturer and plan for future end-of-support events. Even if an end-of-support date is not provided, assume it will happen at some time and have a plan in place. The configurable nature of SEL-3300 devices means end-of-support events often require significant effort because the device, OS, and applications are interdependent with each other and thus may need to be updated or migrated at the same time.

Decommissioning

When removing an SEL-3300 device from service for a long term, such as to be stored, repaired, replaced, sold, or disposed, remove sensitive data to prevent possible disclosure.

In BIOS Setup, clear the password if one has been set. Remove any custom Secure Boot keys by deleting each custom key or by setting the Secure Boot Mode setting to Standard to install factory-default keys. If Intel AMT is enabled, reset the Intel AMT settings by enabling the Un-Configure ME setting in BIOS Setup under **Features > Manageability Settings**.

SEL-3300 devices use Serial-ATA (SATA) solid-state drives (SSDs) for storage of the OS, applications, and user data. The SSDs are user-serviceable, so you can easily remove them from the SEL-3300 device and move them to a secure storage area or erase all stored data using a number of standard methods or devices. The SSDs support the ATA **Secure Erase** command, which can be sent to the SSD using either OS or third-party software tools. The OS may not allow the drive to be erased if the OS is currently installed on that drive, so the SSD will likely need to be plugged into a device as a secondary drive in order to execute the **Secure Erase** command. For example, the following commands can be run on Linux distributions to perform a secure erase on an SSD with the label **'sdb'** (replace <passwd> with your choice of password):

hdparm --user-master u --security-set-pass <passwd> /dev/sdb

hdparm --user-master u --security-erase <passwd> /dev/sdb

External Interfaces

Ports and Services

Physical Ports

USB ports connect to input devices and peripherals, such as a keyboard, mouse, touchscreen, printer, or portable data storage device. They are located on the front and rear panels of the device, labeled as either **USB** or **USB x**, where *x* is a number or letter. There is also an internal USB connection on the mainboard that can only be accessed after removing the top panel of the product. USB ports are enabled by default and can be disabled individually in BIOS/UEFI Setup, and some operating systems provide security settings to block USB ports and/or devices.

Display ports connect to display devices like monitors, TVs, and projectors. They are located on the rear panel of the device, labeled as either **DisplayPort** or **DVI-D** depending on the connection type. Display ports are mostly one-directional by nature, sending digital video and audio data to the display device, but they also have a bidirectional low-speed auxiliary/display data channel (DDC) used for display device identification. Display ports are enabled by default and can be disabled in most operating systems via either display settings or by disabling the display device driver.

HD Audio ports are analog electrical interfaces to speaker systems, headphones, microphones, and various audio sources. They are located on the rear panel of the device, labeled as **Audio** with color-coded TRS connections. Being analog interfaces, no data is exchanged through these ports. The HD Audio ports are enabled by default and can be disabled in BIOS/UEFI Setup and in most operating systems, can be disabled via either audio settings or by disabling the HD audio device driver.

Ethernet ports connect to networks via copper (RJ45) or fiber-optic (LC/SFP) cables. They are located on the front and rear panels of the device and are labeled **ETH x** where *x* is a number or letter (except on SEL-3390 PCIe cards where the port label is simply a number). The Ethernet ports on SEL-3300 devices are discrete connections with unique MACs, so by default there is no path for data to traverse from one port to another. Ethernet ports are enabled by default and can be disabled in most operating systems via either network settings or by disabling the Ethernet device driver. On SEL-3355 and SEL-3360 devices, the Ethernet ports **ETH 1** and **ETH 2** can also be disabled in BIOS Setup.

Serial ports connect to devices like protective relays, automation controllers, and modems. They are located on the rear panel of the device and are labeled **COM x** where *x* is a number (except on SEL-3390 PCIe cards where the port label is simply a number). Most SEL-3300 device serial ports repurpose the DTR and DSR signal pins as IRIG-B input or output pins for precise time distribution to serial-connected devices. The IRIG-B input and output functions operate independently from the serial port functions—see the following IRIG-B description. Serial ports are enabled by default and can be disabled in most operating systems via either device settings or by disabling the serial device driver. On SEL-3355 and SEL-3360 devices, serial ports **COM 1** and **COM 2** can also be disabled in BIOS Setup.

IRIG-B inputs and outputs connect to precise time sources, automation controllers, and protective relays. They are located on the rear panel of the device, using either BNC connections labeled **IRIG-B IN** or **IRIG-B OUT** or serial

port connections (see previous Serial description). IRIG-B inputs and outputs are enabled by default and can be disabled in most operating systems via either time-synchronization settings or by disabling the IRIG-B device driver.

Logical Ports

The SEL-3300 devices and associated device drivers have no logical ports open by default. The OS and application software running on the system create and configure all logical ports associated with the SEL-3300 device ports. The wide range of OSs and applications that can be used with the SEL-3300 devices, such as SEL Blueframe, SEL RTAC, Microsoft Windows, and Linux variants, each have their own sets of logical ports that are too broad to cover in this appendix. Refer to the instruction manuals or online resources for your OS and applications for information on logical ports and their functions. If you require a complete list of logical ports for your SEL-3300 device, you must perform an audit, such as a port scan of the system after the OS and all applications are configured.

Table C.2 lists the logical ports that are part of the Intel AMT feature accessible from the ETH 1 Ethernet port on SEL-3355 and SEL-3360 devices. The ports are controlled by the Intel Management Engine firmware, so they operate independent of the OS and application software running on the system. The default setting for Intel AMT is disabled, which disables all associated ports. When Intel AMT is enabled, some of the ports are automatically enabled, while others are enabled once the associated feature is enabled via either the MEBx configuration menu or the remote management software (such as Intel Manageability Commander or Mesh Commander). See *Section 9: Intel Active Management Technology (AMT)* for more information.

Table C.2 Logical Ports for Intel AMT on SEL-3355 and SEL-3360

Port Number	Network Protocol	Default State	Setting to Enable/ Disable Port	Purpose
623	ASF-RMCP	Disabled	Intel AMT enabled	DASH/DMTF
664	ASF-RMCP (TLS)	Disabled	Intel AMT enabled	DASH/DMTF (TLS)
5900	TCP	Disabled	Port 5900	KVM (VNC Server)
16992	HTTP	Disabled	Intel AMT enabled	Web Management
16993	HTTPS (TLS)	Disabled	TLS	Web Management (TLS)
16994	TCP/VNC	Disabled	Redirection	KVM/SOL/Storage Redirection
16995	TCP/VNC (TLS)	Disabled	Redirection & TLS	KVM/SOL/Storage Redirection (TLS)

Access Controls

This section describes the access controls inherent to SEL-3300 device hardware, for example, in BIOS Setup and Intel AMT. During normal runtime on a fully commissioned device, most access controls are facilitated through the OS and application software running on the device. Refer to the instruction manuals or online resources for your OS and applications for information on their access control features.

Privilege Levels

The BIOS Setup interface provides privilege-level control by requiring password authentication to access BIOS Setup. The password is disabled by default, allowing full read/write access to BIOS Setup without authentication.

The Intel AMT feature on SEL-3355 and SEL-3360 devices provides privilege-level control through user accounts that can be assigned access to individual AMT features. Intel AMT is disabled by default, which disables all privilege levels.

Local Accounts

The Intel AMT feature on SEL-3355 and SEL-3360 devices is disabled by default. When Intel AMT is enabled, a default admin account is created. This account cannot be renamed or removed. Additional user accounts can be created and managed via the remote management software (such as Intel Manageability Commander or Mesh Commander). The admin account always has full access to all features, while each additional user account must be assigned access to individual AMT features.

Passwords

The BIOS Setup interface contains an Administrator Password setting which, when configured with an appropriate password, requires the password to be entered to gain access to BIOS Setup. The Administrator Password is blank by default, which allows access to BIOS Setup without entering a password. SEL recommends setting the Administrator Password to prevent unauthorized access to the critical system settings in BIOS Setup. The password must be 8 to 20 characters in length and contain at least one uppercase and lowercase letter, one number, and one special character. If an incorrect password is entered three times while trying to access BIOS Setup, the device writes an event to the SMBIOS Event Log and must be manually reset via a power cycle or by pressing **<Ctrl+Alt+Delete>**. See *Section 4: BIOS Setup* for information on setting the Administrator Password setting.

The Intel AMT feature on SEL-3355 and SEL-3360 devices support multiple user accounts and passwords. When AMT is enabled, the default admin account is enabled with the default password “admin”. The initial MEBx Setup process requires admin to login with the default password and then forces the user to set a new password for admin. Intel AMT passwords must be 8 to 32 characters in length and contain at least one uppercase and lowercase letter, one number, and one special character. If an incorrect password is entered while trying to access Intel AMT, the device writes an event to the AMT Event Log.

X.509 Certificates

The Intel AMT feature on SEL-3355 and SEL-3360 devices supports X.509 certificates for the TLS encryption of the management interfaces. The default configuration has no X.509 certificates installed and TLS is disabled. Generate and install certificates via the remote management software (such as Intel Manageability Commander or Mesh Commander). See the remote management software instruction manual for additional information.

Logging Features

This section describes the logging features inherent to SEL-3300 device hardware, for example, in BIOS Setup and Intel AMT. During normal runtime on a fully commissioned device, most logging is facilitated through the OS and application software running on the device. Refer to the instruction manuals or online resources for your OS and applications for information on their logging features.

Security Events

The BIOS stores security events in the SMBIOS event log. The Intel AMT feature on SEL-3355 and SEL-3360 devices stores security events in the AMT Event and Audit logs, which are accessible from the remote management software (such as Intel Manageability Commander or Mesh Commander). These events include failed authentication attempts, configuration changes, hardware initialization reports, and subsystem errors and failures.

Internal Log Storage

The SMBIOS event log has a maximum size of 64 KB. The Intel AMT Event and Audit logs can each hold approximately 400 events. When the logs reach maximum capacity, new events replace old events (first in, first out).

Alarm Contact

SEL-3300 devices have a system alarm that drives the **ALARM** LED status indicator on the front-panel and operates a contact output on the rear panel. On SEL-3355 and SEL-3360 devices, the contact output is named ALARM, and this output is always controlled by the system alarm status. On SEL-3350 devices, the contact output is named OUT101, and this output is configurable to be controlled by either the system alarm status (default configuration) or by system software. See *Section 2: Installation* for information on the ALARM LED status indicator and contact output.

Backup and Restore

Always backup all system and application configuration files after commissioning or updating a system. Some OSs include backup features and functionality; see the OS manual or online help for details. A complete drive backup will capture the entire system configuration and can be used for quick disaster recovery in the case of a hardware failure or file system corruption. The SEL-5813 Backup and Recovery Tool (SEL BaRT) is available at no cost from the SEL website at https://www.selinc.com/selbart/ and can be used to create full drive backups on all SEL-3300 devices. Refer to *Section 8: Software Backup and Failure Recovery* for more information.

Malware Protection Features

Malware/virus protection is built into the SEL Blueframe and RTAC OSs through whitelisting technologies. Windows and Linux OSs may have built-in malware/virus protection features and support for third-party malware/virus protection software. Ensure your SEL-3300 device always has some form of active and up-to-date malware/virus protection.

Product Updates

Ensure all OS, software, and firmware components are kept up to date for the purpose of correcting defects and security vulnerabilities in those components. *Obtaining Updates on page C.9* lists components that may be included with SEL-3300 devices and provides the recommended sources for updates to those components. Additionally, see the SEL Process for Disclosing Security Vulnerabilities at https://selinc.com/security_vulnerabilities/.

Obtaining Updates

The software components included with SEL-3300 devices can be sorted into the following categories: BIOS/UEFI, firmware, operating systems, device drivers and software, and application software. Each component is owned and maintained by either the device manufacturer (SEL) or the component manufacturer (third-party). Some third-party components, like device drivers, can be sourced from either the third-party or SEL, while other third-party components, like Microsoft Windows operating system updates, can only be sourced from the third-party, not from SEL.

When a component sourced from SEL has a new release available, if the release corrects an issue that has a significant customer impact or is a security vulnerability, then end-users will be notified by SEL via Service Bulletin. SEL also provides a security notifications service that will alert you of any security-related updates to the SEL components in your SEL devices, which you can sign up for at https://selinc.com/support/security-notifications/.

BIOS/UEFI and Firmware

All BIOS and firmware updates for SEL-3300 devices must be sourced from SEL. Updates to these are infrequent, with typically one to two releases each year when the product is new, and less frequent as the product matures.

Table C.3 BIOS/UEFI and Firmware

Component	Sources	Examples
SEL BIOS/UEFI	➤ https://selinc.com/products/3350/support/ ➤ https://selinc.com/products/3355/support/ ➤ https://selinc.com/products/3360/support/ ➤ SEL Compass software (https://selinc.com/products/compass/)	➤ SEL-3350 BIOS Update ➤ SEL-3355 BIOS Update ➤ SEL-3360 BIOS Update
SEL Embedded Controller Firmware (SEL-3355/SEL-3360 only)	➤ https://selinc.com/products/3355/support/ ➤ https://selinc.com/products/3360/support/ ➤ SEL Compass software (https://selinc.com/products/compass/)	➤ SEL B2071 Firmware Update
Intel Management Engine Firmware (SEL-3355/SEL-3360 only)	➤ https://selinc.com/products/3355/support/ ➤ https://selinc.com/products/3360/support/ ➤ SEL Compass software (https://selinc.com/products/compass/)	➤ Intel ME Firmware Update

Operating Systems

Operating system updates must be sourced from the OS manufacturer using their own defined methods. For SEL Blueframe and RTAC OSs, refer to the instruction manuals and documentation for those operating systems. For third-party OSs like Microsoft Windows and Linux, background automatic update services periodically attempt to download updates directly from the internet. Devices with no internet access can usually update the OS using offline update packages that can be downloaded and transferred to the device using an internet-connected computer. Your company IT/IS group may be able to assist you with setting up automatic or offline OS updates.

Device Drivers and Software

Device drivers and software can be sourced from either SEL or the component manufacturer, depending on end-user preference. The component manufacturer will have the most recent releases, but these releases may not have been tested by SEL, so you should consider testing to confirm the new

driver does not introduce new problems. SEL tests third-party drivers in-house before releasing, and as such the releases are delayed and less frequent. The table below lists the device drivers and software in current production SEL-3300 devices and the source for where you can obtain the latest releases. To obtain drivers and software for discontinued SEL-3300 devices, refer to **Computing Platforms > Discontinued Computing Platforms** at https://selinc.com/products/.

Table C.4 Device Drivers and Software

Component	Sources	Examples
Intel device drivers and software	➤ https://selinc.com/products/3355/support/ ➤ https://selinc.com/products/3360/support/ ➤ SEL Compass software (https://selinc.com/products/compass/) ➤ https://downloadcenter.intel.com/	➤ Intel Chipset utility ➤ Intel SATA Controller driver ➤ Intel Rapid Storage Technology software ➤ Intel Ethernet driver ➤ Intel Graphics driver ➤ Intel Management Engine driver
SEL Mainboard device drivers	➤ https://selinc.com/products/3350/support/ ➤ https://selinc.com/products/3355/support/ ➤ https://selinc.com/products/3360/support/ ➤ SEL Compass software (https://selinc.com/products/compass/)	➤ SEL 3300 Driver Bundle ➤ SEL B2071 Driver ➤ SEL B2071 System Control Library
SEL SysMon software	➤ https://selinc.com/products/3350/support/ ➤ https://selinc.com/products/3355/support/ ➤ https://selinc.com/products/3360/support/ ➤ SEL Compass software (https://selinc.com/products/compass/)	➤ SEL Alarm Service ➤ SEL SysMon GUI ➤ SEL SysMon Service ➤ SEL SysMon SNMP Agent Extension
SEL-3390 PCIe card drivers	➤ https://selinc.com/products/3390E4/ ➤ https://selinc.com/products/3390S8/ ➤ https://selinc.com/solutions/rugged-computers/ ➤ https://selinc.com/products/3390T/ ➤ https://selinc.com/solutions/rugged-computers/ ➤ SEL Compass software (https://selinc.com/products/compass/)	➤ SEL 3300 Driver Bundle ➤ SEL-3390E4 Driver ➤ SEL-3390S8 Driver

Application Software

Most application software updates should be sourced from the software manufacturer. The exceptions to this are the following optional software packages that can be factory-installed on SEL-3300 devices.

Table C.5 Application Software

Component	Sources	Examples
McAfee Embedded Control	https://selinc.com/software/downloads/?filter=mcafee	

Update Verification

Updates for SEL-3300 devices are packaged as signed executable files for Microsoft Windows OSs (.exe files). The file signature can be verified by copying the file to a computer running Microsoft Windows and reviewing the Digital Signatures tab of the Properties display for the executable file. Microsoft and other vendors usually also use these digital signatures for updates, so the same verification method used for SEL updates can be used for most other updates intended to be used with Windows OSs.

Depending on the type of update, the components processing the update might automatically verify the update's digital signature before allowing the update to proceed. BIOS/UEFI updates files are digitally signed by SEL, and that signature is verified by the update processes built into the BIOS/UEFI during the update process. If the signature verification fails, the update will not be applied. SEL RTAC and Blueframe OSs also use signature verification for firmware and OS updates. Refer to the instruction manuals and documentation for those operating systems for additional information.

Contact SEL

For further questions or concerns about SEL product security, please contact SEL:

Email: security@selinc.com or phone +1.509.332.1890.

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Glossary

10/100/1000BASE-T Part of the IEEE 802.3 Ethernet communication standards, referring to device connections using twisted-pair cable (as opposed to other media such as coaxial or fiber optics). The number (10, 100, 1000) denotes the link speed in Megabits per second (Mbps), while the BASE-T denotes the twisted-pair cable.

A Abbreviation for amps or amperes; unit of electrical current flow.

ac Abbreviation for alternating current.

BIOS Basic Input/Output System. System software that provides the most basic interface to peripheral devices and controls the first stage of the boot process, including operating system installation.

Burden Percentage of time during which the CPU is working.

CPU Central processing unit.

CTS Clear to send, EIA-232 control signal, typically used for data flow control.

dc Abbreviation for direct current.

DCD Data Carrier Detect, EIA-232 control signal, typically used by a modem to indicate a data carrier signal is present.

DSR Data Set Ready, EIA-232 control signal, typically used by a modem to indicate it is ready to receive data.

DTR Data Terminal Ready. A wire in an EIA-232 connection that tells data communications equipment (typically a modem) that the system or terminal is ready to transmit and receive data.

EIA-232 Electrical definition for point-to-point serial data communications interfaces, based on the standard EIA/TIA-232. Formerly known as RS-232.

EMI Electromagnetic Interference.

ESD Electrostatic discharge. The sudden transfer of charge between objects at different potentials caused by direct contact or induced by an electrostatic field.

Ethernet A network physical and data link layer defined by IEEE 802.2 and IEEE 802.3.

Firmware The nonvolatile program stored in the relay that defines relay operation.

GND Ground.

GPS Global Positioning System. Source of position and high-accuracy time information.

GUI Graphical user interface.

HMI Human-machine interface.

IRIG-B A time-code input that the relay can use to set the internal relay clock.

LED Light-Emitting Diode. Used as indicators on the SEL-3355-2 front panel.

MAC Address The hardware address of a device connected to a shared network medium.

MOV Metal-Oxide Varistor.

Null-Modem Cable A serial cable for direct connection of systems without use of a modem.

PC Personal Computer.

Peak Common Mode Maximum voltage between a signal line and common (ground).

Peak Differential Mode Maximum voltage between two signal lines.

Ping Packet InterNet Grouper. A program that tests the ability to communicate with a remote device by sending one, or repeated, echo requests to a remote location and waiting for replies. The term is also used as a verb to indicate the action of sending signals to and receiving echoes from remote devices.

Pinout The definition or assignment of each electrical connection at an interface. Typically refers to a cable, connector, or jumper.

Protocol A language for communication between devices.

RAM Random-Access Memory.

RFI Radio-Frequency Interference.

RTS Request to Send, EIA-232 control signal, typically used for data flow control.

RXD Received data.

SCADA Supervisory control and data acquisition.

TTL Transistor-Transistor Logic. A term originating with Texas Instruments describing a common semiconductor technology for building discrete digital logic integrated circuits.

TXD Transmitted data.

V Abbreviation for volts; unit of electromotive force.

W Abbreviation for watts; unit of electrical power.

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