SEL-3355

Automation Controller

Instruction Manual

20221221

SEL SCHWEITZER ENGINEERING LABORATORIES

PM3355-01

PM3355-01

Table of Contents

List of Tables

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List of Figures

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Preface

Manual Overview

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

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.
- Section 3: Hardware Setup and Serviceability. Accessing main board features and control (DIP) switches. 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: SEL SysMon. Introduction to included system health monitoring software.
- 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.
- Appendix A: Manual Versions. Change log for manual versions.
- Appendix B: Microsoft Windows System Configuration. Features of the Windows operating systems.

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. Using any non-SEL cable can cause severe power and ground problems involving Pins 1, 4, and 6 on the SEL-3355 communications ports.	**⚠AVERTISSEMENT** Ne jamais utiliser de cables standards à inversion de signaux (“null-modem”) avec le SEL-3355. 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.
⚠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.
⚠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

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

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

Section 1
Introduction and Specifications

Overview

The SEL-3355 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 enables you to use your choice of a automation controller operating system and software in very harsh environments not suitable for general purpose computers.

Features

The SEL-3355 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 uses the latest Intel Core i7 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.
- **Operating System Choices.** The SEL-3355 may be purchased as hardware only, or with a variety of modern Microsoft Windows operating systems to provide extreme flexibility and functionality along with enhanced security features. See *Appendix B: Microsoft Windows System Configuration* for more information.
- **Form Factor.** The SEL-3355 provides a 19-inch rack-mount form factor, designed for substation and industrial control applications. The system includes rear-panel I/O connectors and front-panel status LEDs for network, peripherals, storage, video, audio, alarm, and serial I/O—all with protection against electrical shock and surge.
- **Power Supplies.** The SEL-3355 supports two load-sharing, hot-swappable power supply modules, enabling you to power the SEL-3355 from two independent power sources for maximum availability.
- **Mass Storage.** The SEL-3355 supports four 2.5-inch SATA drives, which are easily accessible and hot-swappable from the front panel.

- **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, VGA, or HDMI video connections enable you to connect one or two 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 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 supports as many as five standard PCI/PCIe form factor expansion cards, enabling you to customize the system I/O to meet your application needs. Choose from a selection of SEL PCI/PCIe expansion cards, or install your own custom third-party expansion card. Refer to *PCI Expansion Slots on page 3.4* for more information.
- **Ethernet.** Two 10/100/1000 Mbps Ethernet 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 quad-gigabit Ethernet card can be added to the SEL-3355 for additional network connectivity.
- **Serial I/O.** Two standard EIA-232 serial ports enable connection to nearby electronic devices such as automation controllers, communication radios, and modems. Multiple SEL-3390S8 serial expansion cards can be added to the SEL-3355 for applications that require many serial I/O connections and IRIG time synchronization and distribution.
- **System Monitoring and Watchdog.** An embedded controller works in unison with the SEL SysMon software to provide an extra level of automation controller system reliability and 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, and, if necessary, can restart the system to return to a good operational state.
- **Alarm Contact Output.** An alarm contact output is controlled by the SEL SysMon software 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 can be accessed remotely over Ethernet by using Windows Remote Desktop or Intel vPro Active Management Technology (AMT), enabling full access to the 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 Model Option Table at selinc.com.

Options

The SEL-3355 has the following options and features:

- Processor
  - Intel Core i7-3555LE dual-core 2.5 GHz
  - Intel Core i7-3612QE quad-core 2.1 GHz
- RAM
  - 4 to 16 GB DDR3 ECC PC3-10600 (1333 MHz)
- Conformal Coating
  - Conformally coated circuit boards
- Mounting
  - Horizontal 19-inch rack
  - Horizontal panel
- Power Supplies
  - 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 multi-level cell (iMLC) drives: 120 to 480 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
- Software
  - Selectable factory-installed operating systems and software applications

Applications

The SEL-3355 may be used for many applications. With proper software installed, the SEL-3355 provides a comprehensive solution for substation integration as shown in *Figure 1.1*. The SEL-3355 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).

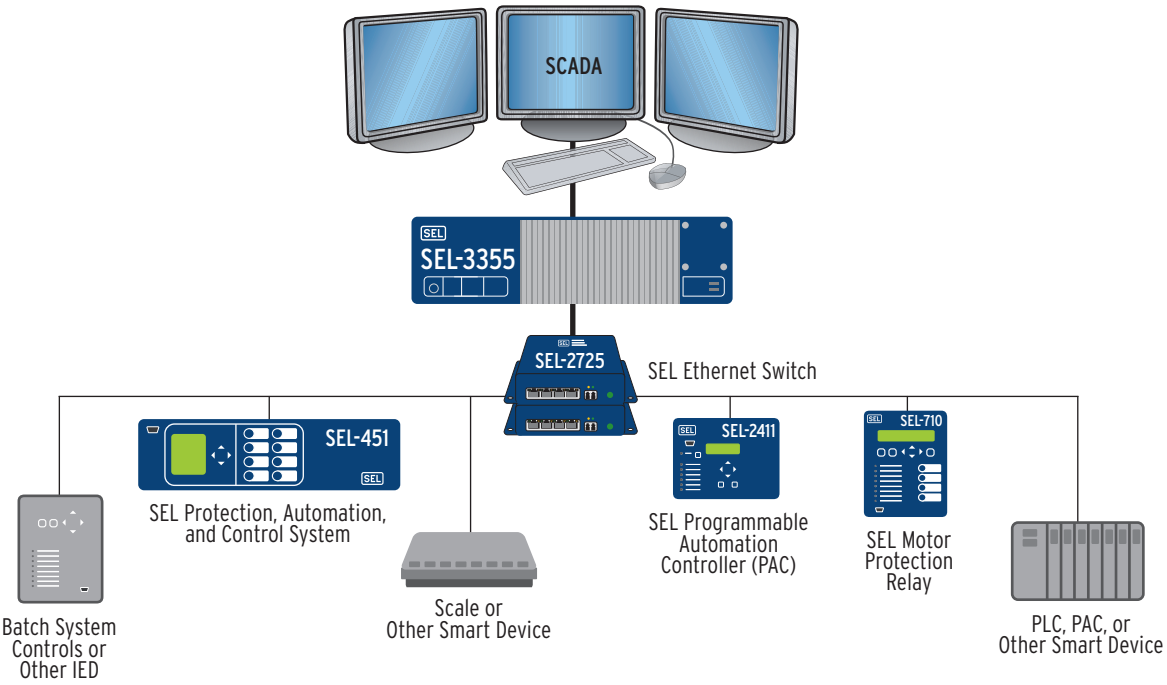

Figure 1.1 Functional Model

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; NRAQ2, NRAQ8)

CE Mark

UKCA Mark

General

Supported Operating Systems

Microsoft Windows 7
Microsoft Windows 8/8.1
Microsoft Windows 10*
Microsoft Windows Server 2008 R2
Microsoft Windows Server 2012 R2
Microsoft Windows Server 2016*
CentOS Linux 6
CentOS Linux 7
Red Hat Enterprise Linux 6
Red Hat Enterprise Linux 7
VMware ESXi (Contact SEL for hardware and version compatibility)
* Orderable as a factory-installed option.

CPU

Intel Core i7-3555LE Dual-Core

Speed:	2.5 GHz base, 3.2 GHz turbo
Cache:	2 x 256 KB L2, 4 MB L3

Intel Core i7-3612QE Quad-Core

Speed:	2.1 GHz base, 3.1 GHz turbo
Cache:	4 x 256 KB L2, 6 MB L3

RAM

4–16 GB DDR3 ECC PC3-10600 (1333 MHz)

Chipset

Intel QM77 Express Chipset

Mass Storage

Internal Drive Bay:	Supports 2.5 inch SATA drives, four industrial-grade drives, two consumer-grade drives 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 iMLC SSD 120–480 GB 5-year warranty Consumer-Grade MLC SSD 240–1920 GB 3-year warranty

Video

Intel HD Graphics 4000 Controller

Dual Independent Displays From 2 of the 3 Outputs:	DVI-I (digital + VGA) maximum resolution 1920 x 1200 @ 32 bpp DVI-D (digital only) maximum resolution 1920 x 1200 @ 32 bpp DisplayPort 1.1 maximum resolution 1920 x 1200 @ 32 bpp Cable length <10 m

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

Intel Display Audio

Digital Audio Outputs:	DVI-I, DVI-D, DisplayPort

USB

4 Rear-Panel ports, 2 Front-Panel Ports
USB 2.0 Compliant
800 mA Current Limit Each
Cable length <10 m

Expansion Cards

5 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

Ethernet

2 Rear-Panel 1 Gb Copper RJ45 Ports

ETH1:	Intel 82579LM, 10/100/1000 Mbps RJ45 copper
ETH2:	Intel 82574L, 10/100/1000 Mbps RJ45 copper
Optional SEL-3390E4 PCIe x4 Expansion Cards:	As many as 8 additional 10/100/1000 Mbps ports, copper or LC fiber SFP

Serial Ports

Standard Ports:	2 EIA-232 ports, DB-9 connectors 300 to 115200 bps
Optional SEL-3390S8 PCIe x1 Expansion Cards:	As many as 24 additional EIA-232/422/485 ports, RJ45 connectors 300 to 921600 bps

(Meets EIA/TIA-562 Specifications)

Time-Code Input/Output

Main Board (Input Only)

Connector:	COM1 DB-9 serial port
Time Code:	Demodulated IRIG-B TTL compatible

SEL-3390S8 Expansion Card (Input/Output)

Connector:	RJ45 serial port
Time Code:	Demodulated IRIG-B TTL compatible

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

Real-Time Clock/Calendar

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

BIOS

Phoenix SecureCore Tiano UEFI

Trusted Platform Module

Integrated TPM 1.2

Intel Active Management Technology

Intel AMT v8.1, accessible through ETH1

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:	149 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.
Insulation:	3600 Vdc
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:	155 W, 160 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.
Insulation:	3600 Vdc
Power Factor:	>0.9 (at full load)
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

Fuses are not serviceable.

Alarm Output Contact

Per IEC 255-0-20:1974, using the simplified method of assessment

Output Type:	Relay, Form C, break-before-make
Power Supply Burden:	<1 W maximum
Mechanical Life:	2000000 operations
Operational Voltage:	250 Vac/Vdc
Make:	30 A at 250 Vdc
Carry:	6 A continuous at 70°C
1 s Rating:	50 A
MOV Protection:	270 Vac/360 Vdc, 75 J
Insulation Voltage:	300 Vac/Vdc
Pickup Time:	<8 ms
Dropout Time:	<8 ms

Breaking Capacity (10000 operations):

24 V	0.75 A	L/R = 40 ms
48 V	0.50 A	L/R = 40 ms
125 V	0.30 A	L/R = 40 ms
250 V	0.20 A	L/R = 40 ms

Cyclic Capacity (2.5 cycles/second):

24 V	0.75 A	L/R = 40 ms
48 V	0.50 A	L/R = 40 ms
125 V	0.30 A	L/R = 40 ms
250 V	0.20 A	L/R = 40 ms

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)

Temperature Range

Operating

With i7-3555LE CPU: –40° to +75°C (–40° to +167°F)

With i7-3612QE CPU: –40° to +60°C (–40° to +140°F)

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

Storage

–40° to +85°C (–40° to +185°F)

Relative Humidity

5% to 95% noncondensing

Maximum Altitude

5000 m

Atmospheric Pressure

80–110 kPa

Overvoltage Category

Category II

Insulation Class

1

Pollution Degree

2

RoHS Compliance

Compliant with the European Union's RoHS directive

Weight

9.072 kg (20 lb) maximum

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 UL 61010-1:2016, C22.2 No. 61010-1-12 IEC 61010-2-201:2013
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
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 +A2:2010 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
0.5, 1 kV line-to-line
0.5, 1, 2 kV line-to-earth
0.5, 1, 2 kV communications ports

Environmental

Change of Temperature:
IEC 60068-2-14:2009
Severity Level:
5 cycles, 1°C per minute ramp
–40°C to +60°C (i7-3612QE CPU)
–40°C to +75°C (i7-3555LE CPU)
IEC 60255-1:2009
IEC 61850-3:2013

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
IEC 60255-1:2009
IEC 61850-3:2013

Damp Heat, Cyclic:
IEC 60068-2-30:2005
Severity Level:
12 + 12-hour cycle
25° to 55°C, 6 cycles, >93% r.h.

Damp Heat, Steady:
IEC 60068-2-78:2012
Severity Level:
40°C, 240 hours, >93% r.h.
IEC 61850-3:2013

Dry Heat, Operational:
IEC 60068-2-2:2007
Severity Level:
16 hours at 60°C (i7-3612QE CPU)
16 hours at 75°C (i7-3555LE CPU)
IEC 60255-1:2009
IEC 61850-3:2013

Dry Heat, Storage:
IEC 60068-2-2:2007
Severity Level: 16 hours at 85°C
IEC 60255-1:2009
IEC 61850-3:2013

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 60529:1989+A1:1999
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 (Dual-Core CPU, 1 PSU, 4 GB RAM, 1 SATA Drive):	25 W	35 W	50 W
Additional Consumption From Optional Components			
Quad-Core CPU:	+2 W	+5 W	+13 W
2nd Power Supply:	+10 W	+10 W	+13 W
2nd RAM Module (4–8 GB):	+2 W	+2 W	+3 W
Additional SATA Drives, each:	+1 W	+2 W	+3 W
SEL-3390E4 Ethernet Card	+6 W	+8 W	+10 W
SEL-3390S8 Serial Card	+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 Current Limits

Connection	Current Limit
DVI-I and 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	0.8 A, +5 Vdc, 4 W each

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Section 2
Installation

Overview

The first steps in applying the SEL-3355 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 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 helps ensure that you receive years of trouble-free operation. Use the following guidelines for proper installation of the SEL-3355.

Physical Location

Mount the SEL-3355 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.

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. No fans or forced air ventilation are required, but a minimum of 2.5 cm (1 inch) clearance around the heat sinks is recommended.

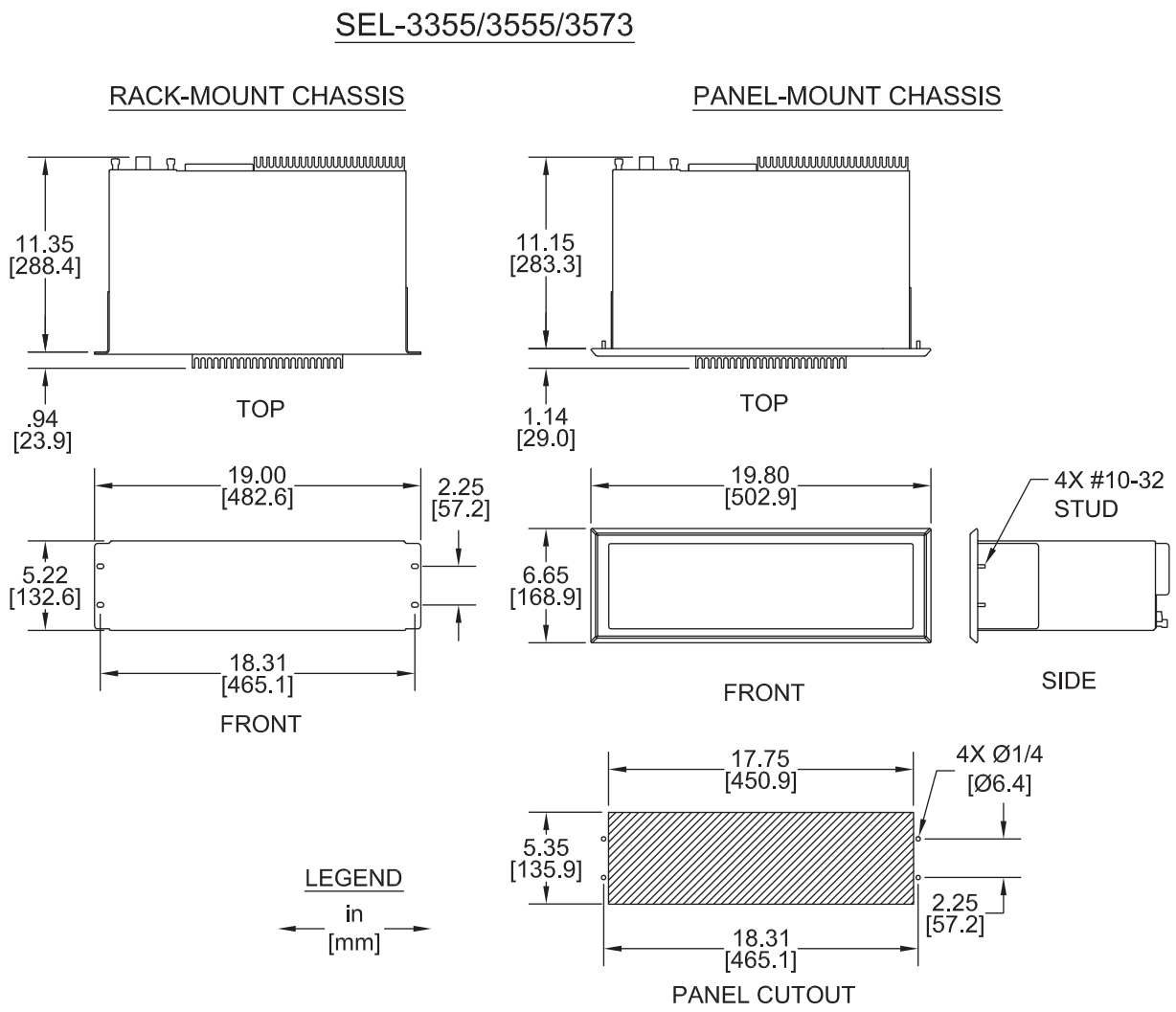


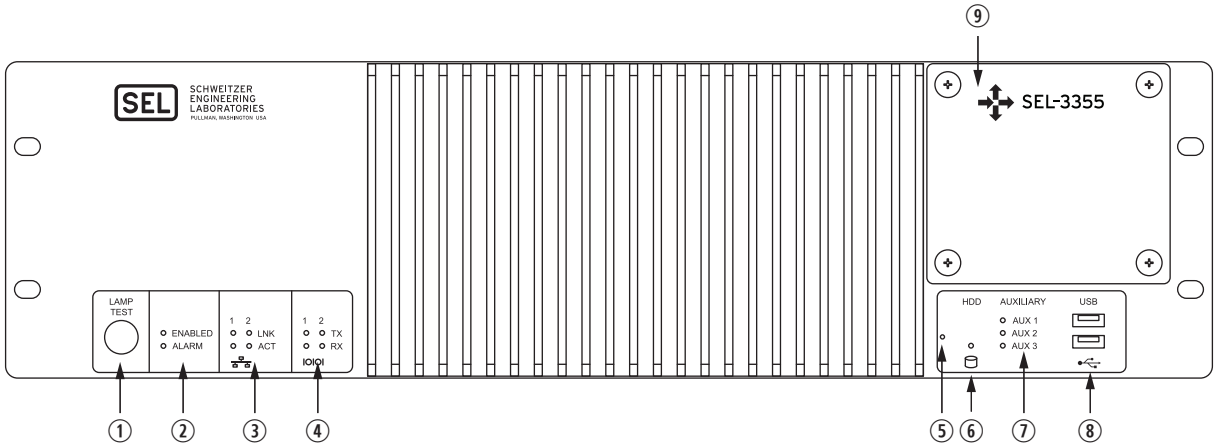
Figure 2.1 Dimensions Diagram

Cleaning

Use care when cleaning the SEL-3355. 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 and *Figure 2.3* show the physical layout of the connectors on the front panel of an SEL-3355.



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 2.0 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

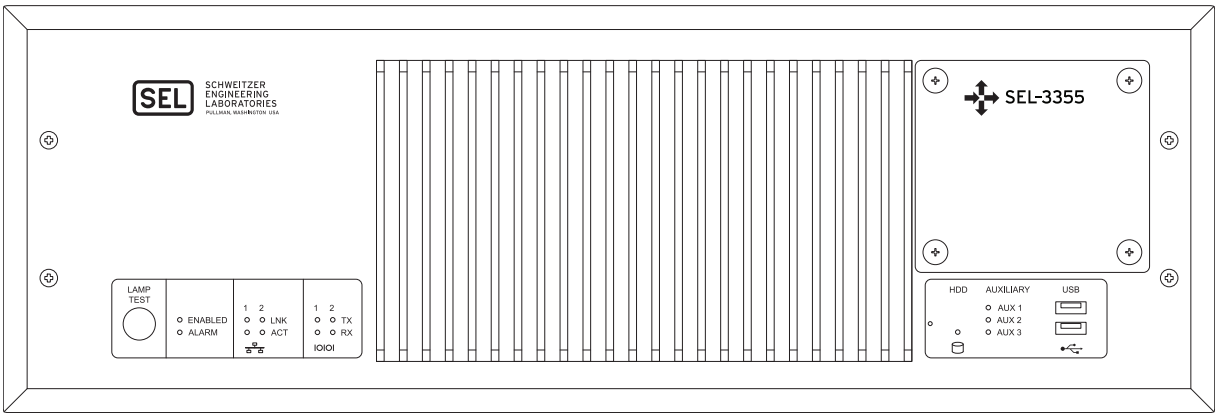


Figure 2.3 Front Panel-Mount Diagram

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 4.3*).

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 2.8*.

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

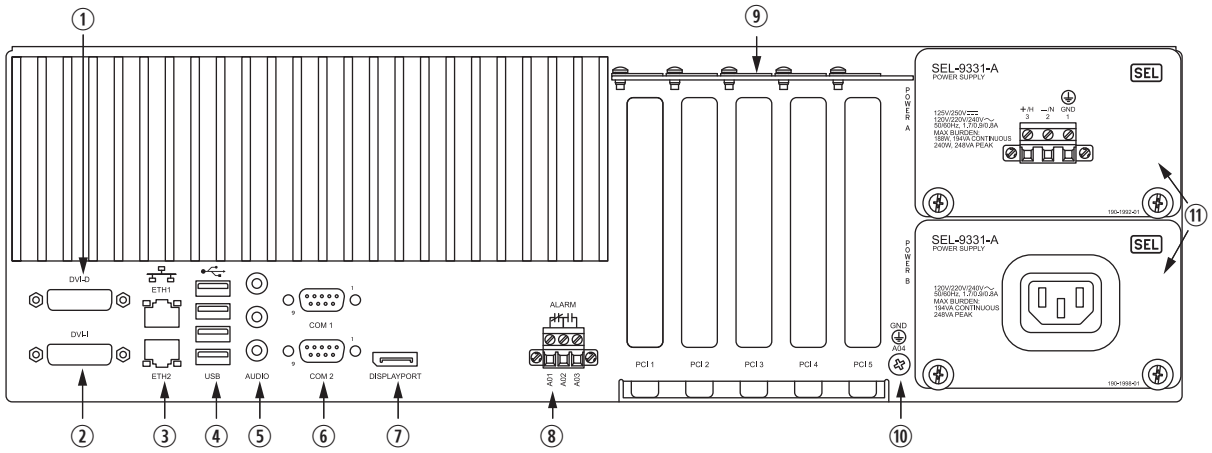
Attach one or two USB 2.0 devices, enabling custom, application-specific peripherals. Enter the BIOS setup to selectively disable USB port(s).

SATA Drive Bay

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 2.4 shows the physical layout of the connectors on the rear panel of an SEL-3355.



① **DVI-D**. Connect digital monitors by using native DVI or an HDMI adapter.
② **DVI-I**. Connect either digital or analog monitors by using native DVI, an HDMI adapter, or a VGA adapter.
③ **ETH1** and **ETH2**. Onboard independent Gigabit Ethernet interfaces.
④ **USB** Ports. Connect as many as four USB 2.0 peripherals at the rear panel.
⑤ **AUDIO** Ports. Line Input (blue), Line Output (green), and Microphone Input (pink).
⑥ **COM1** and **COM2**. Standard EIA-232 serial ports with configurable +5 Vdc power on Pin 1.
⑦ **DISPLAYPORT**. Connect new digital monitors supporting the DisplayPort interface.
⑧ **ALARM**. The Form C alarm contact output can be wired either normally closed or normally open.
⑨ **PCI** Expansion Slots. Install SEL or third-party PCI or PCI Express expansion cards for additional network, serial, or other application-specific I/O.
⑩ **Earth Ground** Terminal Screw. The earth ground connection for the SEL-3355.
⑪ **POWER** supply modules. The rated input voltage is clearly marked on the chassis near the terminals.

Figure 2.4 Rear-Panel Diagram

Video

Connect simultaneous displays by using any two video ports. Choose among DVI-I, DVI-D, and DisplayPort. Connect VGA monitors by using a DVI-to-VGA adapter connected to the DVI-I port. The DVI-D port does not have an analog VGA signal. 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 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 by installing PCI Express expansion cards such as the SEL-3390E4. For information on those cards, please refer to the expansion card instruction manual.

USB

Attach as many as four USB 2.0 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 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 *Peripheral Configuration on page 4.4* to configure the serial port features.

Serial port **COM1** 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 to synchronize the automation controller 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 **COM1**, refer to *COM 1 Jumpers on page 3.2*. 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 system clock during initial setup and any time the RTC battery is removed.

On SEL-3355 systems running Microsoft Windows operating systems, the Windows Time interface is used to synchronize the automation controller 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.

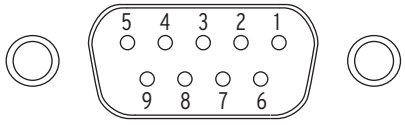
See *Figure 2.5* for the serial port DB-9 female connector pin numbers. The corresponding EIA-232 serial port pin functions are shown in *Table 2.1*.

Table 2.1 EIA-232 Serial Port Connector Pin Definition

Pin	Ports 1-2
1	DCD or +5 Vdc[a]
2	RXD
3	TXD
4	DTR or +IRIG-B[b]
5	GND
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 2.5 EIA-232 DB-9 Connector Pin Numbers

The communications circuits have internal surge protection.

Common serial cable configurations are shown in *Figure 2.6* and *Figure 2.7*. 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.

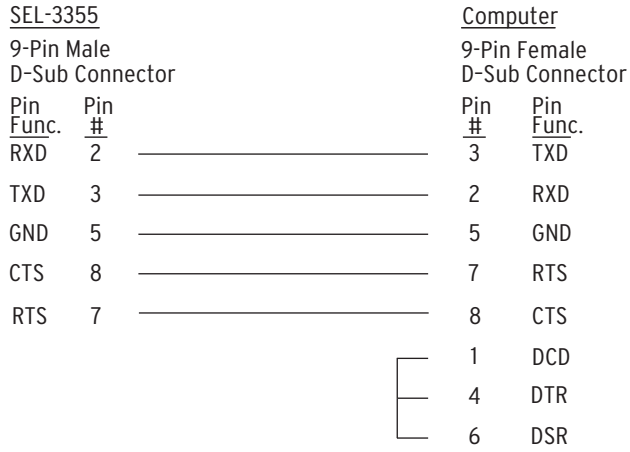


Figure 2.6 SEL-C235 Cable

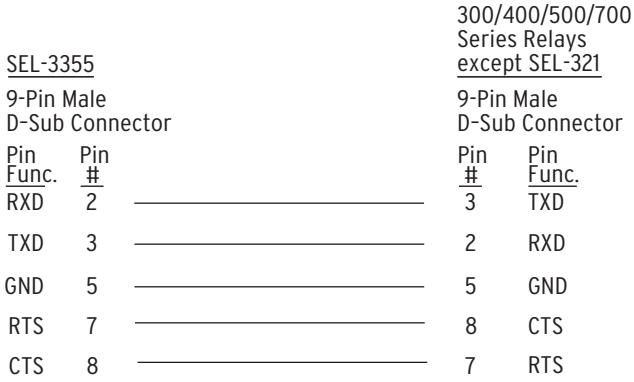


Figure 2.7 SEL-C282 Cable

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).
- 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 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 2.4*) 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 3.0 m (9.8 feet) in length, for this connection. This terminal connects directly to the internal chassis ground of the SEL-3355.

Alarm Contact

The grounding terminal should be connected before 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 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 SEL SysMon software has loaded, or if the Watchdog is disabled (via main board control [DIP] switch or BIOS setting). During normal operation, the SEL SysMon software controls alarm operation based on the software and hardware operational status. For additional information, see *Section 7: SEL SysMon*. Ratings for the contact are 30 A make, 6 A continuous, and 0.5 A or less break (depending on circuit voltage). The alarm contact has a maximum safety rating of 250 Vac/330 Vdc.

Power

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 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.

⚠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.

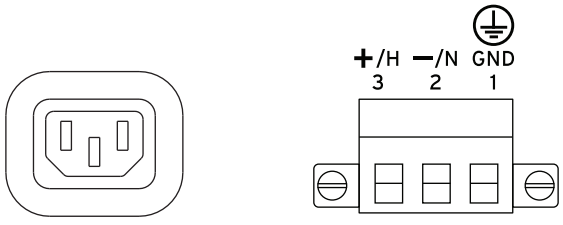


Figure 2.8 Power Connections

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.

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 3.0 m (9.8 feet) of the SEL-3355. Disconnect devices must comply with IEC 60947-1 and IEC 60947-3-1.

Initial Checkout and Startup

Checkout Using Monitor, Keyboard, and Mouse

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

NOTE: At temperatures below 5°C (41°F) the SEL-3355 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 as shown in *Figure 2.4*.

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

Step 3. The SEL-3355 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 automation controller 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.

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Section 3
Hardware Setup and Serviceability

Overview

The SEL-3355 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 main board.

⚠CAUTION
The main board is not field serviceable and should not be removed from the SEL-3355. 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.

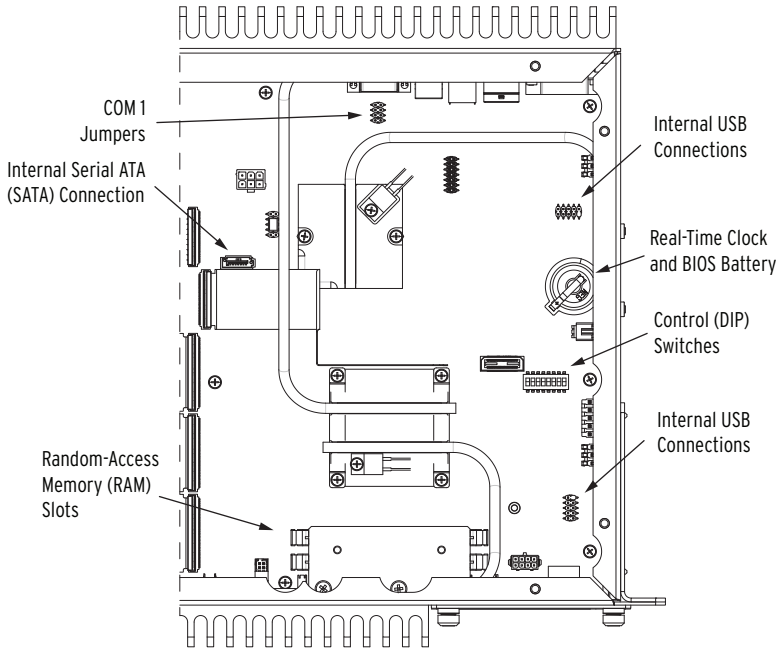


Figure 3.1 Main Board Diagram

Top Panel Removal

To access the main board and PCI expansion slots you must first remove the top panel from the SEL-3355. 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.

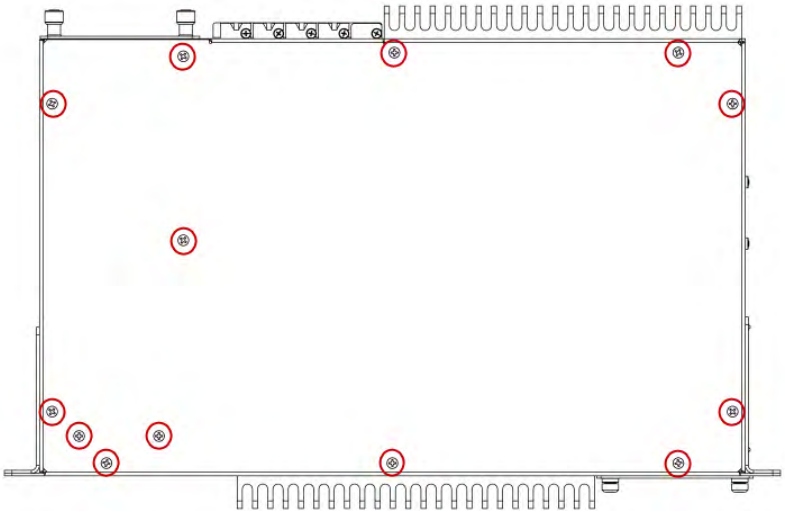


Figure 3.2 Top Panel Removal

Control (DIP) Switches

Figure 3.3 shows the control (DIP) switches and their functions on the SEL-3355 main board. The switches can be accessed from the top of the unit by removing the top panel (see *Top Panel Removal*) or by removing the drive bay cover from the front of the unit (*Figure 3.4*) and all installed SATA drives.

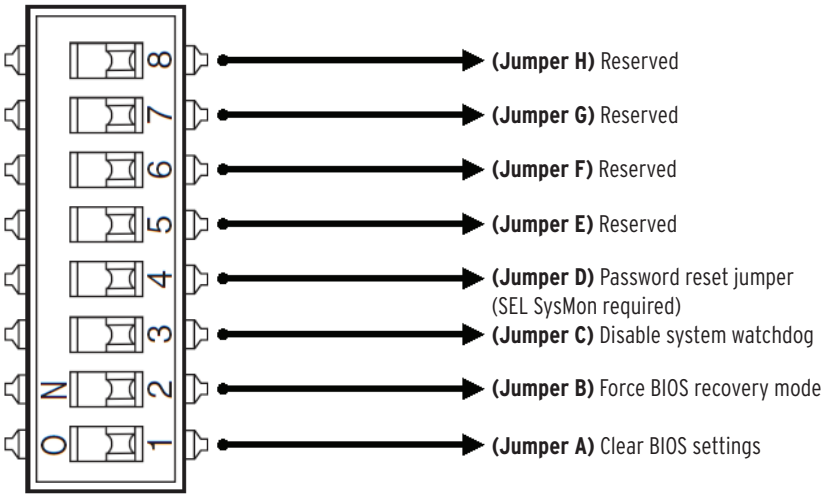
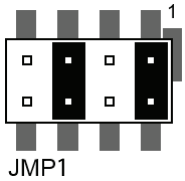


Figure 3.3 Main Board Control (DIP) Switches

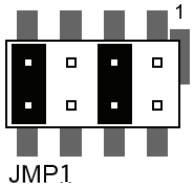
COM 1 Jumpers

The **COM 1** jumpers, labeled **JMP1** on the SEL-3355 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 contains a button cell battery that is used to maintain BIOS settings and clock when an external power source is disconnected.

Replacing the Real-Time Clock and BIOS 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.

You can replace the real-time clock and BIOS battery in the SEL-3355. If your BIOS battery needs to be replaced, the time and date will revert to midnight 1/1/2010. You can confirm this by entering the BIOS on reboot and examining the **Advanced > SMBIOS Event Log > View SMBIOS Event Log**. You will see a `CMOS Battery Failure` message. Perform the following steps to replace the battery:

Step 1. Follow your company standard procedure to remove an automation controller from service.

Step 2. Disconnect power from the SEL-3355 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 automation controller from the mounting location.

Step 6. Ground the automation controller 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 automation controller 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.

Step 17. Turn on the SEL-3355.

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 automation controller to service.

Random-Access Memory (RAM) Slots

Each RAM slot accepts a single mini-UDIMM memory module with a capacity of 8 GB each. The SEL-3355 has two RAM slots to hold a maximum 16 GB of RAM.

Internal USB Headers

The main board for the SEL-3355 contains two USB headers. With the proper SEL adapter, you can attach a USB device permanently inside the unit.

Internal Serial ATA (SATA) Header

An internal SATA header provides connectivity for permanent, high-speed storage or other media.

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 3.4 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; therefore, they may negatively impact the total system reliability. See *Requirements* for recommendations.

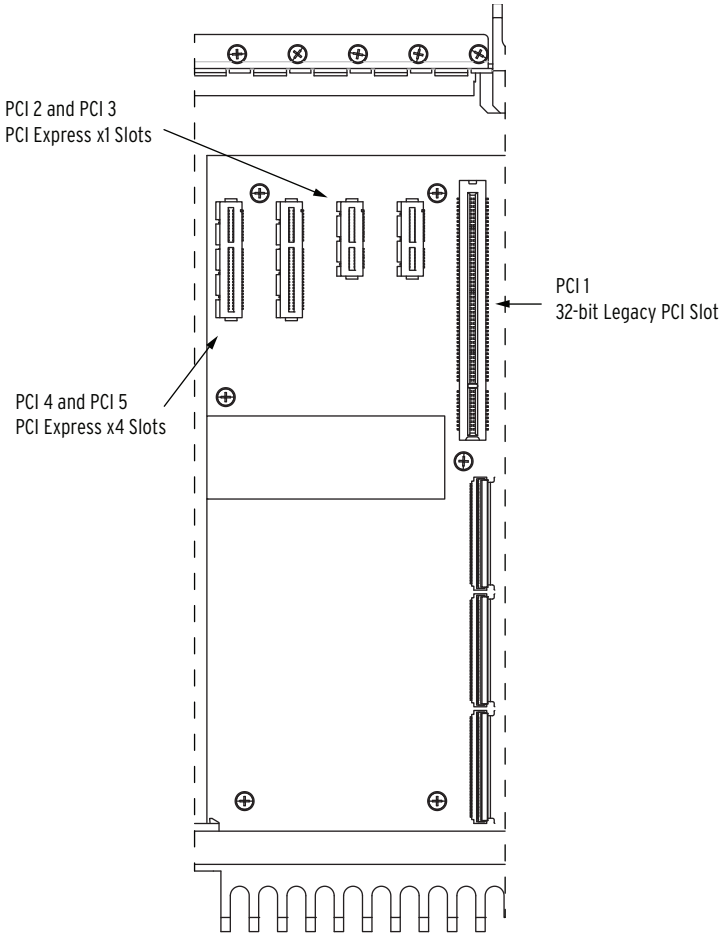


Figure 3.4 PCI Expansion Slots

Expansion Slot	Function
PCI 1	A legacy 32-bit, +5 V PCI slot for older/traditional PCI expansion cards.
PCI 2 and PCI 3	Two PCI Express x1 slots for PCIe x1 cards such as the SEL-3390S8 serial expansion card.
PCI 4 and PCI 5	Two PCI Express x4 slots for PCIe x4 cards such as the SEL-3390E4 Ethernet expansion card.

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 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. 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 inches) and maximum card length of 168 mm (6.6 inches).

The expansion slots are compliant with PCI/PCIe power requirements. A maximum of 25 W is provided to each of the PCIe x4 and legacy PCI slots, and 10 W to each of the PCIe x1 slots. Exceeding these limits will adversely affect automation controller 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 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. SEL recommends performing thermal and reliability testing on any third-party expansion cards installed in the SEL-3355, prior to deploying the system.

Power Supplies

The SEL-3355 allows for dual, redundant power supply configurations to maximize availability in critical service situations. The SEL-3355 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.

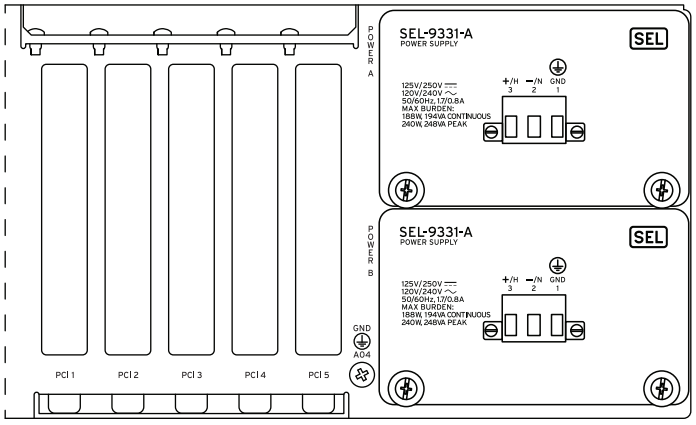


Figure 3.5 Power Supply Installation

Removal and Installation

The SEL-3355 power supplies contain two thumbscrews that secure them to the SEL-3355 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, 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 (85ºC or higher operating temperature rating) are required when installing more than two drives in an SEL-3355. Do not install more than two SATA drives when using consumer-grade drives, or drive failure may occur.

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

A key feature of the SEL-3355 is its data storage capacity. The SEL-3355 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 RAID configuration (see *Section 5: SATA Drive RAID* for information on configuring RAID on the SEL-3355). Refer to *Requirements* for help with SATA drive selection.

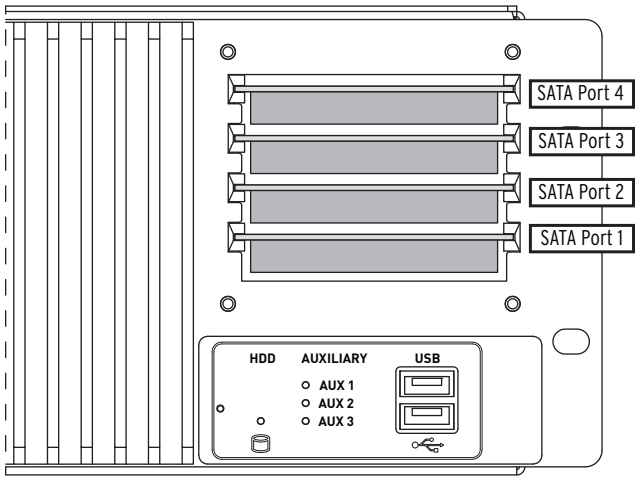


Figure 3.6 SATA Drive Bay

Drive Types

There are three types of SATA drives offered as factory-installed options for the SEL-3355: industrial-grade single-level cell (SLC) solid-state drives (SSDs), industrial-grade multi-level cell (iMLC) 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.

iMLC 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. iMLC SSDs from SEL carry a 5-year warranty.

MLC drives provide the highest capacities and lowest cost but are not rated for industrial environments and have the lowest endurance. MLC drives are suitable for use in office environments with applications that do not require a significant amount of write/erase cycles. MLC SSDs from SEL 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 Automation Controllers* 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 SATA drive bay slots are numbered 1–4, with Port 1 being the bottom SATA drive bay slot, and Port 4 being the top.

Requirements

Each SATA drive slot can accommodate a standard 2.5 inch form factor SATA drive, with a maximum drive height of 0.4 inches (10 mm). The SATA drive bay provides +5 V and +12 V power to the drive slots, which accommodates most standard 2.5-inch SATA drives. Drives that require 3.3 V power are not supported. The +12 V total combined continuous power consumption of all installed SATA drives must not exceed 15 W (1250 mA). The +5 V total combined continuous power consumption of all installed SATA drives must not exceed 16.25 W (3250 mA). Exceeding these limits will adversely affect automation controller 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 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. 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. 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, prior to deploying the system.

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Section 4
BIOS Setup

Overview

The SEL-3355 contains a Phoenix SecureCore 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 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 main board control (DIP) switch 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* 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 control (DIP) switch (see *Control (DIP) Switches on page 3.2*).

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

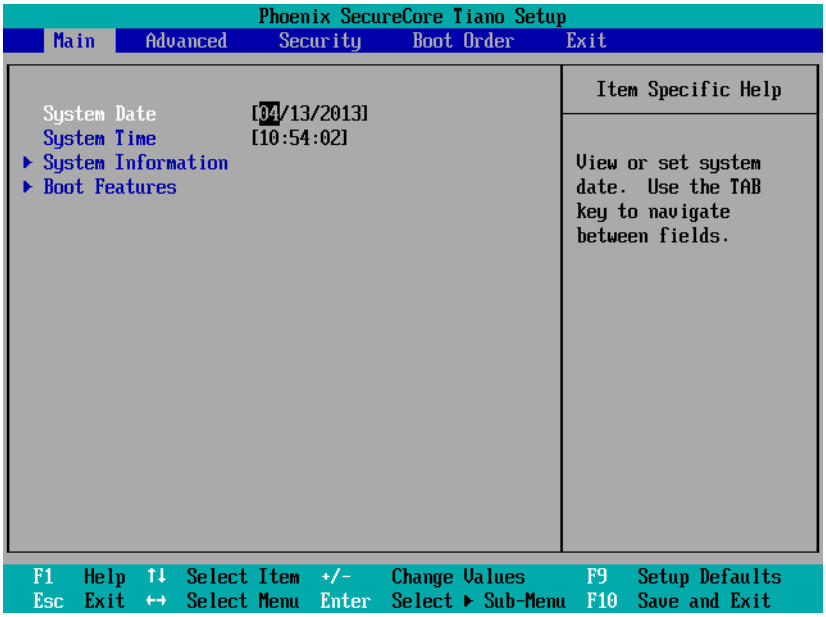

Figure 4.1 BIOS Setup Main Screen

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 greater than symbol (**>**) to the left of the item name. The right side of the screen displays item-specific help for the currently selected item. The bottom of the screen displays the following information:

Left/Right Arrow	Navigate between top-level tabs
Up/Down Arrow	Select different values and submenus in the current menu
+/–	Change the selected setting value
<Enter>	Enter the selected submenu
<Esc>	Exit a submenu
F1 or **<Alt+H>**	View the **Help** screen

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.

System Date and Time

The System Date and System Time settings are used for the SEL-3355 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 Information

System Information contains additional submenus for main board and power supply information and health monitoring. Use the Main Board Information submenu to view the BIOS and firmware versions, processor type and speed, installed memory modules, and total system availability and boot count. Main board power and thermal submenus report system health information such as voltage rail and temperature measurements. The Power Supply submenu

displays the installed power supply types and serial numbers, overall health status, input and output voltage measurements, temperature, and power output.

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 main board watchdog control (DIP) switch (see *Control (DIP) Switches on page 3.2*). 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.

Advanced Menu

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

Boot Configuration

Boot Configuration contains settings that affect compatibility with the operating system being started. These settings include legacy emulation of USB devices such as keyboards and mice, and priority for legacy versus UEFI boot methods. This submenu also contains settings for console redirection, allowing the BIOS setup screen to be streamed out **COM 1** to allow remote terminal access without an attached keyboard or display. Note that some function keys may not work via console redirection, depending on the terminal type and software used.

Processor Configuration

Processor Configuration contains settings that enable or disable advanced features built into the processor. These features include the number of active processor cores and Intel technologies such as Hyper-Threading, Execute Disable, Virtualization, Trusted Execution, SpeedStep, and Turbo Mode.

SATA Configuration

SATA Configuration contains settings that configure the SATA drive controller and check which SATA ports have devices connected. The SATA Interface Mode default setting is set to AHCI for best performance in modern operating systems. This setting can be changed to IDE for compatibility with older operating systems, or to RAID to enable RAID functionality (see *Section 5: SATA Drive RAID*). *Table 4.1* shows the physical location of each of the six SATA ports listed as Hard Disk # in the SATA Configuration menu.

Table 4.1 SATA Port Locations (Sheet 1 of 2)

SATA Port Name	SATA Port Location
Serial ATA Port 0	Not connected
Serial ATA Port 1	SATA drive bay bottom slot
Serial ATA Port 2	SATA drive bay second slot

Table 4.1 SATA Port Locations (Sheet 2 of 2)

SATA Port Name	SATA Port Location
Serial ATA Port 3	SATA drive bay third slot
Serial ATA Port 4	SATA drive bay top slot
Serial ATA Port 5	Main board header J18

System Agent Configuration

System Agent Configuration contains settings to enable the Intel Virtualization Technology for Directed I/O feature, and to select the primary display device when a PCI video expansion card is installed.

South Bridge Configuration

South Bridge Configuration contains settings to disable the Azalia audio controller, PCI port virtualization, and any of the system USB ports. The Intel architecture used in the SEL-3355 has 14 USB ports. Six of these ports are on the front and rear panels of the SEL-3355; the other eight are routed internally. *Table 4.2* indicates the physical location of each of the 14 USB ports listed in the South Bridge USB Configuration menu.

Table 4.2 USB Port Locations

USB Port Number	USB Port Location
USB Port #0	Main board header J28
USB Port #1	Main board header J28
USB Port #2	Main board header J15
USB Port #3	Main board header J15
USB Port #4	Expansion B
USB Port #5	Expansion C
USB Port #6	Rear-panel top port
USB Port #7	Rear-panel second port
USB Port #8	Rear-panel third port
USB Port #9	Rear-panel bottom port
USB Port #10	Front-panel top port
USB Port #11	Front-panel bottom port
USB Port #12	Expansion A
USB Port #13	Not connected

Expansion Slot Configuration

Expansion Slot contains submenus for configuring the five expansion card slots. Depending on the expansion baseboard installed in the SEL-3355, each slot can be enabled or disabled. PCI Express slots can be forced to Gen 1 or Gen 2 speeds, for compatibility with expansion cards that do not negotiate speed properly.

Peripheral Configuration

Peripheral Configuration contains settings to disable the **COM 1** and **COM 2** ports, and to enable the +5 V power COM port feature (see *Serial on page 2.5*).

Network Configuration

Network Configuration contains settings to configure the **ETH1** port Ethernet controller, including OPROM for PXE boot and Wake-on-LAN functionality.

SMBIOS Event Log

SMBIOS Event Log allows you to view and manage entries stored in the SMBIOS event log. These logs can be useful for testing and troubleshooting hardware problems.

AMT Configuration

AMT Configuration contains settings to configure and manage the Intel Active Management Technology features in the SEL-3355. See *Section 9: Intel Active Management Technology (AMT)* for more information.

ME Configuration

ME Configuration displays the Intel Management Engine version information and allows you to disable ME access from BIOS and software applications.

Security Menu

The Security menu tab contains submenus for configuring the BIOS access control 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.

User Administration

User Administration allows you to add, edit, and delete user accounts. When access control is disabled (no authentication required), the only user available is Administrator, and the only action available is Edit User. Use the **Edit User** action to set an Administrator account password, which will enable access control. After enabling access control, you must save changes and exit the BIOS setup before you can add new user accounts. User accounts can be configured as either administrators, which have full read and write access to the BIOS settings and user accounts, or non-administrators, which have read-only access and can only change their account password. To disable user administration, edit the Administrator user and set a blank/empty password.

TPM Configuration

TPM Configuration allows you to view the current TPM state and execute a TPM action. The TPM action selected is executed upon saving and exiting the BIOS setup.

Boot Order Menu

The Boot Order menu tab contains a prioritized list of all bootable interfaces on the SEL-3355. All interfaces are shown regardless of whether a device is attached, allowing you to configure very predictable boot behavior even when new bootable devices are attached to, or removed from, the system. Each interface name is followed by a colon, and if a device is attached to that interface, the device name is displayed after the colon. Interfaces can be moved up and down the list, or disabled to prevent booting certain interfaces.

Exit Menu

The 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>**.

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Section 5
SATA Drive RAID

Overview

The SEL-3355 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 drives (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, 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 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 re-enabled. 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 4.3*). 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

Create the RAID volume before installing any operating system, software, or data files to the drives, because the creation process will destroy all data stored on the drives that are assigned to the RAID volume. If you already have an operating system installed and are creating a RAID volume for secondary storage, you can create the RAID volume by using either the BIOS RAID configuration utility or the Intel RST software. For help creating a RAID volume, refer to the Intel RST software online help.

NOTE: The BIOS RAID configuration utility can only be accessed if two or more SATA drives are installed in the SEL-3355.

To use the BIOS RAID configuration utility, apply power to the SEL-3355 and press **<Ctrl+I>** immediately before the operating system boots up.

In the BIOS RAID configuration utility, use the onscreen menu to create a new volume, specifying the RAID type and drives to be part of the RAID volume. Be careful to select the correct drives, because all data on the drives will be erased when the volume is created. Refer to *Table 4.1* to determine which SATA ports go to which SATA drive bay slots. Once the RAID volume is created, exit the RAID configuration utility. The RAID volume will now function like a single drive, so you can begin loading the operating system or initialize the volume.

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 using the Intel RST software.

To initialize the RAID volume, boot up the SEL-3355, 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 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 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 supports hot-plugging of SATA drives, the repair can be performed without shutting down or otherwise interrupting the normal operation of the SEL-3355.

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 click on the failed drive to determine its port number. The SEL-3355 SATA drive bay ports are numbered 1–4, with Port 1 being the bottom SATA drive bay slot, and Port 4 being the top. If the failed

drive port shows as **unknown**, click on 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 click on the degraded RAID volume. Click 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 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

To install the operating system, determine which 2.5-inch solid-state drives you will use. The SEL-3355 can be ordered without any solid-state drives or with as many as four solid-state 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. Disabling the watchdog prevents the embedded controller from restarting. After installing the operating system, drivers, and SEL System Monitor software, re-enable the watchdog.

BIOS Watchdog Disable

You can use the BIOS setup utility to disable the watchdog by performing the following steps:

Step 1. Press **<F2>** immediately after applying power to the SEL-3355. The BIOS setup main screen will appear.

Step 2. Under Boot Features select **Enable** for the Disable Watchdog setting.

Step 3. Press **<F10>** to save changes and exit the BIOS setup.

Control (DIP) Switch Watchdog Disable

Set Control (DIP) Switch 3 to the ON position to disable the watchdog. See *Control (DIP) Switches on page 3.2* for additional information.

Set Legacy or EFI Boot Modes

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

Connect CD/DVD-ROM

Using Standard CD/DVD-ROM With USB Connection

The following steps describe how to install an operating system from a CD/DVD-ROM equipped with a USB connector.

Step 1. Plug the USB cable from the CD/DVD-ROM into a USB port on the SEL-3355.

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

Step 3. Plug the power supply into the CD/DVD-ROM drive and apply power to the SEL-3355.

Step 4. Press **<F5>** immediately after applying power to display the boot menu, then select the CD/DVD-ROM.

The SEL-3355 will now try booting from the CD/DVD-ROM, and you can continue with the installation process.

Using Preboot eXecution Environment (PXE)

The following steps describe how to install an operating system from a PXE server.

Step 1. Plug the network cable into the SEL-3355 **ETH1** 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 and immediately press **<F5>** to display the boot menu.

Step 3. Select **PCI LAN:** and press **<Enter>** to continue.

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

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 through use of a USB storage device.

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

Step 2. Properly remove the USB storage device from your automation controller.

Step 3. Apply power to the SEL-3355.

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

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 Ethernet ports.

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

See *Common Operation Oversights 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.

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

Overview

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 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 7.1 shows an overview of how SEL SysMon collects status data from the SEL-3355 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 7.1 SEL SysMon Overview

SEL SysMon is factory-installed on SEL-3355 automation controller platforms that include an operating system. If you install your own custom operating system on the SEL-3355, see *Installing and Updating SEL SysMon*.

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.

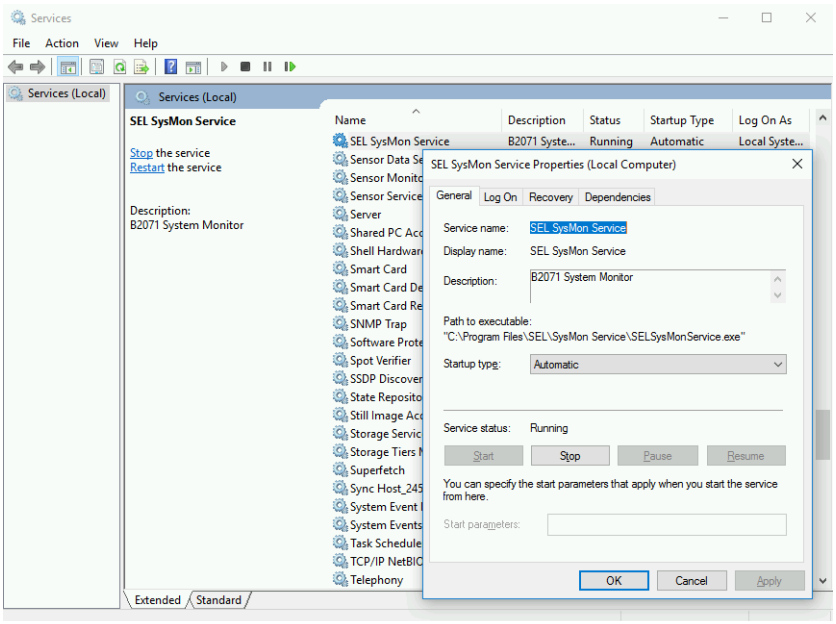

Figure 7.2 SEL SysMon Service in Windows Services Control Panel

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 main board device driver and the Windows performance counter interface. The SEL-3355 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 in an attempt to recover to an operational state.

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 main board control (DIP) switch.

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.

Step 2. Set the Password Reset control (DIP) switch to the ON position (see *Control (DIP) Switches on page 3.2*).

Step 3. Turn the SEL-3355 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 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 (see *User Accounts and Passwords on page B.5*).

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.

Step 2. Set the Password Reset control (DIP) switch back to the OFF position.

Step 3. Turn the SEL-3355 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, click the up-arrow to show all hidden tray icons (see *Figure 7.3*).

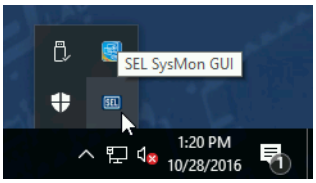

Figure 7.3 SEL SysMon GUI Tray Icon

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.

Clicking on 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 7.4*).

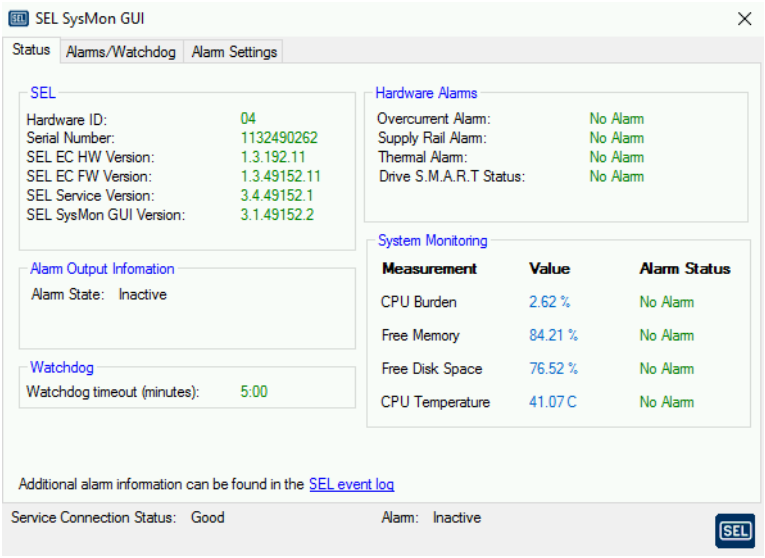

Figure 7.4 SEL SysMon GUI Status Tab

SEL Group

The SEL group displays the main board hardware ID, SEL-3355 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 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 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 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*).

Alarms/Watchdog Tab

The **Alarms/Watchdog** tab provides controls for testing and muting the alarm output, for setting the watchdog timeout value (see *Figure 7.5*).

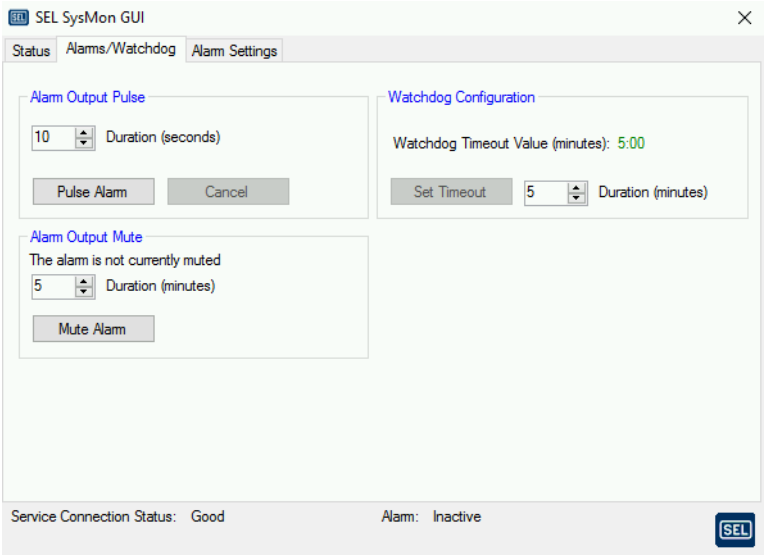

Figure 7.5 SEL SysMon GUI Alarms/Watchdog Tab

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 click 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 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 7.6*).

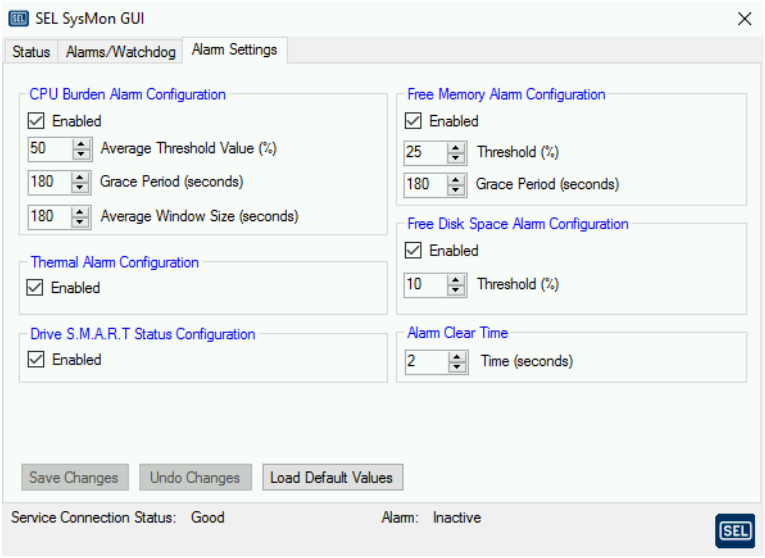

Figure 7.6 Alarm Settings Tab

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. 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. Click **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, click the **Undo Changes** button. Clicking the **Load Default Values** button will change all settings to factory defaults, at which point you can click 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 7.1* lists all performance counters and objects that SEL SysMon provides.

Table 7.1 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, 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. 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 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. 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.

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. 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 automation controller platforms that include an operating system. If you install your own custom operating system on the SEL-3355, 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 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 *Boot Features on page 4.3* for information on how to disable the watchdog.

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 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 automation controller).

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 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 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. This section briefly describes a few common backup methods that can be used on the SEL-3355.

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 using open-source technology, and it is provided free of charge.

The SEL BaRT is available on the SEL website at selinc.com/software/downloads/?search=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, 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 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 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.

Bootable or online methods enable you to create backups without removing the SATA drives from the SEL-3355. 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 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 SATA drive. These methods require removing the SATA drives from the SEL-3355 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 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.

Intel Active Management Technology (AMT) is a subset of the Intel vPro Technology present in the CPU of the SEL-3355. It provides out-of-band access and management of the SEL-3355 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 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, which is how all out-of-band management is performed. After AMT provisioning (see *Enabling AMT*) you can use a web browser to reach the AMT web interface of the SEL-3355 from another workstation.

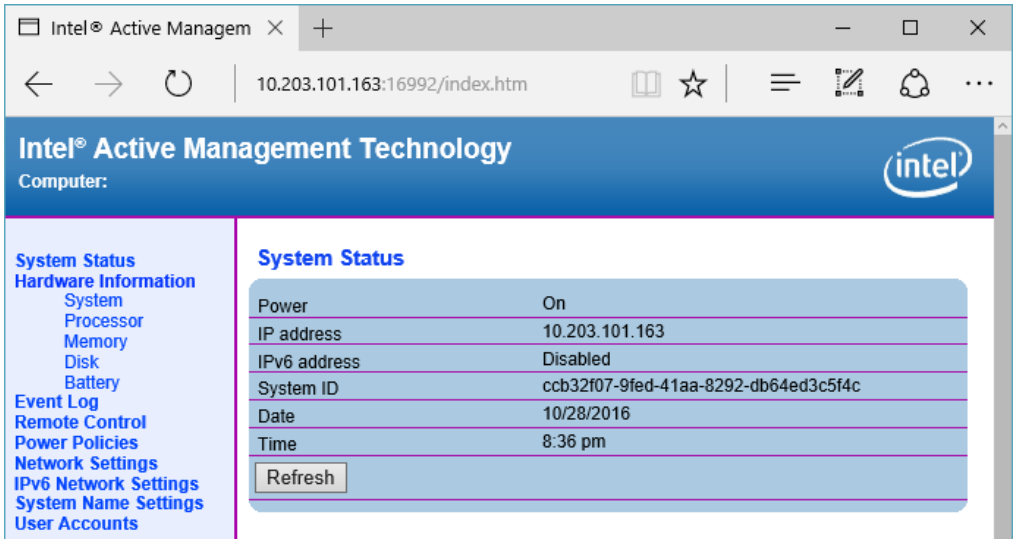

Figure 9.1 Intel AMT Web Interface

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. 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. It also includes an IP KVM feature that allows you to see the display and control the keyboard and mouse of the SEL-3355, even when no operating system is installed.

Remote Monitoring

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

Enabling AMT

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

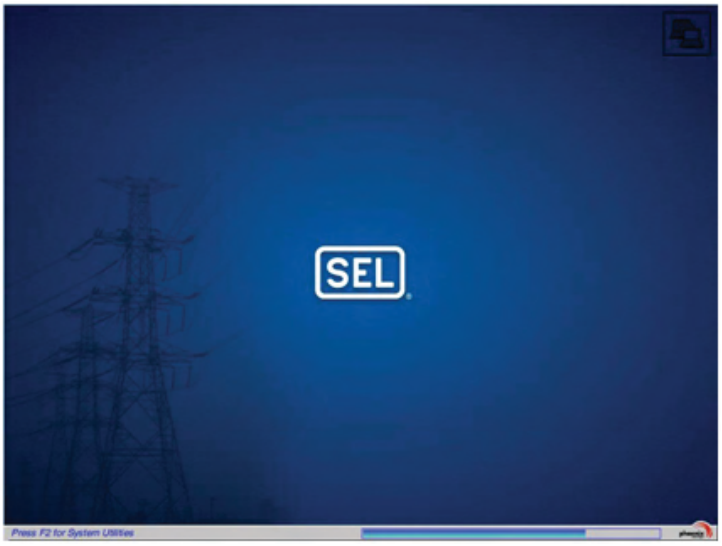

Figure 9.2 SEL-3355 Startup Screen

Step 1. Select the **Advanced** tab, then select **AMT Configuration** and press **<Enter>**.

Note that when AMT is disabled you will only see the top-level option to enable or disable **Intel (R) AMT**.

Step 2. To enable AMT, press **<Enter>**, select **Enabled**, and press **<Enter>** again.

You will then see the rest of the AMT BIOS configuration options appear. It is safe to ignore most of these options because they are all accessible through the main AMT configuration interface.

Step 3. To open the AMT configuration interface select **Intel AMT Setup**, press **<Enter>**, select **Enabled**, and press **<Enter>** again.

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 9.3*.

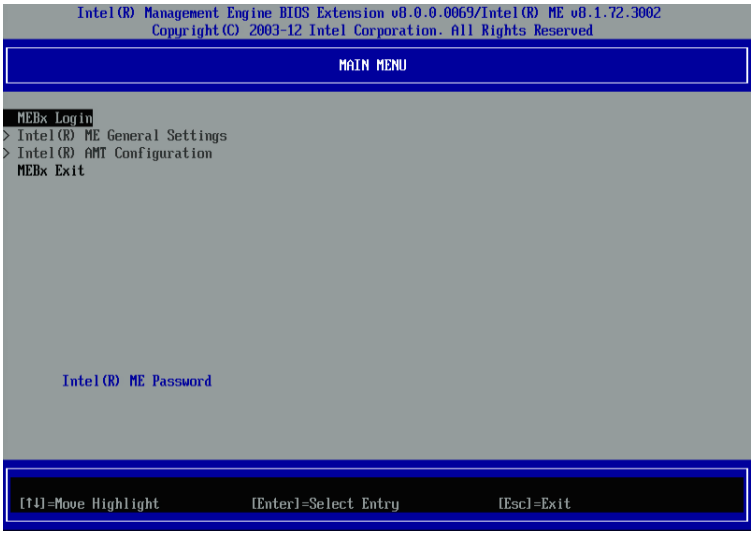

Figure 9.3 Intel AMT Main Menu

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

NOTE: Choose a unique and sufficiently complex password. See User Accounts and Passwords on page B.5.

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. 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 9. Select **Network Setup > TCP/IP Settings > Wired LAN IPV4 Configuration**. Here you can set a static IP address. If you prefer DHCP, leave the **DHCP Mode** set to **Enabled**.

Step 10. Once you have configured the IP information, press **<Esc>** *twice* to go back to the main AMT network configuration menu.

Step 11. Select **Intel (R) ME Network Name Settings** to choose a host name for the automation controller 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.

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Section 10
Troubleshooting

Overview

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

Common Operation Oversights

Blank Monitor

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

Table 10.1 Blank Monitor Troubleshooting

Symptoms/Possible Cause	Diagnosis/Solution
VGA-connected monitor indicates no signal present	➤ Plugging a DVI-to-VGA adapter into the DVI-D video interface will not pass any VGA signal. The DVI-D video interface has no VGA signal or pins to pass the signal. Plug into the DVI-I video interface instead.
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.
Equipment failure	➤ Contact your automation controller administrator if you cannot determine the cause.
SEL-3355 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 is connected to a power source that meets the input ratings stenciled on the back of the power supplies.

Fails to Boot Windows

Undesirable operating conditions, such as sudden loss of power, system lockup, or failed software installations, may adversely affect standard Microsoft Windows or Windows Server installations, preventing the system from booting up and running properly. Often the system can be restored to a workable state by using the following startup options (on some Windows versions, these options can be accessed by pressing **<F8>** immediately before Windows boots):

- **Repair Your Automation Controller (Windows 7 and Server):** Starts the Windows Recovery Environment, which has options for repairing the system automatically and restoring a previously saved system image. The Windows

Recovery Environment also has a command prompt interface that can be used to run tools such as check disk or other troubleshooting tools from a USB storage device.

- **Safe Mode:** Attempts to start Windows with only the bare minimum hardware drivers and system services. If this mode successfully boots up the system, try to uninstall any software or hardware that may have caused the boot failure and schedule a boot time disk check. A simple restart may restore the system to a workable state.
- **Last Known Good Configuration:** Restores the Windows system files and settings to the state they were in during the last successful startup, possibly restoring the system to a bootable state.

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 click on the **CPU** column header to sort by CPU usage. Select the process showing high CPU usage and click **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 automation controller system networking is an extremely broad topic, there are a few steps that can help with simple network troubleshooting. Ensure that the Ethernet hub, switch, or router is compatible with the SEL-3355. See *Specifications on page 1.5* to determine compatible network interfaces. Verify that the SEL-3355 and the network are communicating by observing the LEDs associated with the Ethernet network switch or hub. If the LEDs display no activity, then verify that the proper cabling exists. If you are sure the Ethernet cabling is correct, then try disabling the firewall temporarily and ping the SEL-3355 from another desktop computer or laptop. As a basic rule, nothing will work if pinging does not work. When pinging, use an IP address or automation controller 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, this most often means that a drive with an operating system was not found. This is most often caused by a drive boot order different from what is intended. To fix this problem, enter the BIOS setup and verify the boot order so that the intended boot drive is the first drive found. Ensure that the drive with your operating system is listed first under the **Boot Order** menu (see *Boot Order 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

There are three ways to reset a forgotten password. Use the SEL SysMon software's Password Recovery feature to set a new password. See *Password Recovery on page 7.3* for more information.

Another way to reset a forgotten password is to use the password recovery feature of Windows, which requires you to have previously created a password recovery disk. Details for using this method are outside the scope of this manual.

The third way to recover a forgotten password is to boot from a password reset tool. Several commercial and open-source tools are available to do this. Please refer to your security policies for how your company requires forgotten passwords to be handled. SEL can provide a recommendation for a commercial password reset tool—see *Technical Support*.

IRIG Time Synchronization

If you have an IRIG time source properly connected to COM1 or Port 1 on an installed SEL-3390S8 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.

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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Pullman, WA 99163-5603 U.S.A.
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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 4)

Date Code	Summary of Revisions
20221221	Section 1 ➤ Added UKCA Mark to *Specifications*.
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*.
20190109	Preface ➤ Updated *Safety Symbols* in *Safety Information*. Section 1 ➤ Updated *Specifications*. Section 9 ➤ Updated *Figure 9.3: Intel AMT Main Menu*.
20170127	Section 1 ➤ Updated *Specifications*. Section 2 ➤ Updated *SATA Drive Bay*. Section 3 ➤ Updated *SATA Drives*. Section 8 ➤ Updated *Backup and Recovery Methods*. Section 10 ➤ Updated *Table 10.1: Blank Monitor Troubleshooting*. ➤ Added *SATA Drive Failures*.
20161109	Section 7 ➤ Updated figures for Microsoft Windows 10. Section 9 ➤ Updated *Figure 9.1: Intel AMT Web Interface* for Windows 10.

Table A.1 Instruction Manual Revision History (Sheet 2 of 4)

Date Code	Summary of Revisions
	Appendix B ➤ Updated references to Windows operating systems. ➤ Updated figures for Windows 10.
20160921	Section 1 ➤ Updated *Specifications*. ➤ Updated *Table 1.1: System Power Consumption*. Section 7 ➤ Updated *SEL SysMon GUI*.
20160908	Section 1 ➤ Updated *Specifications*. Section 2 ➤ Updated *Figure 2.4: Rear-Panel Diagram*.
20160505	Preface ➤ Added *Trademarks*. Section 1 ➤ Updated *Specifications*. Section 2 ➤ Added Warning to *Power*. Section 3 ➤ Added *Replacing the Real-Time Clock and BIOS Battery*.
20160311	Section 1 ➤ Updated *Features*. ➤ Updated *Specifications*. Section 2 ➤ Updated *Figure 2.2: Front Rack-Mount Diagram*. ➤ Updated *Status Indicators*. ➤ Updated *Figure 2.4: Rear-Panel Diagram*. ➤ Updated *Ethernet*. ➤ Updated *Serial*. ➤ Updated *Alarm Contact*. ➤ Updated *Power*. ➤ Updated *Figure 2.8: Power Connections*. ➤ Updated *Initial Checkout and Startup*. Section 3 ➤ Updated *SATA Drives*. Section 6 ➤ Updated *Control (DIP) Switch Watchdog Disable*.
20160105	Section 1 ➤ Updated *Specifications*.
20150916	Section 1 ➤ Updated *Specifications*.
20150803	Section 1 ➤ Updated *Specifications*.
20150721	Preface ➤ Updated the *General Safety Marks* table. Section 1 ➤ Updated *Specifications*.

Table A.1 Instruction Manual Revision History (Sheet 3 of 4)

Date Code	Summary of Revisions
	Section 7 ➤ Updated the information under *Password Recovery*.
20150520	Preface ➤ Updated *Safety Information*. Section 1 ➤ Updated *Specifications*. Section 3 ➤ Updated *Figure 3.1: Main Board Diagram*. ➤ Added COM1 jumper information. Section 10 ➤ Added *IRIG Time Synchronization*. Appendix B ➤ Updated appendix.
20150126	Preface ➤ Added *Safety Information*.
20141212	Section 1 ➤ Updated *Specifications*. Section 3 ➤ Updated *Figure 3.5: Power Supply Installation*. ➤ Updated *Figure 3.6: SATA Drive Bay*.
20141205	Section 1 ➤ Updated *Options*. ➤ Updated *Specifications*. Section 7 ➤ Updated *Table 7.1: Peripheral Connection Current Limits*.
20140523	Section 3 ➤ Added cautionary note regarding battery replacement. ➤ Removed 3.3 V power rail information from *SATA Drives*.
20140516	Section 1 ➤ Updated *Specifications*. Section 4 ➤ In *Table 4.2: USB Port Location*, changed references to Main Board Header J24 to J28, and J12 to J15. Section 10 ➤ Changed references to Windows 7 Ultimate to Windows 7. Appendix B ➤ Changed references to Windows 7 Ultimate to Windows 7.
20140227	Section 1 ➤ Updated *Specifications*. Section 2 ➤ Updated *Figure 2.4: Rear-Panel Diagram*. Section 3 ➤ Updated *Figure 3.5: Power Supply Installation*. Section 5 ➤ Added warning about system page file in *Configuring RAID Volumes*.

Table A.1 Instruction Manual Revision History (Sheet 4 of 4)

Date Code	Summary of Revisions
	Section 7 ➤ Updated the location and usage for SELalarm and SELAuxLED in *Command-Line Programs*.
20130830	➤ Initial version.

Appendix B
Microsoft Windows System Configuration

Overview

This section describes the important features of the Microsoft Windows operating systems (OS) available on the SEL-3355. SEL offers the general purpose and Server versions of Windows as factory-installed options.

Windows operating systems offer a balance of expandability, security, reliability, functionality, and maintainability. Windows Server provides numerous roles such as Active Directory (AD), DNS, Domain Controller, and Web Server. Windows Server also provides high-availability features, such as clustering, not available with Windows client operating systems.

Security

The Windows operating systems installed from the factory on the SEL-3355 use the default Microsoft installation options, with the exceptions noted in *Factory-Default Settings*.

Reliability

Reliability is achieved by solid SEL designed hardware and quality components, and also, in a large part, by restricting your SEL-3355 to a limited set of software applications, and drivers that are thoroughly tested for compatibility and stability. Do not add unnecessary software applications to the SEL-3355.

Functionality

Most networks, software, and hardware are designed to be used with Windows. For legacy applications that do not run properly on current Windows operating systems, Windows XP Mode and Windows virtualization software are available.

Maintainability

PC-AT compatible hardware and Windows compatible software provide opportunities for future growth and backward compatibility. Windows Server operating systems include a number of integrated services to enable enterprise management, network services, and virtualization technologies.

Enterprise Management

Active Directory Domain services allow the Microsoft Windows Server OS to become a primary or backup domain controller. This enables single sign-on access in remote locations to AD and Lightweight Directory Access Protocol (LDAP) capable devices, even with limited connectivity to the corporate network.

Network Services

Services such as Dynamic Host Configuration Protocol (DHCP) and DNS server, file server, and web server on Microsoft Windows Server enable connectivity, integration, and management of devices on the network. All Ultimate, Professional, and Enterprise versions of Windows allow for full connectivity to Microsoft AD domains.

Virtualization

Leverage the Intel Core i7 processor on the SEL-3355 for the latest in hardware virtualization (Intel Virtualization Technology, Intel Trusted Execution Technology [TXT], Intel Virtualization Technology [VT] for Directed I/O).

Factory-Default Settings

The SEL-3355 is shipped from the factory with modifications to the Microsoft Windows default configuration of the operating system. Each of these modifications is described in this section.

Username/Password

There is no default password set for the administrator account on Windows because the Microsoft default is for the administrator account to be disabled. During the first boot the user is prompted to choose a username and password for an administrator account. On Windows Server, the administrator account already exists, and the user is prompted to choose a password on the first boot. See *Section 10: Troubleshooting* for information on how to recover a forgotten password.

Automation Controller Name

A automation controller name is set by default at the factory to be **SEL<SN>** where <SN> is the serial number of the SEL-3355.

Locale

The default locale is set to English and time is set to Pacific Daylight Time (PDT).

Virtual Memory

Virtual memory uses the system disk to expand system memory (RAM) when application demand exceeds the system RAM capacity. Exceeding system RAM greatly diminishes performance, because disk access is orders of magnitude slower than RAM access. Virtual memory also accelerates wear on the solid-state storage. For these reasons, Virtual Memory has been set to **No Page File** on Windows versions previous to Windows 10 and all versions of Windows Server. You can enable virtual memory if your application requires it, but performance can be impacted.

General System Configuration

Once logged on, the SEL-3355 provides access to Windows functions and software through the standard Windows desktop interface (see *Figure B.1*).

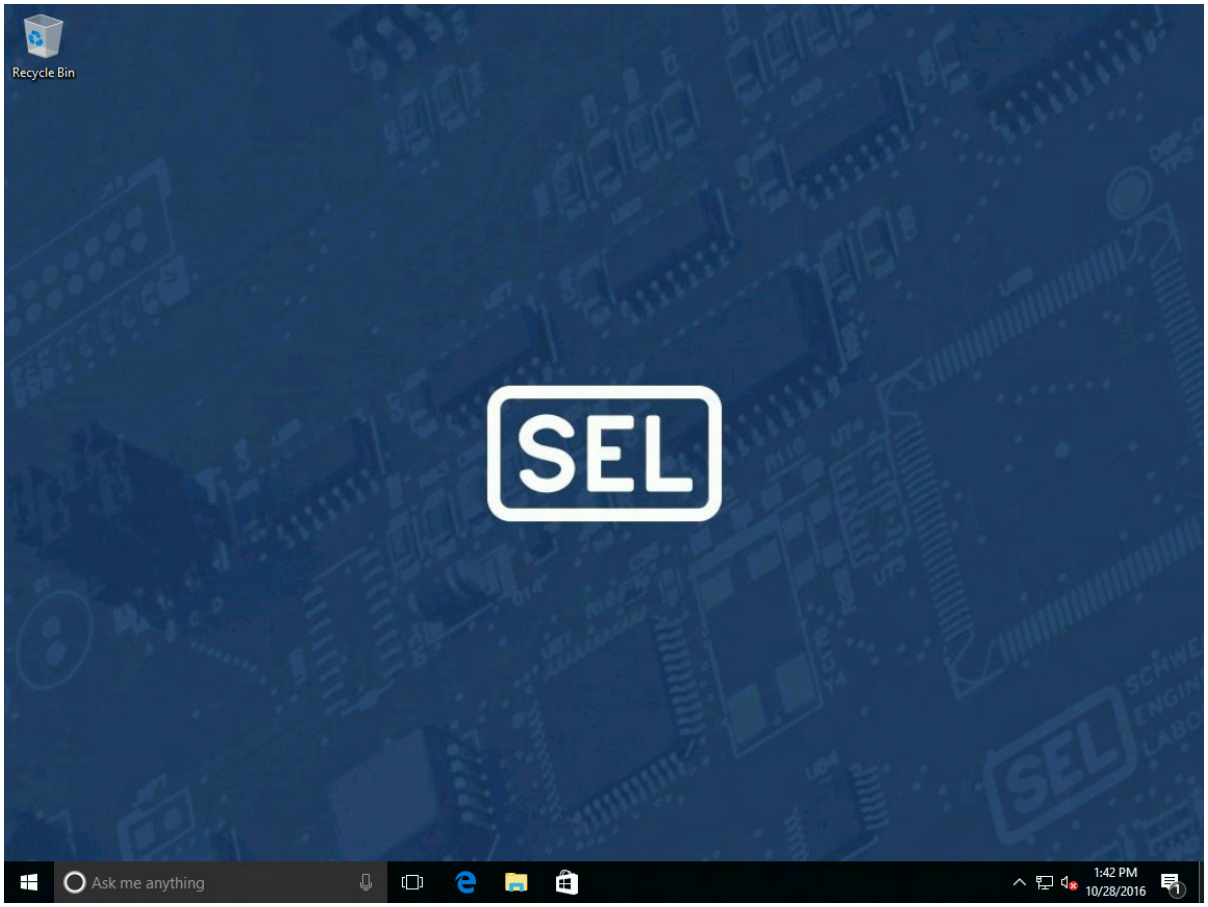

Figure B.1 Windows 10 Desktop Interface

Logging On and Off

The SEL-3355 maintains the standard Windows logon methods. *Figure B.2* shows the standard Windows logon dialog box.

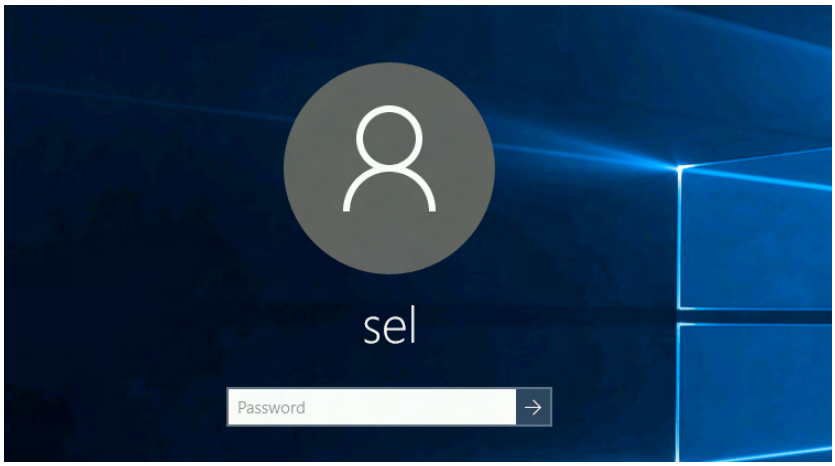

Figure B.2 Logon Dialog

The method used to log off depends on the version of Windows in use. Most modern versions use one of these two methods:

- Click the **Start** button and then the **Log off** button or the arrow by the **Shut down** button.

➤ Click the **Start** button, then the user icon, and finally the **Sign out** menu item.

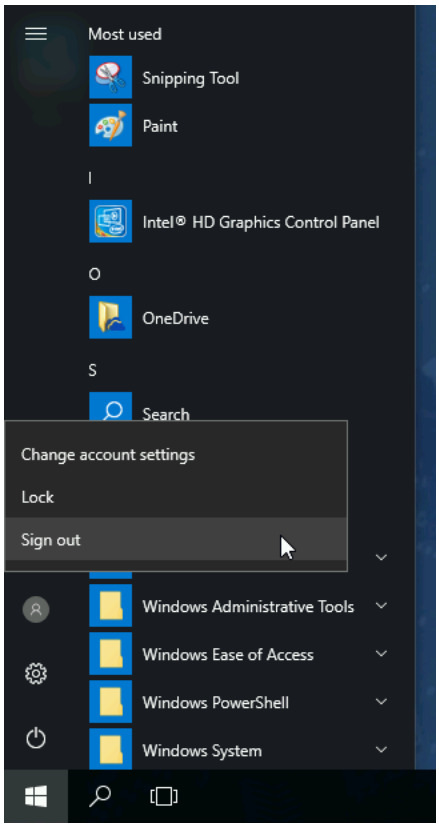

Figure B.3 Logging Off of Windows 10

Display

To access the OS display property options on the SEL-3355, right-click on the desktop background and select **Screen Resolution** or **Display Settings**. The standard Windows display features are available.

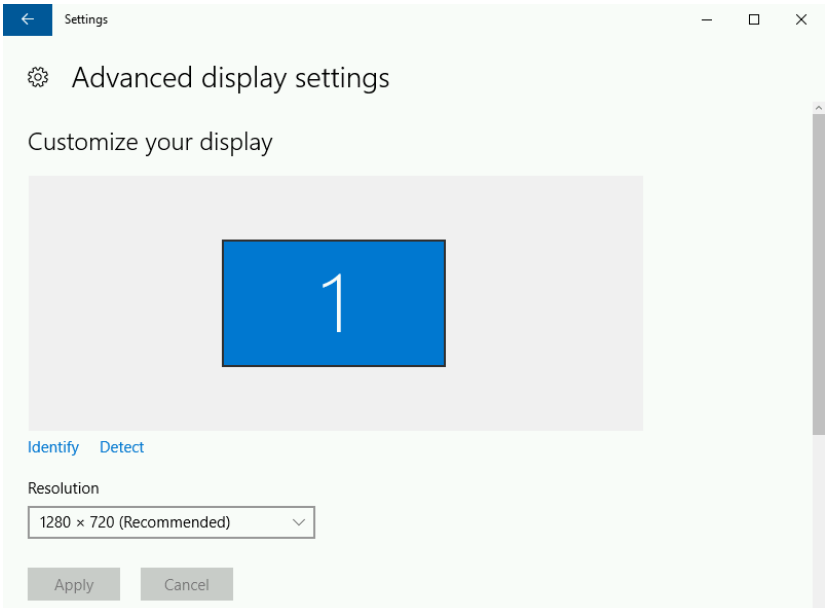

Figure B.4 Display Properties

You may also use the Intel HD Graphics Control Panel **<Ctrl+Alt+F12>** to control display settings or right-click on the background and select **Graphics Properties**. Use the **Help** available from each of these tools for assistance configuring the display(s).

User Accounts and Passwords

NOTE: Passwords and usernames should be configured during initial setup to ensure device security. See Section 10: Troubleshooting for ways to access or reset forgotten passwords.

The SEL-3355 contains the standard Windows User Accounts accessible through the Control Panel. To add or remove user accounts to Windows 7 or Windows Server 2012, open the Control Panel and use the corresponding link under the User Accounts and Family Safety category (Windows 7) or under the User Accounts (Windows Server and later versions of Windows) from the SEL-3355 Control Panel window. For Windows 10, open PC Settings and click the **Accounts** icon then **Family & other people** (see *Figure B.5*).

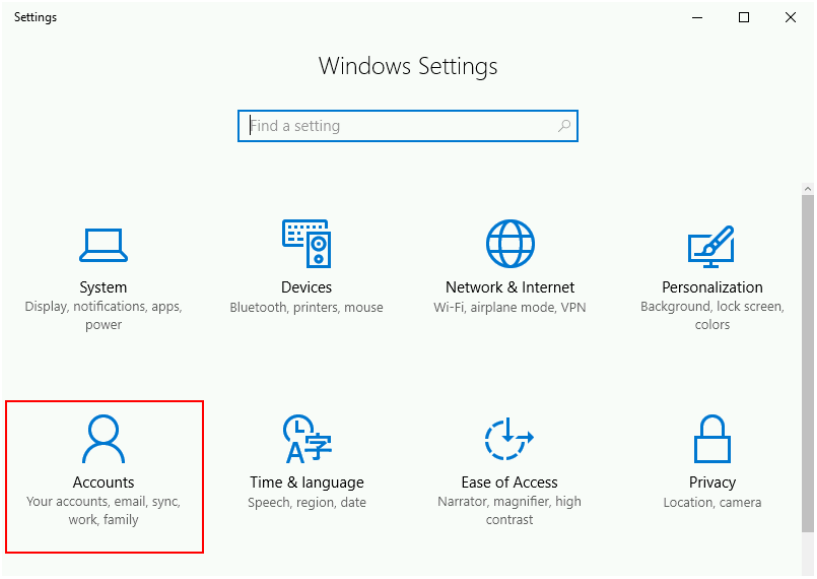

Figure B.5 Selecting User Accounts From the Control Panel (Windows 10)

During initial setup the first user account created is made a member of the Administrators group.

The Administrator account remains enabled when booting in Safe Mode. Individuals in the Administrators group have complete and unrestricted access to the following automation controller/domain functions:

- Upgrade the operating system
- Install Windows or software updates
- Configure critical automation controller-wide operating system parameters
- Take ownership of objects
- Configure the network

The management of passwords is controlled in the User Accounts dialog box. SEL recommends the following criteria in selecting a password:

- Passwords can be as many as 127 characters in length.
- Password contains at least eight nonblank characters, provided such passwords are allowed by the operating system or application.

- Password contains a combination of letters (preferably a mixture of upper and lowercase), numbers, and at least one special character within the first seven positions, provided such passwords are allowed by the operating system or application.
- Password contains a nonnumeric character in the first and last position.
- Password does not contain the user ID.
- Password does not include your own name, other familiar names, employee serial number, Social Security number, birth date, phone number, or any information about you that could be easily learned or guessed.
- Password does not include common words that would be in an English dictionary or from another language with which the user has familiarity.
- Password does not employ commonly used proper names, including the name of any fictional character or place.
- Password does not contain any simple pattern of letters or numbers, such as "qwertyxx" or "xyz123xx."
- Password used on unclassified systems is different from the passwords used on classified systems.

To change the password of the currently logged-in user, press **<Ctrl+Alt+Del>** and select **Change a password**. The process used to change the password for another user account varies depending on the version of Windows. In general, these settings can be accessed by opening the Control Panel and either clicking **User Accounts and Family Safety > User Accounts** or clicking **User Accounts > User Accounts**, and then clicking either **Manage User Accounts** or **Manage another account**. Select the user account to edit, and then select the link for changing the password.

Automation Controller Name

Every automation controller on an Ethernet network must have a unique name. This name should be something meaningful and easy to remember. The following are three different ways to open **System Properties** to change the automation controller name:

1. Type **sysdm.cpl** into the start menu search box.
2. Right-click on the Computer option on the Start menu and select **Properties**.
3. Open the Control Panel, then click **System and Security > System**.

If you chose one of the last two options, then you will need to click **Advanced system settings** on the left menu, then click the **Computer Name** tab, (see *Figure B.6*).

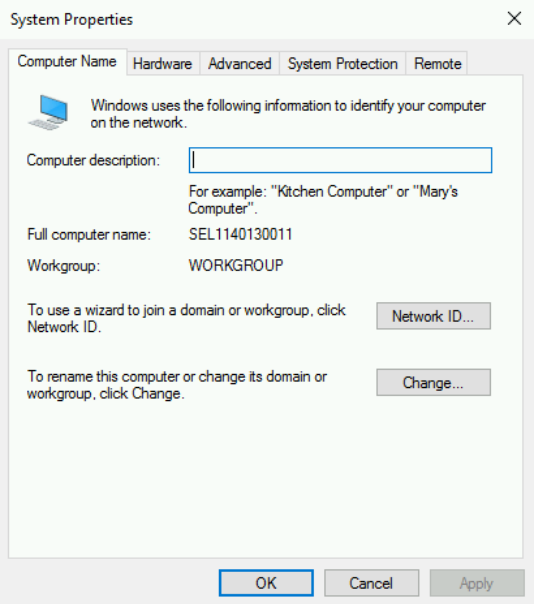

Figure B.6 System Properties

To rename the automation controller or change its domain or workgroup, click **Change** to display the **Computer Name/Domain Changes** (*Figure B.7*). Type in a new automation controller name and select **OK** to save your changes. Changing the automation controller name requires a restart for the change to take effect.

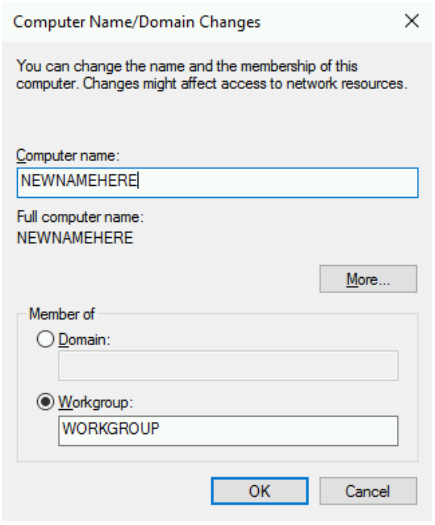

Figure B.7 Name Change Window

TCP/IP Settings

TCP/IP defines how your automation controller communicates with other computers. Perform the following steps to change TCP/IP settings for any of the network adapters.

Step 1. Open the network connections

a. Click the **Start** button.

b. Type **network connections** in the search box.

c. Click **View network connections**.

Step 2. Right-click the connection that you want to change, and then click **Properties**.

Step 3. Click on the **Networking** tab.

a. In the **This connection uses the following items** group, select either **Internet Protocol Version 4 (TCP/IPv4)** or **Internet Protocol Version 6 (TCP/IPv6).**

b. Click on **Properties**.

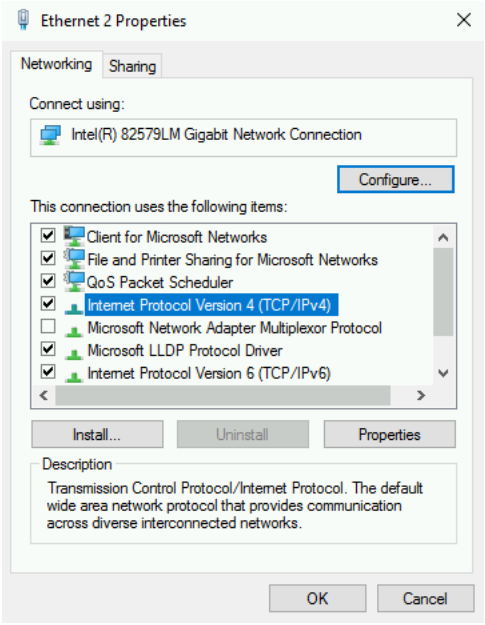

Figure B.8 Network Connection Properties Dialog Box

Step 4. To configure the IP address, do one of the following:

a. To get IP settings automatically by using DHCP, click **Obtain an IP address automatically**, and then click **OK**.

b. To specify an IP address, click **Use the following IP address**, and then type in the IP address settings.

Step 5. To specify DNS server address settings, do one of the following:

a. To get a DNS server address automatically by using DHCP, click **Obtain DNS server address automatically**, and then click **OK**.

b. Specify a DNS server address by clicking **Use the following DNS server addresses**, and then, in the **Preferred DNS server** and **Alternate DNS server** boxes, type the addresses of the primary and secondary DNS servers.

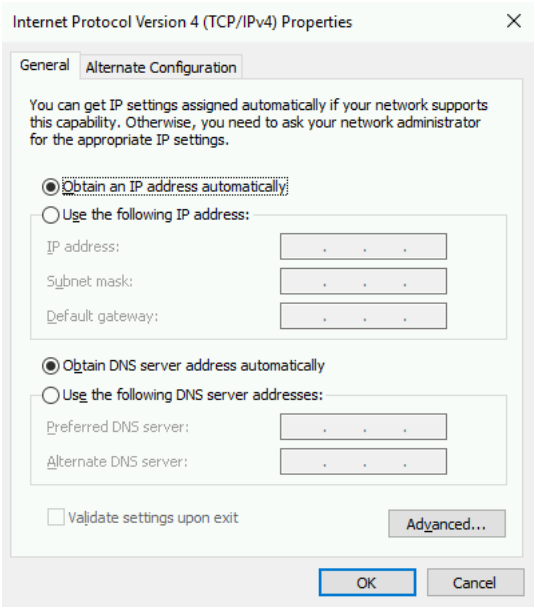

Figure B.9 Internet Protocol Version 4 (TCP/IPv4) Properties Dialog Box

Step 6. To change advanced DNS, WINS, and IP settings, click **Advanced**.

Firewall

You should not turn off Windows Firewall unless you have another firewall enabled. Turning off Windows Firewall can make your automation controller and network more vulnerable to damage from malware or hackers.

To turn the Windows Firewall on or off, perform the follow steps:

Step 1. Click the **Start** button.

Step 2. In the search box type **firewall**.

Step 3. Click on **Windows Firewall**.

Step 4. Click **Turn Windows Firewall on or off**.

Step 5. Click the desired firewall setting under each network location and then click **OK**.

Local Security Settings

Standalone Windows automation controllers are not part of Active Directory and group policies do not apply to them. Follow these steps to access the local security settings to view and edit a local security policy:

Step 1. Click the **Start** button.

Step 2. In the search box type **secpol.msc**.

Step 3. Click on **secpol.msc**.

You should see the **Local Security Policy** dialog box, as shown in *Figure B.10*.

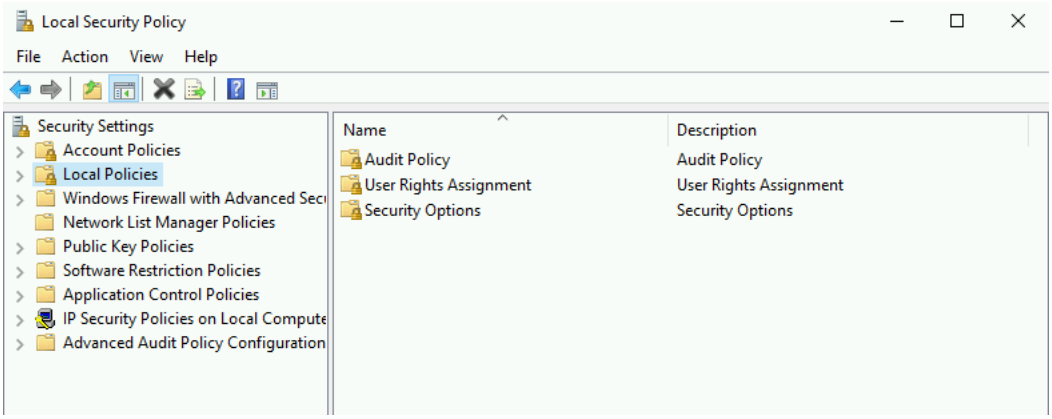

Figure B.10 Local Security Policy Editor

Step 4. Open items in the tree to find the policy that you would like to change (*Figure B.11*).

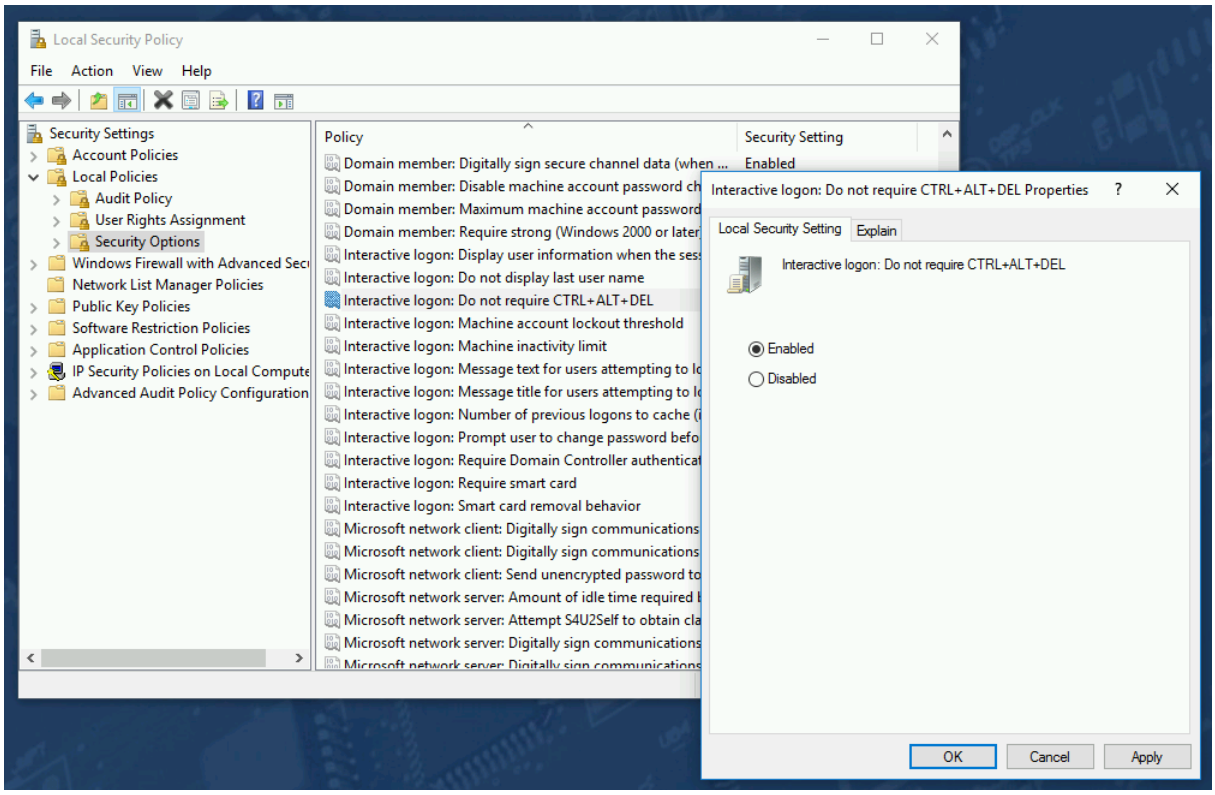

Figure B.11 Changing Local Security Policy

Step 5. Double-click the policy, make the change, and then click **OK**.

Step 6. Close the **Local Security Policy** window.

Remote Desktop

Use Remote Desktop Client (**mstsc.exe**) to remotely connect to or from another Windows computer. Linux workstations also have a remote desktop client usually named **rdesktop**. Remote Desktop may be enabled to permit connections using **Windows Remote Desktop Connection** from other computers. To allow access via **Remote Desktop**, select the **Remote** tab of the Windows **System Properties** dialog box (see *Figure B.12*). Use the **Select**

Users function to limit who may have access to the SEL-3355. Users in the Administrators and Remote Desktop Users group are allowed access by default.

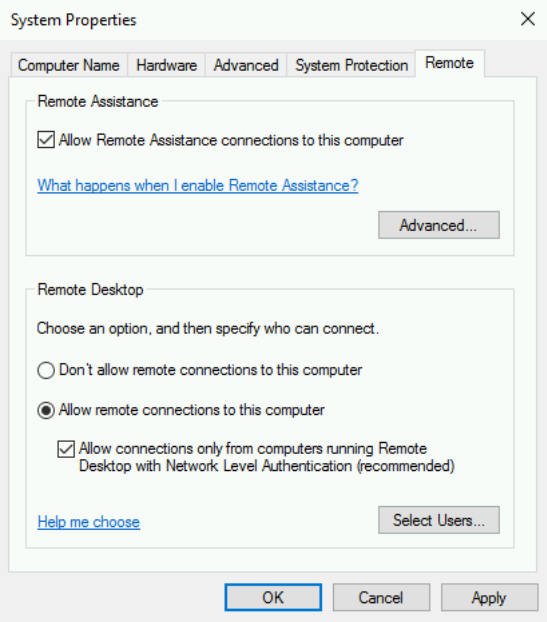

Figure B.12 Remote Desktop System Properties Dialog Box

Date and Time

The SEL-3355 System Date and Time may be configured to synchronize over a network connection by using Network Time Protocol. A satellite clock and demodulated IRIG-B connection may also be used to synchronize the system time by connecting it to COM 1 or an optional SEL-3390S8 serial PCIe expansion card. The SEL-3390S8 serial card also can provide demodulated IRIG-B to other serial connected devices. If IRIG-B input is lost or is not connected, the automation controller system clock becomes the time source for IRIG output.

Services

Use the Services interface to specify what action the SEL-3355 takes during a trouble or failure condition associated with a service. Perform the following steps to access the Windows Services interface.

Step 1. Click the **Start** button.

Step 2. In the search box, type **Component Services.**

Step 3. Select the matching program found.

Step 4. Select **Services (Local)** in the left navigation pane (see *Figure B.13*).

The Windows Services interface lists all of the service processes that are running on the Windows operating system. *Figure B.13* shows the **Component Services** window for viewing the **Standard** tab.

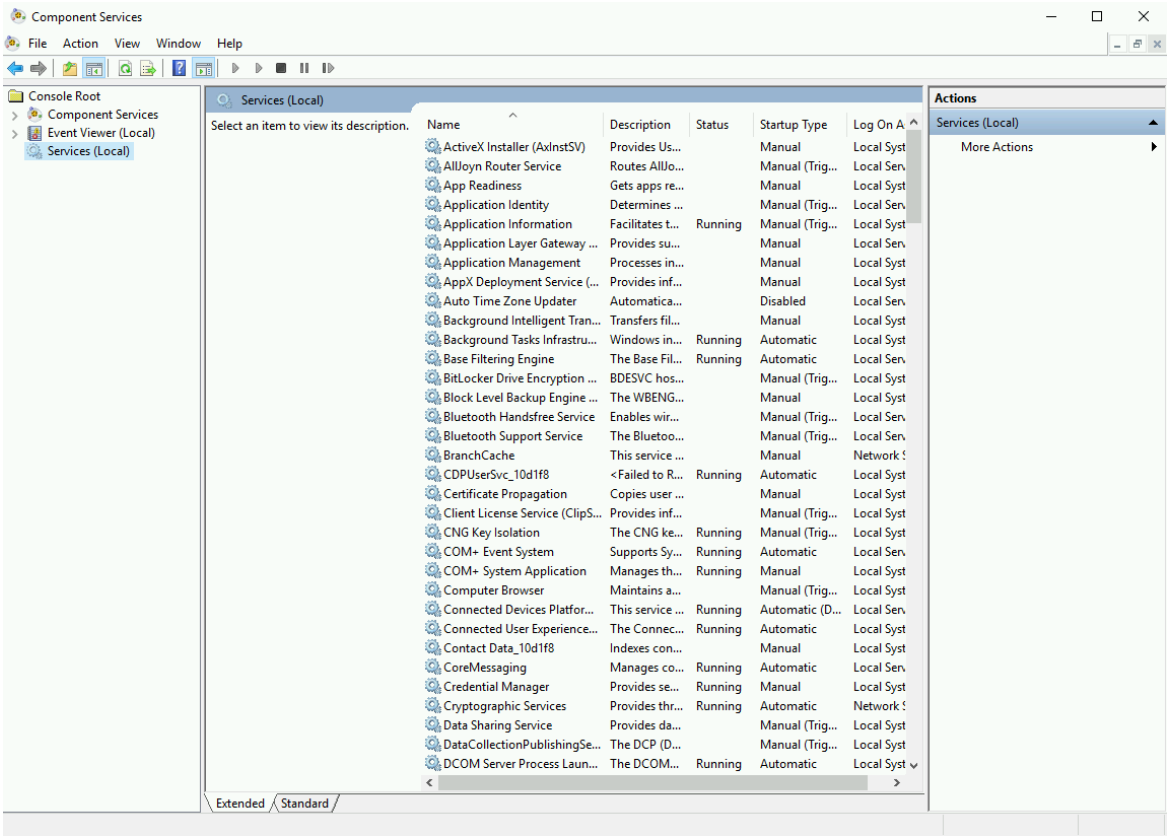

Figure B.13 Component Services Window

You can use the **Properties** dialog of a service (*Figure B.14*) to perform first, second, and subsequent failure recovery actions for a service including restarting the service, running a program, or even restarting the automation controller.

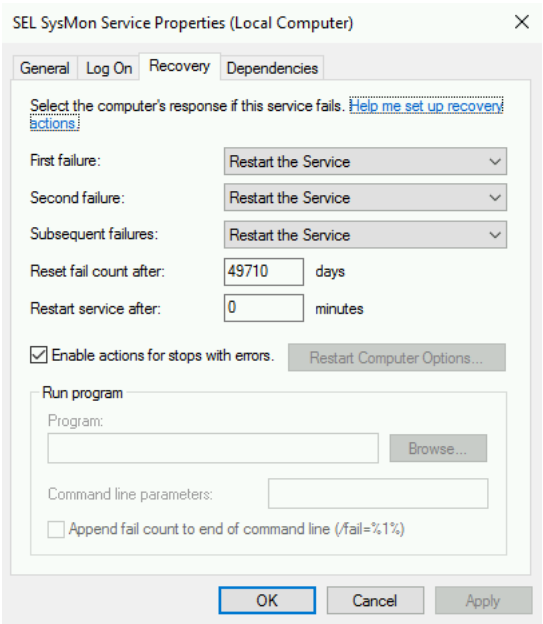

Figure B.14 Recovery Actions for Services

Device Drivers

A driver is software that allows your automation controller to communicate with hardware or devices. Without drivers the hardware you connect to your automation controller will not work properly. The **Device Manager** lets you verify which drivers are in use and what their status is. To open the **Device Manager** select **Start** and type in **Device Manager**, then select the matching program found.

SEL provides two drivers for the main board—an upgrade controller driver and the B2071 main board driver (shown in *Figure B.15*). If you have recently added additional hardware to your SEL-3355 and it is not operating properly, then the **Device Manager** is the first place to look. If a device or driver is malfunctioning you will see a yellow exclamation mark or a red X over the device.

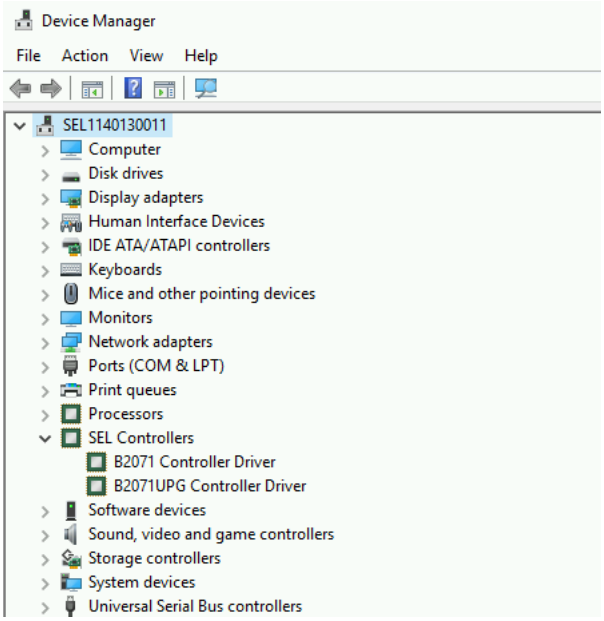

Figure B.15 Device Manager

Event Viewer

The main tool for troubleshooting Windows and Windows applications is the **Event Viewer** (*Figure B.16*). To access the **Event Viewer**, either select **Event Viewer (Local)** from the **Component Services** screen or click **Start**, type **eventvwr** into the search box, and select the program to launch the **Event Viewer** directly.

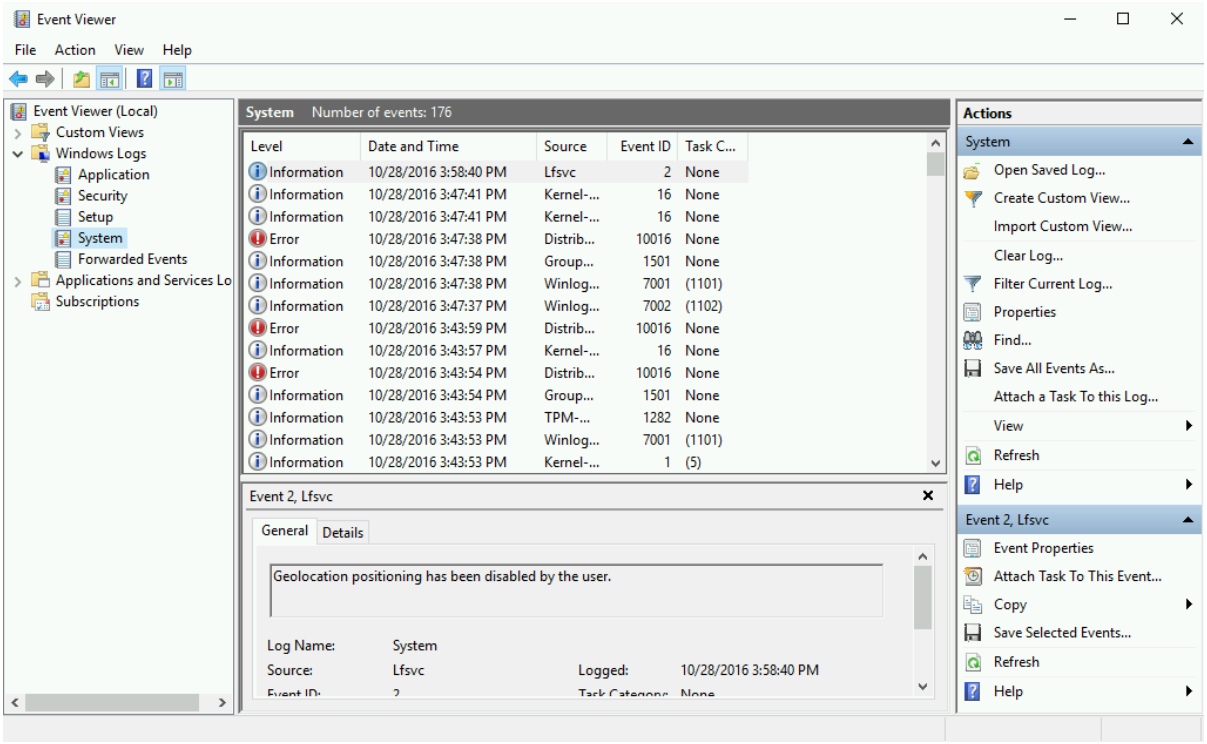

Figure B.16 Event Viewer Dialog

Server Manager (Windows Server Only)

Server Manager (see *Figure B.17*) is the main system management point for Windows Server. From the Server Manager you can add server roles such as Active Directory Domain Services, Application Server, and File Services. You can also add Windows features such as BitLocker Drive Encryption, Group Policy Management, and Windows Server backup. The default Windows Server installation includes a minimal set of features to improve reliability and performance. Access the **Server Manager** by clicking the **Server Manager** button next to the **Start** button, or navigate to **Control Panel > System and Security > Administrative Tools**.

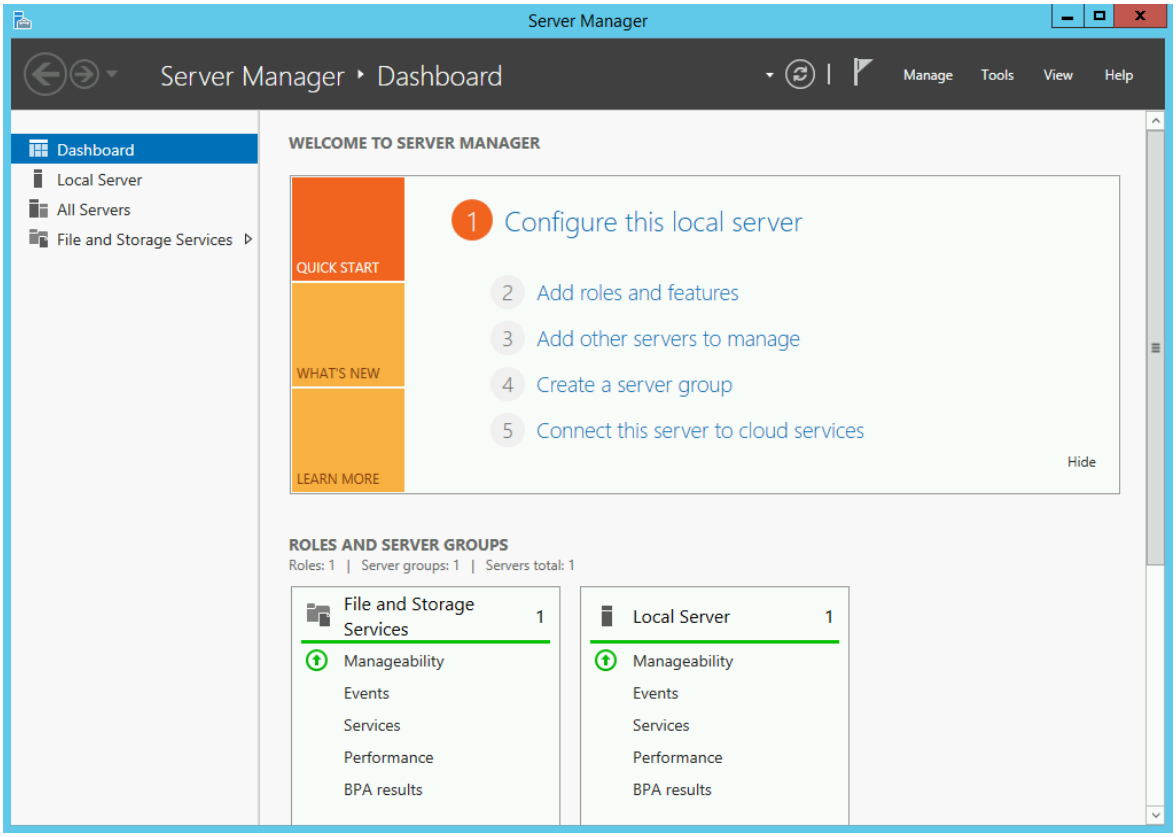

Figure B.17 Server Manager Dialog (Server 2012)

Installing Roles (Windows Server Only)

For Server 2008, choose **Roles** from the **Roles** tree and **Add Roles > Server Roles** to get a list of the roles (see *Figure B.18*). For Server 2012, choose **Manage > Add Roles and Features** to get a list of the roles. Select a role you want to install and follow the instructions to complete the configuration of that role.

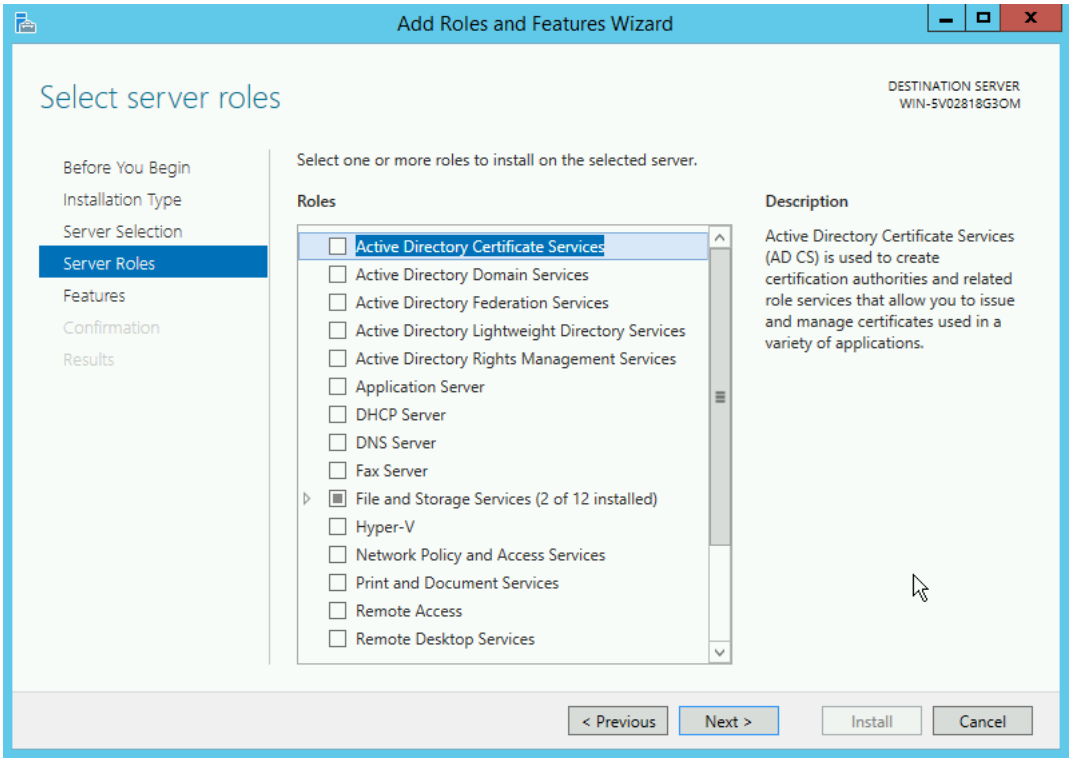

Figure B.18 Select Server Roles (Server 2012)

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 automation controller 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 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 automation controllers 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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