SEL-3354

Embedded Automation Computing Platform

Instruction Manual

20150126

SEL SCHWEITZER ENGINEERING LABORATORIES, INC.

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Preface

Manual Overview

The SEL-3354 Embedded Automation Computing Platform manual includes necessary information to properly install the product.

The scope of the manual covers specifications, installation and mechanical information, operating system configuration, self-monitoring, alarming, and IRIG-B generation. Please refer to included software manuals or quick-start guides for proper use of the application software.

Appendices include information on system configuration for the Microsoft® Windows® and Ubuntu® Linux® operating systems. Additional information on the operating system that will be used may be desired. This information is readily available at most bookstores and online.

An overview of each manual section and topics follows:

Preface. Describes the manual organization and conventions used to present information.

Section 1: Introduction and Specifications. Describes the basic features and functions of the SEL-3354; lists the specifications.

Section 2: Installation. Describes how to mount and wire the SEL-3354; illustrates wiring connections for various applications.

Section 3: Operating System and Software Installation. Describes the methods of installing operating systems and software.

Section 4: SEL SysMon. Describes custom functions built into the SEL-3354. These functions are assessed by using a custom IRIG-B, Status, Alarms Control Panel, and Watchdog graphical user interface called the System Monitor or SysMon.

Section 5: Troubleshooting. Lists common operating and troubleshooting questions.

Appendix A: Software and Manual Versions. Details differences between manual versions. Provides a record of changes made to the manual since the initial release.

Appendix B: Microsoft Windows System Configuration. Describes the features of the Windows operating systems.

Appendix C: Ubuntu Linux System Configuration. Describes the features of the Ubuntu Linux operating system.

Appendix D: Resetting BIOS. Describes steps needed to reset the BIOS to the original BIOS settings.

Safety Information

Dangers, Warnings, and Cautions

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

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

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

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

Safety Symbols

The following symbols are often marked on SEL products.

⚠	⚠**CAUTION** Refer to accompanying documents.	⚠**ATTENTION** Se reporter à la documentation.
⏚	Earth (ground)	Terre
⏚	Protective earth (ground)	Terre de protection
⎓	Direct current	Courant continu
∼	Alternating current	Courant alternatif
∼	Both direct and alternating current	Courant continu et alternatif
📖	Instruction manual	Manuel d'instructions

Safety Marks

The following statements apply to this device.

General Safety Marks

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).	La température ambiante de l'air ne doit pas dépasser 40°C (104°F).

Terminal Ratings
    Tightening Torque
        Terminal Blocks: 0.8 Nm (7 in-lbs)
	Valeurs nominales des bornes
	    Couple de serrage
	        Borniers : 0,8 Nm (7 livres-pouce)

Other Safety Marks

⚠**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** This device is shipped with default passwords. Default passwords should be changed to private passwords at installation. Failure to change each default password to a private password may allow unauthorized access. SEL shall not be responsible for any damage resulting from unauthorized access.	⚠**AVERTISSEMENT** Cet appareil est expédié avec des mots de passe par défaut. A l'installation, les mots de passe par défaut devront être changés pour des mots de passe confidentiels. Dans le cas contraire, un accès non-autorisé á l'équipement peut être possible. SEL décline toute responsabilité pour tout dommage résultant de cet accès non-autorisé.
⚠**WARNING** Never use standard null-modem cables with the SEL-3354. Using any non-SEL cable can cause severe power and ground problems involving Pins 1, 4, and 6 on the SEL-3354 communications ports.	⚠**AVERTISSEMENT** Ne jamais utiliser de cables standards à inversion de signaux ("null-modem") avec le SEL-3354. 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-3354.
⚠**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.
⚠**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.

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Section 1

Introduction and Specifications

Overview

The SEL-3354 Embedded Automation Computing Platform is a PC-AT compatible computer architecture with an additional embedded Field Programmable Gate Array (FPGA). Use the SEL-3354 to provide a solution using extremely rugged SEL hardware and your choice of operating system and custom software.

Features

The SEL-3354 provides a rugged, easy-to-use, computing platform for substation, industrial, or other harsh environments. The SEL-3354 is based on a PC-AT compatible computing platform and a separate FPGA. The following features and enhancements are included in the system:

➤ **Form Factor.** The SEL-3354 provides a form factor specifically designed for the substation and industrial control applications. This includes rear- and front-panel connectors and separate front-panel LEDs for network, storage, alarm, serial port status, and complete surge protections.

➤ **Operating System Choices.** SEL-3354 hardware may be purchased as hardware only, or optionally with Windows® 7 Ultimate or Windows Embedded Standard operating systems to provide extreme flexibility and functionality along with enhanced security features. *Appendix B: Microsoft Windows System Configuration* covers Windows operating system configuration information.

➤ **Power Supply.** Two power supply options are provided in the SEL-3354. Refer to *Power Supply on page 1.4* for information about power supply ordering options.

➤ **Watchdog Functionality.** An FPGA provides an extra level of computer system reliability. One function of the FPGA is to reboot the computer if there is an operating system problem or a problem with specific software services running on the operating system.

➤ **IRIG Updated System Clock.** The FPGA decodes an IRIG-B signal from an external IRIG-B source, and the SEL SysMon Service updates the computer system clock.

➤ **IRIG Generation.** Demodulated IRIG-B is generated by the FPGA from the PC-AT computer system clock when an external IRIG-B signal is absent. Synchronize this system clock with a network time server, if desired.

➤ **High-Speed Network Access.** One copper RJ45 on the front-panel and two multimode fiber or copper 10/100 Mbps Ethernet connections on the rear-panel support high-speed network connectivity.

➤ **Connected Device Time Synchronization.** Demodulated IRIG-B is provided to connected Intelligent Electronic Devices (IEDs) using the rear DB-9 serial ports. Demodulated IRIG-B output is also provided on a separate BNC connector.

➤ **Local or Remote Configuration.** Use a VGA monitor, keyboard, and mouse to locally configure the SEL-3354 Embedded Automation Computing Platform, or configure it remotely over the Ethernet network using Windows Remote Desktop.

➤ **Alarm Output.** The rear-panel contains alarm contact outputs used by the SEL SysMon Service to signal internal errors and malfunctions. The Form C contact supports both normally open and normally closed alarm operation.

Models and Options

Models

Complete ordering information is not provided in this instruction manual. See the latest SEL-3354 Model Option Table at www.selinc.com.

Options

The SEL-3354 has the following options and features:

➤ CPU Module
  ➢ AMD® Athlon 64 2600 1.6 GHz with 4GB DDR2 SDRAM with ECC memory
  ➢ Intel® Pentium® M 1.4 GHz with 1 GB DDR SDRAM with ECC memory

➤ Power Supply Ranges
  ➢ 48/125 Vdc or 120 Vac
  ➢ 125/250 Vdc or 120/230 Vac

➤ Communication Options
  ➢ Two or sixteen serial ports, EIA-232/EIA-485/EIA-422 byte oriented protocols
  ➢ Ethernet 1, 10/100BASE-T copper (standard) or 100BASE-FX multimode fiber-optic port (optional)
  ➢ Ethernet 2, 100BASE-T copper (standard) or 100BASE-FX multimode fiber-optic port (optional)
  ➢ Ethernet F, 10/100BASE-T copper (standard)
  ➢ Four rear Universal Serial Bus (USB 2.0) ports (standard)
  ➢ Two front Universal Serial Bus (USB 2.0) ports (standard)

➤ IRIG-B time-code input
  ➢ modulated
  ➢ demodulated

➤ IRIG-B time-code output, demodulated

➤ Mounting

➢ horizontal panel

➢ horizontal 19-inch rack

➢ 3U race space

➤ Software

➢ Select from a list of common software applications at the time of purchase.

➢ Add software components and applications during installation.

Applications

The SEL-3354 may be utilized for many applications. With proper software installed, the SEL-3354 provides a comprehensive solution for substation integration as shown in *Figure 1.1*. The SEL-3354 provides real-time data to local clients such as human-machine interfaces (HMIs), remote-terminal units (RTUs), and SCADA interfaces. Additionally, it provides time synchronization and data access to the connected IEDs.
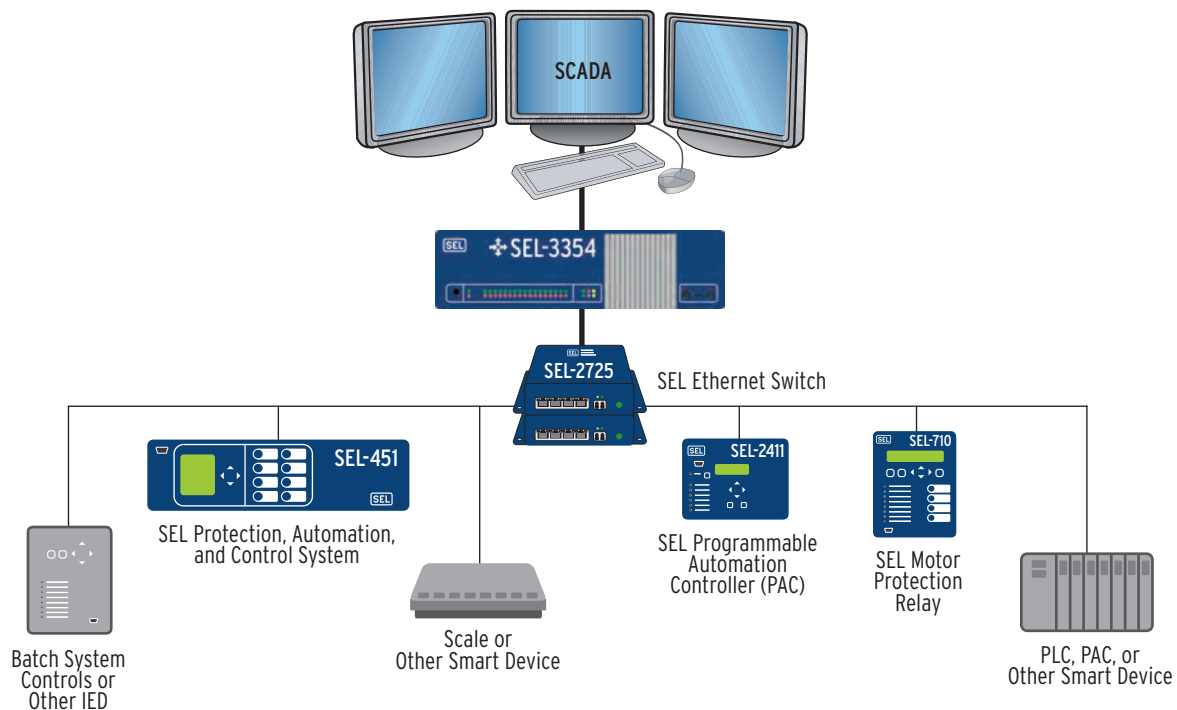
Figure 1.1   Functional Model

Specifications

Compliance

ISO 9001:2008 Certified

CE: CE Mark
EMC Directive, Low Voltage Directive

UL, cUL: NRAQ, NRAQ7 per UL 508, C22.2 No. 14

General

Operating Systems

Microsoft® Windows® 7 Ultimate

Microsoft Windows Server 2008 R2

Microsoft Windows Embedded Standard

Ubuntu® Linux®

None (user-loaded operating system)

Terminal Connections

Rear Screw-Terminal Tightening Torque

Minimum:	0.8 Nm (7 in-lb)
Maximum:	1.4 Nm (12 in-lb)

User terminals and stranded copper wire should have a minimum temperature rating of 105°C and a minimum insulation thickness of 0.4 mm. Ring terminals are recommended.

Power Supply

Option:	125/250 Vdc or 120/230 Vac; 50/60 Hz
DC Range:	85–300 Vdc
AC Range:	85–264 Vac
Frequency Range:	30–120 Hz
Burden:	<50 W
Option:	48/125 Vdc or 120 Vac; 50/60 Hz
DC Range:	38–140 Vdc
AC Range:	85–140 Vac
Frequency Range:	30–120 Hz
Burden:	<50 W
Main Supply Voltage Fluctuations:	as much as ±10% of nominal voltage

Operating Temperature Range

AMD Athlon 64 2600:	–20° to +60°C (–4° to +140°F)
Intel Pentium M:	–40° to +75°C (–40° to +167°F)

Note: Not applicable to UL applications.

Storage Temperature

–40° to +85°C (–40° to +185°F)

Relative Humidity

5 to 95% non-condensing

Maximum Altitude

2000 m

Atmospheric Pressure

80–110 kPa

Overvoltage Category

Category II

Pollution Degree

2

Weight (Maximum)

3.17 kg (7 lbs)

Serial Ports

2 or 16 rear-panel ports, DB-9 connectors

Ethernet Ports

2 rear-panel fiber-optic or copper ports, 1 front-panel copper port

Fiber Optic

100BASE-FX
(multimode)

Maximum TX Power:	–14 dBm
Minimum TX Power:	–19 dBm
RX Sensitivity:	–32 dBm
System Gain:	13 dB
Wavelength:	1300 nm
Source:	LED
Connector Type:	LC (IEC 61754-20)
Fiber cable:	Multimode
Max cable length:	300 meters

Serial Data Speed

300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps (meets EIA/TIA-562 specifications)

Time-Code Input

Connector:	Female BNC
Time Code:	Modulated IRIG-B
	Demodulated IRIG-B TTL compatible

Time-Code Output

Pinout:	DB-9 port connectors
	Pin 4 TTL-level signal
	Pin 6 chassis ground reference
	Female BNC
Connectors:	16 rear DB-9 port connectors
	Female BNC

Note: Outputs are generated from IRIG-B input (when present) or generated by the SEL-3354.

Supported Form Factors

PC104

CPU Type

AMD Athlon 64 2600

Intel Pentium M

System Speed

1.6 GHz (AMD Athlon 64 2600)

1.4 GHz (Intel Pentium M)

Chipset

AMD 690E (AMD Athlon 64 2600)

Intel 855 GME (Intel Pentium M)

BIOS

AMI enhanced

Cache

512 kilobaud L2 write-back cache (AMD Athlon 64 2600)

2 MB L2 write-back cache (Intel Pentium M)

On-Board VGA

VGA1 maximum resolution 2048 x 1536 @ 32 bpp
VGA2 fixed resolution 1024 x 768 @ 16 bpp

LAN

Ethernet 1: Intel Fiber Optic or Copper
Ethernet 2: Intel Fiber Optic or Copper
Ethernet F: Intel Copper

Memory

4 GB DDR2 SDRAM with ECC (AMD Athlon 64 2600)

1 GB DDR SDRAM with ECC (Intel Pentium M)

Video

ATI Radeon X1200 (AMD Athlon 64 2600)

Intel 855GME (Intel Pentium M)

Trusted Platform Module

Infineon TPM 1.2 SLB9635TT12XT (AMD Athlon 64 2600)

Local Bus IDE/SATA

IDE0 Dual CompactFlash® Type 2 Sockets
SATA II 3.0 GB single channel (AMD Athlon 64 2600)

USB

4 rear-panel ports, 2 front-panel ports
USB 2.0 Compliant
1.5 A current limit for all ports combined

Real-Time Clock/Calendar

Battery Type:	IEC No. BR2335 Lithium
Battery Life:	10 years with power 2 years without power

Type Tests

Electromagnetic Compatibility Emissions

Radiated and Conducted Emissions:	IEC 60255-25:2000 IEC 61850-3:2002

Electromagnetic Compatibility Immunity

Conducted Common Mode Disturbances:	IEC 61000-4-16:2002 IEC 61850-3:2002
Conducted RF:	IEC 60255-22-6:2001 IEC 61000-4-6:2008 IEC 61850-3:2002 Severity Level: 10 Vrms
Digital Radio Telephone RF:	ENV 50204:1995 Severity Level:10 V/m at 900 MHz and 1.89 GHz
Electrostatic Discharge:	IEC 60255-22-2:2008 IEC 61000-4-2:2008 IEEE 1613-2003 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 60255-22-4:2008 IEC 61000-4-4:2004 + CRGD:2006 IEC 61850-3:2002 Severity Level: Class A 4 kV, 5 kHz on power supply and outputs; 2 kV, 5 kHz on communication lines
Magnetic Field:	IEC 61000-4-8: 2001 IEC 61850-3:2002 Severity Level: 1000 A/m for 3 s 100 A/m for 1 m IEC 61000-4-10:2001 Severity Level: 100 A/m
Power Supply:	IEC 60255-11:2008 IEC 61000-4-11:2004 IEC 61000-4-29:2000 IEEE 1613-2003
Radiated Radio Frequency:	IEC 60255-22-3:2007 IEC 61000-4-3:2008 IEC 61850-3:2002 IEEE 1613-2003 Severity Level: 10 V/m IEEE C37.90.2-2004 Severity Level: 35 V/m
Surge Withstand Capability:	IEC 60255-22-1:2007 IEEE 1613-2003 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 C37.90.1-2002 Severity Level: 2.5 kV oscillatory 4 kV fast transient
Surge Immunity:	IEC 60255-22-5:2008 IEC 61000-4-5:2005 IEC 61850-3:2002 1 kV line-to-line 2 kV line-to-earth
Oscillatory Waves Immunity:	IEC 61000-4-12:2006 IEC 61850-3:2002 Ring Wave: 2 kV common, 1.0 kV differential Oscillatory: 2.5 kV common, 1.0 kV differential
Power Frequency:	IEC 61850-3: 2002 Class 1

Environmental

Cold:	IEC 60068-2-1:2007 IEC 61850-3:2002 IEEE 1613-2003 Severity Level: 16 hours at –20°C (AMD CPU) 16 hours at –40°C (Intel CPU)
Damp Heat, Cyclic:	IEC 60068-2-30:2005 IEC 61850-3:2002 IEEE 1613-2003 Severity Level: 12 + 12-hour cycle 25° to 55°C, 6 cycles, 95% r.h.

Dry Heat:	IEC 60068-2-2:2007
	IEC 61850-3:2002
	IEEE 1613-2003
	Severity Level:
	16 hours at 60°C (AMD CPU)
	16 hours at 75°C (Intel CPU)
Vibration:	IEC 60255-21-1:1988
	IEC 61850-3:2002
	IEEE 1613-2003
	Severity Level:
	Endurance Class 1
	Response Class 2
	IEC 60255-21-2:1988
	Severity Level:
	Shock Withstand, Bump Class 1
	Shock Response Class 2
	IEC 60255-21-3:1993
	Severity Level:
	Quake Response Class 2

Safety

Enclosure Protection:	IEC 60529:2001 + CRGD:2003
	Severity Level:
	IP2X for Category 2 equipment
Dielectric Strength:	IEC 60255-5:1977
	IEEE 1613-2003
	IEEE C37.90-2005
	Severity Level:
	3100 Vdc on power supply
	2500 Vac on contact output
	Type tested for one minute
Impulse:	IEC 60255-5:2000
	IEEE 1613-2003
	Severity Level: 0.5 Joule, 5 kV

Section 2
Installation

Overview

The first steps in applying the SEL-3354 Embedded Automation Computing Platform 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-3354 safely and effectively, you must be familiar with the device configuration features and options. Carefully plan unit placement, cable connections, and communications during initial design.

This section contains connection drawings for mouse, keyboard, monitor, Ethernet ports, USB, DB-9, EIA-232/EIA-485/EIA-422, IRIG-B, other computer peripherals, and power. Use these drawings as a starting point for planning your particular application.

Unit Placement and Maintenance

Proper placement of the SEL-3354 helps make certain that you receive years of trouble-free operation. Use the following guidelines for proper installation of the SEL-3354.

Physical Location

Mount the SEL-3354 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 1.4*). 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.

Cleaning

Use care when cleaning the SEL-3354. 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. Be careful cleaning the front and rear panels because a permanent plastic sheet covers each panel; do not use harsh chemical solvents such as xylene or acetone on these surfaces.

RACK-MOUNT CHASSIS

PANEL-MOUNT CHASSIS

RACK
MOUNT

6.27
(159.5)

TOP

0.65
(16.3)

19.00
(482.6)

5.22
(132.6)

FRONT

2.25
(57.2)

18.31
(465.1)

PANEL
MOUNT

6.16
(156.5)

TOP

0.76
(19.3)

19.80
(502.9)

6.65
(168.9)

FRONT

#10-32
STUD

SIDE

LEGEND
in
(mm)

17.63
(447.8)

Ø1/4
(Ø6.4)

5.35
(135.9)

PANEL CUTOUT

2.25
(57.2)

18.31
(465.1)
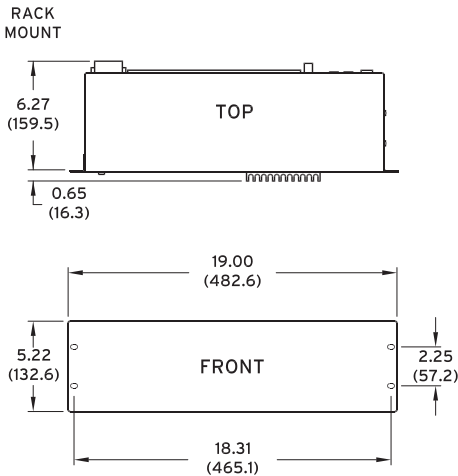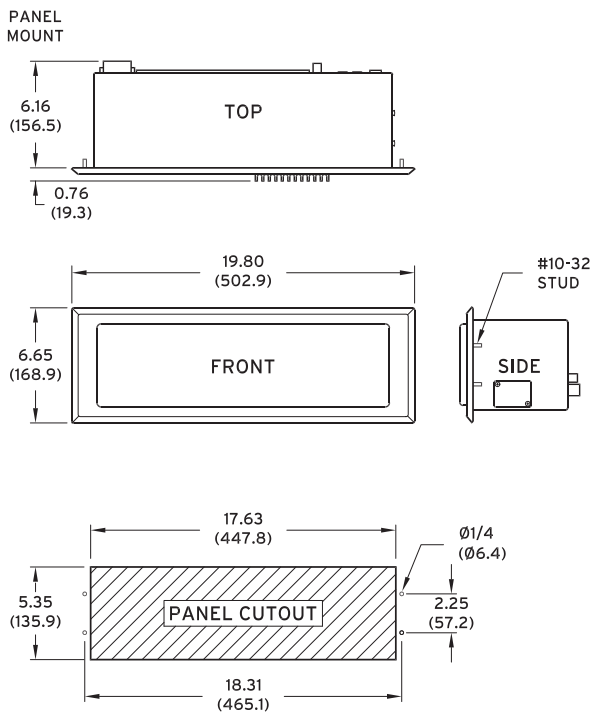
Figure 2.1 Dimensions Diagram
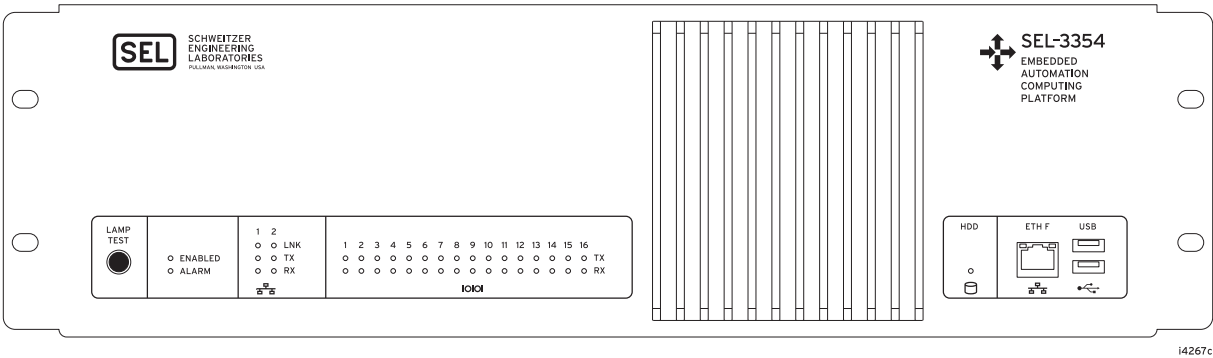
① LEDs indicate transmitted and received activity on each port for easy checkout.

② Rugged enclosure withstands EMI, RFI, shock, and vibration. Clock battery lasts 10 years. No other maintenance is required.

③ High-contrast white-on-blue lettering is highly legible even in dark areas.

Figure 2.2 Front Rack-Mount Diagram
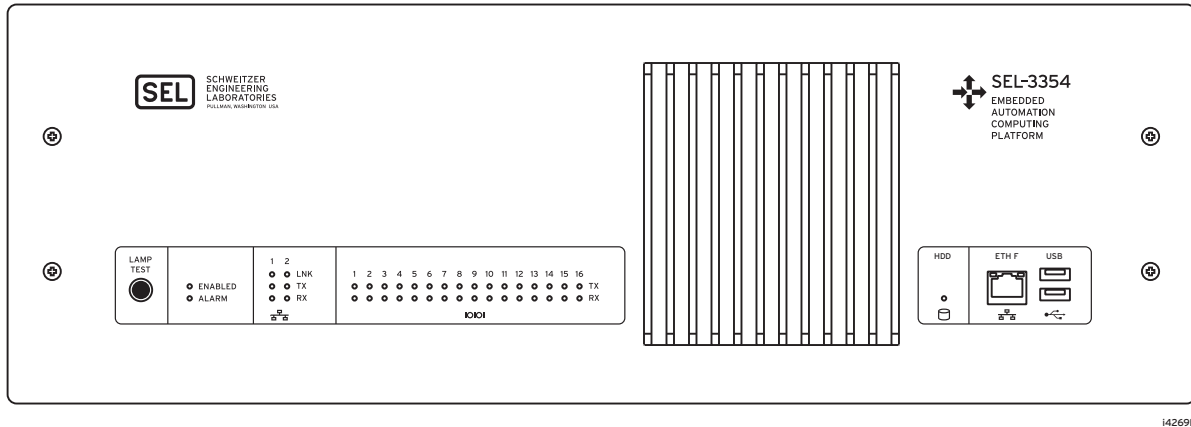
Figure 2.3 Front Panel-Mount Diagram

Rear-Panel Connections

The physical layout of the connectors on the rear panel of an SEL-3354 is shown in *Figure 2.4*.
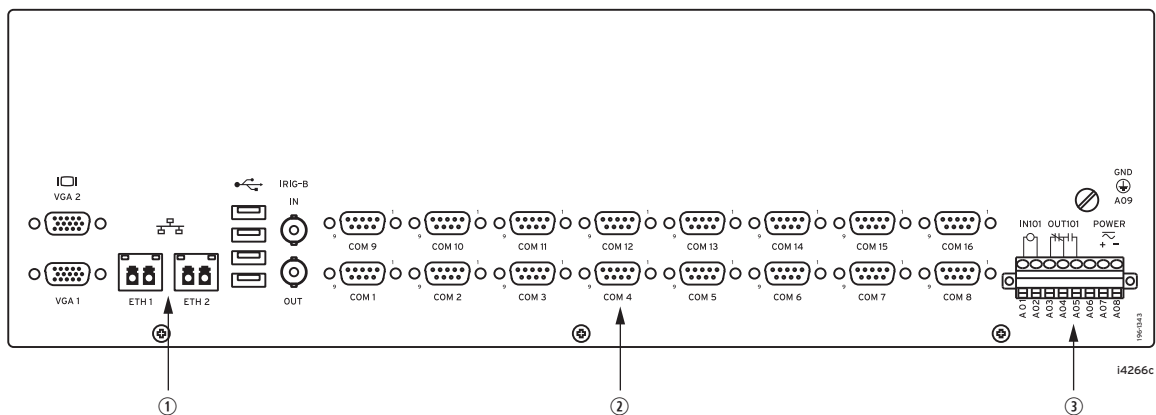
① Dual Ethernet connection.

② All rear serial ports provide communication and time code. Internal clock generates time code and synchronizes to modulated or demodulated time-code input.

③ Wide-range power supply and alarm contact connections.

Figure 2.4 Rear-Panel Diagram

Ethernet Connection

Ethernet connection to the SEL-3354 is optional. Ethernet connection is only required if Remote Desktop Connection or an Ethernet protocol connection is desired.

The SEL-3354 is equipped with three Ethernet ports. Two Ethernet ports (**ETH 1** and **ETH 2**) are on the rear and one Ethernet port (**ETH F**) is on the front. Ethernet **1** and **2** may be ordered as either copper 10/100BASE-T or fiber-optic 100BASE-FX. Ethernet **F** is a standard 10/100BASE-T copper port.

All three Ethernet ports may be used at the same time and have unique MAC addresses. A full discussion of MAC addresses is beyond the scope of this manual. See your network administrator for questions or concerns.

The LEDs for the Ethernet ports apply to both copper and fiber connections. The left LED illuminates orange for a 10 Mbps connection and green for a 100 Mbps connect. The LED on the right flashes yellow during data transfer.

The multiple Ethernet function of the SEL-3354 is the same as a standard multiple Ethernet PC-AT compatible computer. Please refer to *Ethernet Port Configuration on page B.16* to configure the ports.

Alarm Contact Connection

The SEL-3354 provides a Form C, dry alarm contact driven by the FPGA. When used with the SEL SysMon Service, the FPGA closes or pulses the alarm contact during certain operational events. The contact closes if the system computer BIOS, hardware, software, or operating system malfunctions. 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.

IRIG-B Connections

The SEL-3354 accepts modulated (B122) or demodulated (B002) IRIG-B input. Demodulated IRIG-B is provided on the BNC IRIG-B output connector and on Pins 4 and 6 of the serial communications ports.

The IRIG-B signal preference is given to the BNC connector, IRIG-B input. When this signal is not present, then IRIG-B is generated from the system computer clock and distributed to the IRIG-B output connections. The system computer clock is either free running or can be updated from the local area network (LAN) by using network time protocol (NTP). The Microsoft® Windows® XP Professional SP2 and newer operating systems use NTP Version 3 with algorithmic enhancements from NTP Version 4. The SEL-3354 is able to generate demodulated IRIG-B output from NTP.

The system clock and the FPGA decoded or encoded IRIG-B are synchronized to less than 100 ms on average and less than 10 ms typically. The system clock is accurate to 20 ms.

IRIG-B input is *not* available on any serial communications ports. The IRIG-B signal includes code for day-of-the-year and time-of-day. It does not include a code to identify the year. To set the device calendar to the proper year, you need to set the date on each device receiving an IRIG-B signal.

Serial Port Communications

Two or sixteen serial ports are available on the SEL-3354, depending on ordering options. Each serial port has a communications port number assigned in the operating system similar to a standard PC-AT compatible computer.

The serial communications ports by default function as standard EIA-232 ports, with the exception of IRIG-B signals in place of the standard DTR/DSR signals. Additional serial port features such as EIA-485/EIA-422 mode, +5 V power, remapping of DTR/DSR, and synchronous bit mode, are configurable via software settings. Please refer to *Serial Port Configuration on page B.14* to configure the serial port features.

See *Figure 2.5* for DB-9 female connector pin numbers. The corresponding EIA-232 serial port pin functions are shown in *Table 2.1*. See *Table 2.2* for serial port pin functions while in EIA-485/EIA-422 mode.

Table 2.1 EIA-232 Serial Port Connector Pin Definition

Pin	Ports 1-16
1	DCD or +5 Vdc[a]
2	RXD
3	TXD
4	+IRIG-B
5, 9	GND
6	–IRIG-B (GND)
7	RTS or DTR[a]
8	CTS or DSR[a]

[a] Software configurable.

Pin 1 on the ports can provide as much as 0.6 A at 5 V (3 W) total for all 16 ports.
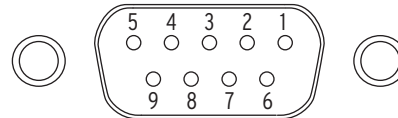
Female chassis connector, as viewed from outside panel.

Figure 2.5 EIA-232 DB-9 Connector Pin Numbers

Table 2.2 EIA-485 Serial Port Connector Pin Definition

Pin	Ports 1-16
1	N/C or +5 Vdc[a]
2	–RXD
3	–TXD
4	+IRIG-B
5, 9	GND (a.k.a. signal ground)
6	IRIG-B
7	+TXD
8	+RXD

[a] Setting controlled by software.

The communications circuits have internal surge protection.

Common serial cable configurations are shown in the following figures. Refer to SEL-5801 Cable Selector Software for the most recent cable configurations. Please refer to individual device manual and Cable Selector Software prior to selecting a proper cable.

SEL-3354
9-Pin Male
D–Sub Connector

Pin Func.	Pin #		Pin #	Pin Func.
RXD	2	———	3	TXD
TXD	3	———	2	RXD
GND	5	———	5	GND
CTS	8	———	7	RTS
RTS	7	———	8	CTS
			1	DCD
			4	DTR
			6	DSR

Computer
9-Pin Female
D–Sub Connector

Figure 2.6   SEL Cable C235

SEL-3354
9-Pin Male
D–Sub Connector

300/400/500/700
Series Relays
except SEL-321
9-Pin Male
D–Sub Connector

Pin Func.	Pin #		Pin #	Pin Func.
RXD	2	———	3	TXD
TXD	3	———	2	RXD
+IRIG	4	———	4	+IRIG
GND	5	———	5	GND
-IRIG	6	———	6	-IRIG
RTS	7	———	8	CTS
CTS	8	———	7	RTS
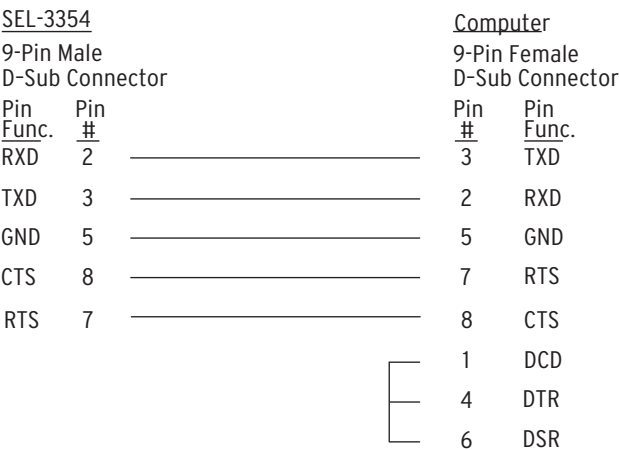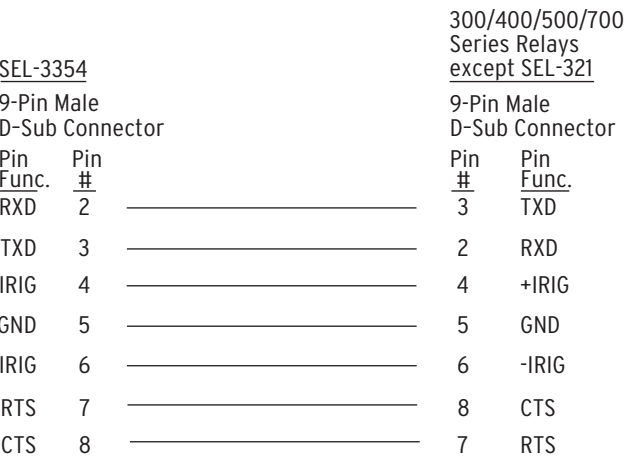
Figure 2.7   SEL Cable 273A

⚠**WARNING**

Never use standard null-modem cables with the SEL-3354. Using any non-SEL cable can cause severe power and ground problems involving Pins 1, 4, and 6 on the SEL-3354 communications ports.

The following list provides additional rules and practices you should follow for successful communication using EIA-232 and EIA-485/EIA-422 serial communications devices and cables:

➤ You should keep the length of the communications cables as short as possible to minimize communications circuit interference and also to minimize the magnitude of hazardous ground potential differences that can develop during abnormal power system conditions.

➤ EIA-232 communications cable lengths should never exceed 50 feet, and you should always use shielded cables for communications circuit lengths greater than 10 feet.

➤ Modems or fiber optics are required for communication over long distances and to provide isolation from ground potential differences between device locations.

➤ 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.

➤ Lower baud rate communication is less susceptible to interference and will transmit greater distances over the same medium than with higher baud rates. You should use the lowest baud rate that provides adequate data transfer speed.

➤ For EIA-422 and EIA-485 communication, termination resistors across the Tx and Rx pairs (from Tx+ to Tx– and from Rx+ to Rx–) are recommended. Without termination resistors, reflections or fast driver edges can cause data corruption. The value of the resistor should be equal to the cable characteristic impedance, typically 120 ohms for twisted pairs. Maximum bus length cannot be specified, as it varies with cable and device characteristics as well as data rate.

Port Isolators

SEL offers a data-line-powered isolator for use with EIA-232 ports and metallic communications cables. The SEL-2910 Port Isolator isolates IRIG-B time-code inputs on the same communications port. These isolators break cable ground loops and are useful in existing applications of metallic cables in switchgear. SEL does not recommend using port isolators for circuits outside the control house. Fiber should be used in such applications. Refer to SEL Application Guide AG2001-06, *Avoiding Magnetic Induction Issues in Communication Cabling* for detailed information.

Fiber-Optic Cables

One benefit of applying the SEL-3354 as the hub of a star topology is it enables low-cost, point-to-point fiber-optic connections. The SEL-2800 family of fiber-optic transceivers connects directly to the serial port connectors on the rear of the SEL-3354. Fiber-optic links improve safety by isolating the equipment from hazardous and damaging ground-potential rise, eliminate instrumentation system ground-loop problems, reduce susceptibility to RFI and EMI, and allow longer signal paths than metallic EIA-232/EIA-485/EIA-422 connections.

USB Connections

The SEL-3354 provides six USB 2.0 connections. Two USB ports are located on the front and four ports are located on the rear of the product.

Main Board Jumpers

Set the main board jumpers to meet your requirements. See *Table 2.3* for jumper functions and positions. See *Figure 2.8* for jumper location on the main board.

Table 2.3   Main Board Jumper Positions

Function	Jumper Position(s) to Bridge	Default
Watchdog disable	JMP5 A	OFF
IRIG demodulated pass through	JMP5 B	OFF
Unused	JMP5 C	OFF
Serial +5 V Pin1 enable[a]	JMP5 D	OFF
Reserved for nonoperational use only	JMP5 E	OFF
COM1 IRIG-B Output[b]	JMP1 A, C	ON
COM1 DSR/DTR[b]	JMP1 B, D	OFF

[a] Only effective when mainboard driver (b2051 device driver) is not loaded.
[b] Either IRIG Output or DSR/DTR must be chosen, not both.
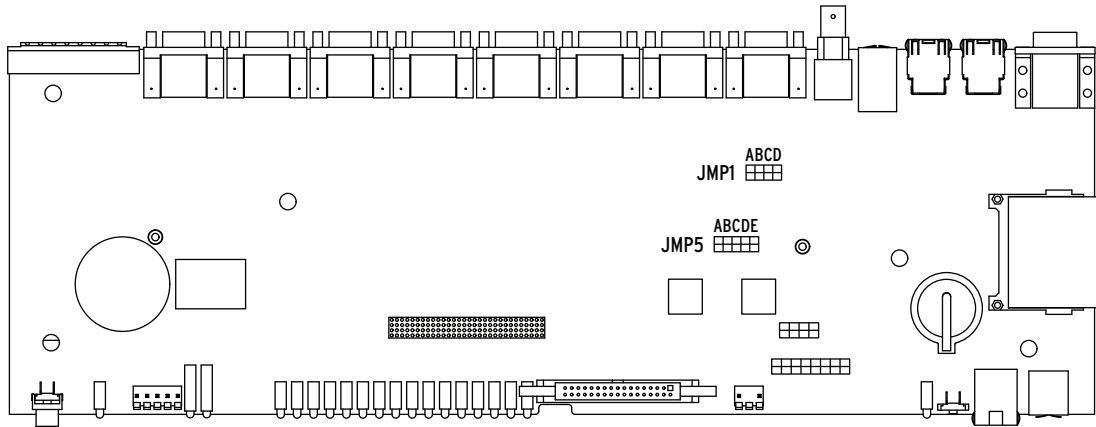
Figure 2.8 Jumper Locations (JMP1 and JMP5) on Mainboard

Grounding

Connect the grounding terminal (see **A09** on *Figure 2.9*) 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 2 m (6.6 feet) in length for this connection. This terminal connects directly to the internal chassis ground of the SEL-3354.

Power Connections

Connect the power terminals on the rear panel (**A07(+/H)** and **A08(-/N)**) to the proper ac or dc power source. Ensure the connected voltage is with the rated range for the power supply ordered. Routed voltages are indicated on the serial number label.
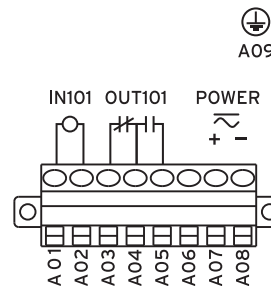
Figure 2.9 Power Connections

> ⚠**WARNING**
> Do not operate device unless properly grounded.

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

The power terminals are isolated from the chassis ground. Use 16 AWG (1.5 mm^2) size or larger wire to connect to the power terminals.

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. The maximum current rating for the overcurrent protection device must be no greater than 20 A. Be sure to locate this device within 3.0 m (9.8 feet) of the SEL-3354. Disconnect devices must comply with IEC 60947-1 and IEC 60947-3-1.

Operational power is internally fused on the power supply. Replacing the internal power supply fuse is not recommended unless indicated otherwise by your local SEL representative. An internal fuse failure indicates possible circuit board or electronic failure that may cause sporadic or incorrect device operation.

Initial Checkout and Startup

Checkout Using Monitor, Keyboard, and Mouse

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

NOTE: At temperatures below 5*C (41*F) the SEL-3354 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 at least 5 minutes and can take as long as 20 minutes in extremely cold conditions.

Step 1. Connect a monitor, keyboard, and mouse to the SEL-3354 as described in *Figure 2.4*.

Step 2. Power up the monitor.

Step 3. Apply power to the SEL-3354.

A power switch is not available. The SEL-3354 is designed to be continuously powered without the need for customer intervention.

Step 4. The SEL-3354 will go through the initial BIOS boot and then boot to the operating system you have chosen. A successful boot shows the logon dialog box for your operating system.

Step 5. Enter the user name and password for your operating system. See *Appendix B* for default username and password for the factory-installed Microsoft Windows operating systems. For factory-installed Linux, please refer to *Appendix C*. Otherwise, refer to the documentation that came with the operating system you have installed.

Field Serviceability

The SEL-3354 is designed to give years of trouble-free and maintenance-free operation. However, in case of a problem, this section enumerates the items that are field serviceable. SEL recommends contacting your local SEL representative before performing any of the service items in this section. Contacting SEL allows necessary feedback for SEL to determine if a common failure mode is developing. It also allows SEL to provide any recent suggestions or clarifications to the following procedures.

Real-Time Clock and BIOS Battery Replacement

A lithium battery powers the clock (date and time) if the external power source is lost or removed. The battery also maintains the configured system computer BIOS settings. The battery is a 3 V lithium coin cell, Ray-O-Vac® BR2335 or equivalent. At room temperature, the battery will operate nominally for 2 years at rated load with no external source present. When the device is powered from an external power source, the battery experiences a low self-discharging rate. Thus, battery life may extend well beyond 10 years. The battery cannot be recharged.

Step 1. De-energize the device by disconnecting or removing power.

Be sure proper tagging is applied to the power source to avoid accidental reenergization.

Step 2. Remove all connections from the rear of the device.

Step 3. Remove the device from the panel or 19-inch rack.

Step 4. Remove the top/rear panel.

To remove the top/rear panel, you will need to remove the two side, two top, and three rear screws.

Step 5. Locate the battery.

Step 6. Carefully remove the battery from underneath the retaining clip.

Properly dispose of the battery.

Step 7. Install a new battery with the positive (**+**) side up.

Step 8. Replace the top/rear panel.

Step 9. Replace the side, top, and rear screws for the top/rear panel.

Step 10. Reinstall the device into the panel or 19-inch rack.

Step 11. Replace all connections to the rear of the device.

Step 12. Reapply power to the device.

Removing or Installing Storage Media

⚠**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.

NOTE: Solid-state storage drives may be factory installed under the main board and require significant disassembly and reassembly. As a result, solid-state drives are only serviced by factory technicians.

The SEL-3354 has two Type II CompactFlash sockets that function as IDE/master and slave hard drive connections. To remove or install a CompactFlash, follow these steps:

Step 1. De-energize the device by disconnecting or removing power.

Be sure proper tagging is applied to the power source to avoid accidental reenergization.

Step 2. Remove any devices that are connected to the front and rear panels.

Step 3. Remove the device from the panel or 19-inch rack.

Step 4. Remove the CompactFlash access panel located on the right side (see *Figure 2.5*).

Step 5. Remove or insert a CompactFlash card by gently pulling it straight out or gently pushing in horizontally.

Step 6. Replace the CompactFlash access cover.

Step 7. Reinstall the device into the panel or 19-inch rack.

Step 8. Replace connections for any devices that were connected to the front and rear panels.

Step 9. Reenergize the unit.

Step 10. Press **F2** during the boot process to enter the BIOS.

Step 11. Verify your new CompactFlash hard drive is available.

Step 12. Verify BOOT order and save.

Section 3

Operating System and Software Installation

Overview

The initial installation of software onto the SEL-3354 requires special attention because of the CompactFlash® and SATA or IDE connection. This section describes the equipment and methods that can be used to install software.

Operating System Installation

To install an operating system you first need to determine if you will be using CompactFlash or a 2.5" solid state hard drive as your drive media. Any one of these two options can be factory mounted in the SEL-3354. You will need to disable the watchdog functionality to ensure the system does not reboot during the installation process (see *Main Board Jumpers on page 2.7*). Jumper JMP5 A must be ON (bridged) to turn the watchdog off. Bridging JMP5 A keeps the watchdog timeout at 300 seconds so that the FPGA will never reboot the system. After installing your operating system, re-enable JMP5 A to make use of the Windows® or Linux® System Monitor programs.

Using Standard Internal-Type CD-ROM With USB-to-IDE Adapter

The following steps illustrate one method of installing an operating system from a CD-ROM. This method uses a USB-to-IDE adapter. Verify that your adapter is compatible with USB 1.1 or USB 2.0 and that it contains a power supply.

Step 1. Plug the adapter into a standard internal-type CD-ROM drive.

Step 2. Plug the adapter into an SEL-3354 USB port. This is the target unit that has either a CompactFlash or 2.5" hard drive.

Step 3. Plug in a standard VESA compliant monitor, USB keyboard, and USB mouse.

Step 4. Plug in the power supply to the CD-ROM.

Step 5. Apply power to the SEL-3354.

Step 6. Press **<Esc>** during the boot process to display the boot menu.

Step 7. Select **USB boot**.

The SEL-3354 will now try booting from the CD-ROM.

Step 8. Continue with the installation process.

Using Standard CD-ROM With USB Connection

The following steps provide another method of installing an operating system from a CD-ROM equipped with a mini-USB connector.

Step 1. Plug the USB cable from the CD-ROM into an SEL-3354 USB port. This is the target unit that has either a CompactFlash or 2.5" solid state hard drive.

Step 2. Plug in a standard VESA compliant monitor, USB keyboard, and USB mouse.

Step 3. Plug in the power supply to the CD-ROM.

Step 4. Apply power to the SEL-3354.

Step 5. Press **<Esc>** during the boot process to display the boot menu.

Step 6. Select **USB boot**.

The SEL-3354 will now try booting from the CD-ROM.

Step 7. Continue with the installation process.

Driver Installation

The Drivers folder on the DVD-ROM contains drivers for video, chipset, SEL System Monitor, IRIG-B, I/O, and serial ports. Ensure that you select the correct drivers for your CPU type. The Linux Source folder on the DVD-ROM contains the open source software packages.

Software Installation

Start installing the software after the operating system has been successfully installed. There are many ways to install software. Three of the simplest methods are described in this subsection.

Using USB Memory Stick

Use the following steps to install software using a USB memory stick.

Step 1. Copy the software installation package onto a USB memory stick using your laptop or desktop computer.

Step 2. Properly remove the USB memory stick.

Step 3. Boot the SEL-3354.

Step 4. Insert the memory stick into the SEL-3354.

Step 5. Navigate to the memory stick and launch the software installation package.

Using CompactFlash

Use the following steps to install software using CompactFlash.

Step 1. De-energize the SEL-3354.

Be sure proper tagging is applied to the power source to avoid accidental reenergization.

Step 2. Remove any connections on the front and rear of the SEL-3354.

Step 3. Remove the device from the panel or 19-inch rack.

Step 4. Remove the CompactFlash access panel (see *Figure 3.1*).

Step 5. Remove the CompactFlash card from the SEL-3354.

Step 6. Place the CompactFlash card in a reader/writer connected to your laptop or desktop computer.

Step 7. Copy the software installation package onto the CompactFlash card from your laptop or desktop computer.

Step 8. Properly remove the CompactFlash card from your laptop or desktop computer.

Step 9. Insert the CompactFlash into the SEL-3354.

Step 10. Replace the CompactFlash access panel.

Step 11. Reinstall the SEL-3354 into the panel or 19-inch rack.

Step 12. Reconnect any front and rear-panel connections.

Step 13. Energize the SEL-3354.

Step 14. Login, navigate to, and launch the software installation package.
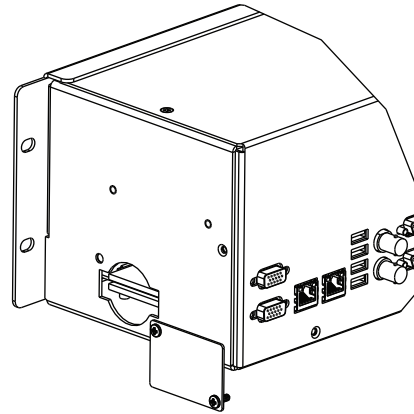
Figure 3.1 CompactFlash Access Panel

Using USB CD-ROM Drive

Use the following steps to install software using a USB CD-ROM drive.

Step 1. Connect a USB CD-ROM drive to the SEL-3354.

Step 2. Apply power to CD-ROM drive.

Step 3. Insert CD-ROM software installation program.

Step 4. Navigate to the CD-ROM drive and launch the software installation package.

Using the Network

Use the following steps to install software from a network.

Step 1. Connect a network cable.

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

See *Common Operation Oversights on page 5.1* for a troubleshooting section on Networking or refer to your operating system manual if you need assistance with this.

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

Step 4. From the SEL-3354, map the network share.

Step 5. Launch your installation software from the network share or copy installation software locally to a directory on your SEL-3354 and launch the software installation package locally.

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Section 4

SEL SysMon

Overview

This section describes the SEL System Monitor Graphical User Interface (SysMon GUI) that displays and configures IRIG, status, and alarm settings in a familiar tabbed Windows® interface. SysMon GUI is a graphical front-end interface for operation of SEL Service functions with the SEL-3354 hardware. For the Linux version of SysMon, please see the SELsysmond section in *Appendix C*. SysMon GUI starts up in the system tray when you log on to the Windows operating system, whereas the SEL Service starts automatically when you boot up your SEL-3354.

Figure 4.1 is an overview of how the SEL Service and SysMon GUI use both the Windows Event Viewer for logging and the alarm contact. Use the alarm contact and Windows event log data to pass alarms and notifications on to SCADA from your SEL-3354.
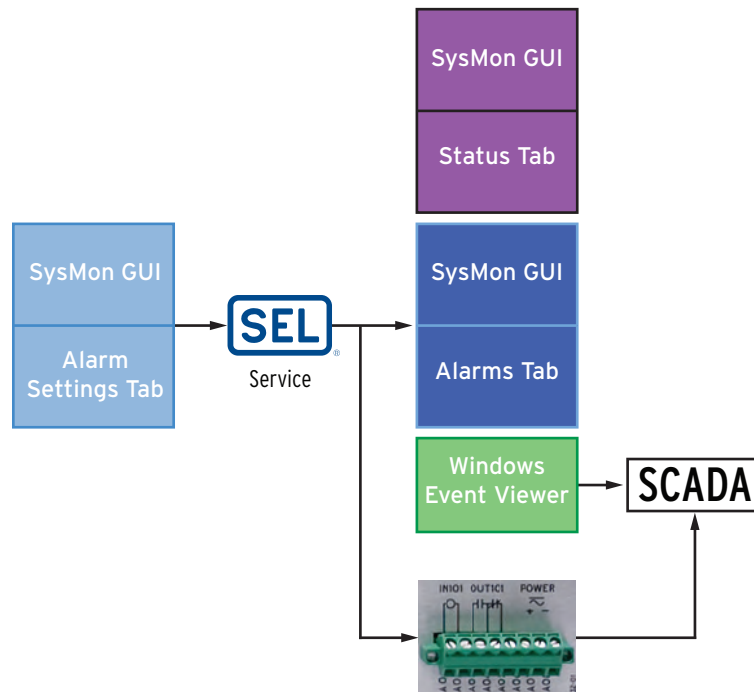

Figure 4.1   Overview of SEL Service and SysMon

SysMon Functions

The application provides five main tabs: Status information, Alarms/Watchdog, Alarm Settings, Time, and Firmware. The sections that follow describe in more detail what you can configure or read within each tab.

Opening and Closing SysMon

From the Windows system tray, double-click on the SEL icon (see *Figure 4.2*) to access SysMon GUI. From the Windows Embedded Standard SEL Menu, click **System**> **SEL SysMon**.

Figure 4.2   Selecting the SEL Icon

Clicking on the Close button (X in the top right corner of the application) closes the application.

The SEL icon in the Windows system tray indicates that the program remains running even when it is not visible.

Status

A summary of status information is available at the **Status** tab (see *Figure 4.3*). The following is a description of the different types of status information. This tab is unique from the other tabs because you can make no configuration changes to SysMon from this window.
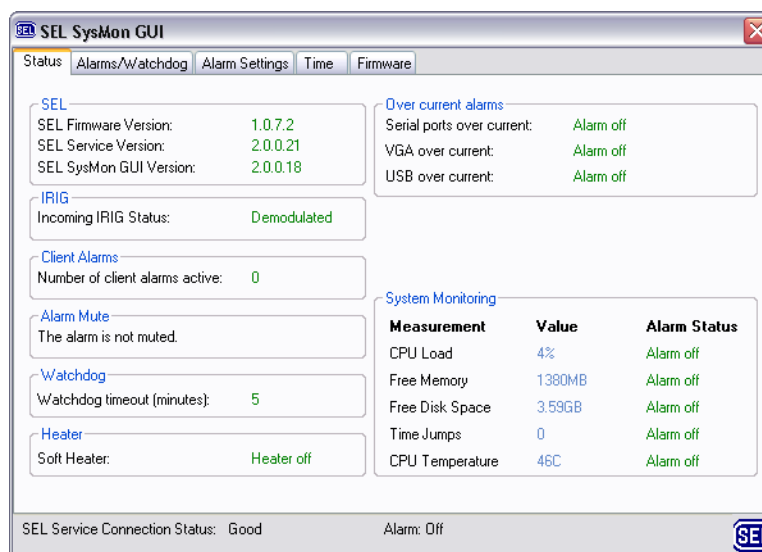
Figure 4.3   Status Tab

System Version Information

SysMon GUI displays version information for SEL firmware, SEL service, and SysMon GUI at the top of the **Status** tab. This information is useful when upgrading your system or determining applicability of a service bulletin.

IRIG

SysMon GUI displays status messages of **Not present**, **Modulated**, or **Demodulated** according to the presence and type of IRIG-B time signal to which it is connected. A status of **Not present** indicates that the SEL-3354 is not connected to an external IRIG time source.

Client Alarms

From the SEL-3354 display, you can see a count of the number of active client alarms. You can test the alarm contacts from the **Alarms** tab (see *Figure 4.5*).

Alarm Mute

Use the **Alarms** tab (see *Figure 4.5*) to mute or unmute the alarm. When you mute the alarm, SysMon displays the remaining mute time in seconds.

Watchdog

The Watchdog Timeout value displays in minutes. You can configure the Watchdog Timeout value from the bottom of the **Time/Watchdog** configuration window (see *Figure 4.11*). This setting takes effect upon startup of SEL Service.

Heater

In extremely cold temperatures, a soft heater (software executing CPU-intensive logic) raises the temperature of the CPU and surrounding chipsets to ensure proper system operation. The name of this binary file is SoftHeater.exe.

Overcurrent Alarms

The SEL-3354 supplies power from the Serial, USB, and VGA ports. These ports provide current limiting to prevent equipment damage in the event of a short circuit. Shorting the power on these ports will not affect the operation of the SEL-3354. Exceeding the limits shown in *Table 4.1* will cause an alarm to activate and the device to enter an alarm state.

When alarms are active, the alarm contact latches (turns on) on the back of the SEL-3354, the alarm light on the front of the SEL-3354 illuminates, and SysMon sends a log message to the SEL Windows Event Log.

Table 4.1   Current Limited Sections

Ports	Limit
VGA	0.4 A, 5 Vdc, 1.0 W total for both
Front and Rear-USB Ports	1.4 A, 5 Vdc, 7.0 W total for all[a,b]
Serial Ports	0.6 A, 5 Vdc, 3.0 W total for all

[a] USB limit drops to 0.8 A, 4 W, when Serial Port power is enabled.
[b] Systems built prior to 5/1/2011 have USB limit of 0.8 A, 4 W.

System Monitoring

SysMon monitors CPU load, system free memory, system free disk space, time jumping conditions on one-second intervals and CPU temperature. The alarm contact latches (turns on) when any of these resources violate conditions with parameters that you can specify from the **Alarm Settings** tab. This section of the SysMon GUI **Status** tab shows present monitored values and whether an alarm is enabled or disabled. The following text explains each of these monitored items.

CPU Load

The SEL-3354 will alarm if the CPU load, averaged over 180 seconds, has maintained a value greater than 50 percent for at least 180 seconds. You can configure these settings, but adjustment of the CPU load settings is not recommended. Contact your SEL representative if the CPU burden is routinely alarming in your application.

Free Memory

The SEL-3354 alarms if the available RAM drops to less than 40 MB for more than one minute.

Free Disk Space

The SEL-3354 alarms when disk space is less than 40 MB. Delete unused application files if the primary CompactFlash® or hard drive disk space is low.

Time Jumps

The SEL-3354 alarms if there are more than four time jumps in five minutes. A time jump occurs upon modification of the system time to align it with the most accurate time source.

CPU Temperature

The SEL-3354 alarms when the CPU temperature falls above 85 degrees Celsius or below 0 degrees Celsius.

Service Status Indicator

The bottom of the SysMon GUI window contains a status indicator for the SEL Service (see *Figure 4.4*).

Figure 4.4 Service Status Indicator

If an alarm condition exists, then the icon in the lower right alternates between the SEL icon and a red exclamation mark. The same red exclamation mark is visible in the Windows system tray when the SysMon GUI window is minimized and an alarm condition exists.

Alarms/Watchdog

The **Alarms/Watchdog** tab is an interface for monitoring soft alarms and testing the alarm contacts on the SEL-3354 (see *Figure 4.5*) or to adjust the watchdog time-out. SysMon GUI displays a count of the number of active client soft alarms at the top of the window and lists active individual alarms with a check box for selective deletion.

The **Client Alarm List** displays a maximum of 20 alarms, even though more than 20 alarms can be active at a time. The 20 oldest alarms display individually. The count of active alarms on the Status tab and the Alarms tab shows the total number of alarms.
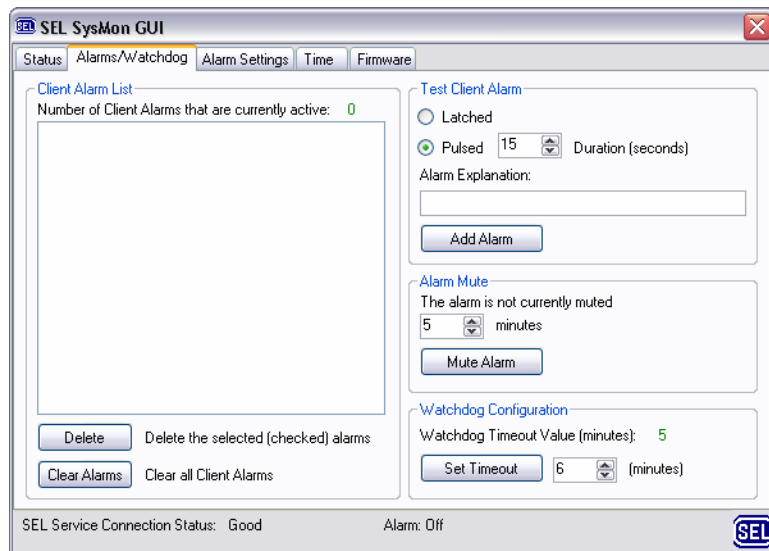
Figure 4.5   Alarms/Watchdog Configuration Tab

Adding Client Alarms

You can add client alarms in the **Test Client Alarm** area. Type a short Alarm Explanation in the provided box. Next choose what type of alarm you want to set. **Latched** will turn the alarm contacts on until the alarm clears. **Pulsed** allows an alarm to remain active for a configurable duration as long as 30 seconds. After selecting latched or pulsed and the pulse duration, click the **Add Alarm** button to add the client alarm. The alarm should appear in the **Client Alarm List** area. SysMon removes a pulsed client alarm automatically and decrements the number of active alarms when the pulse duration expires. A latched alarm will remain active until you delete the alarm.

Deleting Client Alarms

Delete individual client alarms by selecting the checkbox for the alarm(s) to remove and using the **Delete** button (see *Figure 4.6*). Using the **Clear Alarms** button removes all active alarms. When you have removed the last active alarm, the alarm contact opens and the red LED on the front of the SEL-3354 turns off. There is also an audible click, and the SEL icon will no longer alternate to the red exclamation mark.
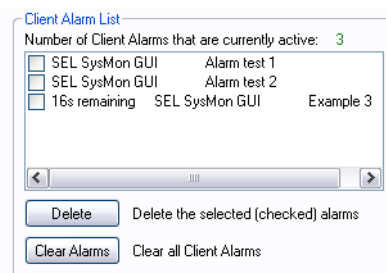

Figure 4.6   Example Client Alarms

Muting All Alarms

You can mute alarms for a configurable duration. See *Table 4.2* for the default mute duration. To use Alarm Mute, select the number of minutes and press the **Mute Alarm** button at the middle right of the **Alarms/Watchdog** configuration tab (see *Figure 4.5*). While alarms are muted, SysMon will continue to accept and process alarms, but the alarm light will not turn on nor will the alarm contact latch. When the alarm is unmuted or the mute timeout expires, the alarm contact and corresponding LED return to normal operation.

Watchdog Configuration

SEL Service resets the hardware watchdog every second. If SEL Service fails to reset the watchdog after a period equal to half the Watchdog Timeout, then SEL Service writes a warning log message to the SEL Windows Event Log. If SEL Service fails to reset the watchdog for a period of 75 percent or more of the Watchdog Timeout, then SEL Service writes one Error event log message to the SEL Windows Event Log per failure. The watchdog hardware (FPGA) will force a reboot of the SEL-3354 if the FPGA receives no reset within the Watchdog Timeout period (see *Table 4.2*).

The forced reboot is to bring the SEL-3354 back to a known good state after problems such as memory exhaustion, disk space depletion, or CPU issues. See *Table 2.3* and *Figure 2.8* for the location and jumper position to disable the watchdog if you do not want this behavior for your intended use of the SEL-3354.

Alarm Settings

Use the **Alarm Settings** tab (see *Figure 4.7*) to configure the following soft alarms: CPU, CPU Temperature, Free Memory, Free Disk Space, and Time Jumping. You can also configure seconds for an alarm to clear (Alarm Clear Time) and disable each alarm independently.

SEL Service uses the values you set on the **Alarm Settings** tab to implement a system of user-configurable soft alarm conditions. The alarm contact latches (turns on) when any individual soft alarm capability is enabled and any soft alarm condition is present. If the soft alarm condition is met, or all soft alarms are disabled, the alarm contact will only latch if a hardware alarm condition is active.

When you disable an alarm, the corresponding alarm section remains grayed-out until it is re-enabled. SEL Service sends Windows Event Log messages to the SEL event log when an alarm condition occurs and the alarm is enabled. See *Table 4.2* for all default settings, including maximum and minimum configurable ranges.

Table 4.2 Alarms and SysMon Service Default Settings (Sheet 1 of 2)

Setting	Default	Min. Value	Max. Value
CPU Load Average Threshold Value	50 percent	1 percent	100 percent
CPU Load Grace Period	180 seconds	1 second	600 seconds
CPU Load Average Window Size	180 seconds	1 second	600 seconds
CPU Temperature Threshold	NA	0	85
Alarm Clear Time	2 seconds	1 second	30 seconds
Free Memory Threshold	40 MB	40 MB	512 MB
Free Memory Grace Period	180 seconds	1 second	600 seconds
Free Disk Space Threshold	40 MB	40 MB	4096 MB

Table 4.2 Alarms and SysMon Service Default Settings (Sheet 2 of 2)

Setting	Default	Min. Value	Max. Value
Number of time jumps that cause an alarm	4 jumps	1 jump	100 jumps
Time in which jumps must occur	300 seconds	1 second	65535 seconds
Alarm Pulse Duration	15 second	30 seconds	10 seconds
Test Alarm Mute Duration	5 minutes	1 minute	10 minutes
IRIG Good Requirement	0 seconds	0 seconds	1000 seconds
IRIG Bad Requirement	5 seconds	0 seconds	1000 seconds
Watchdog Timeout Value	5 minutes	1 minute	8 minutes

CPU Alarm Configuration

CPU load is averaged over a period of time called the average window. If the average exceeds the threshold for longer than the grace period, the alarm activates. The CPU Alarm clears automatically when the average CPU use falls below the CPU Load Average Threshold for the Alarm Clear Time.

Free Memory Alarm Configuration

If free memory falls below the Free Memory Alarm Threshold for longer than the Free Memory Alarm 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 remains above the Free Memory Alarm Threshold for the duration of the Alarm Clear Time.

**Free Disk Space Alarm Configuration**

The Free Disk Space Alarm activates when free system disk space falls below the Disk Space Alarm Threshold. The alarm condition clears when free system disk space increases above the Free Disk Space Alarm Threshold.

Time Jumping Alarm Configuration

Adjust thresholds to monitor how often time jumps occur. Investigate excessive time jump alarms—they may indicate multiple time systems attempting to adjust the system clock, resulting in unreliable time information on the system clock.

Alarm Clear Time

To avoid very short alarm pulses, SEL Service holds all system monitor alarms on for a minimum clear time. This is the time without violations that causes SysMon alarms to transition from an On to Off state.
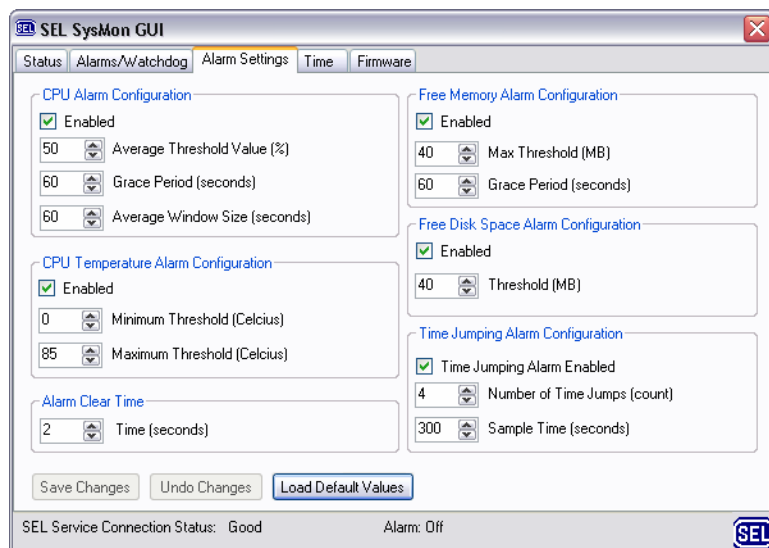
Figure 4.7   Alarm Settings Configuration Tab

Save Changes, Undo Changes, Load Default Values Buttons

At the bottom of the **Alarm Settings** tab, but above the **Service Status Indicator** area, are three buttons (see *Figure 4.8*).
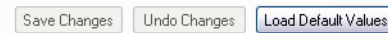

Figure 4.8   Save, Undo, or Load Defaults Buttons (Only Load Default Values Available)

In the absence of settings changes, the **Save Changes** and **Undo Changes** buttons are grayed out (see *Figure 4.8*). Making any changes to the settings on this page causes SysMon GUI to provide options for saving, undoing, or loading default values. As soon as you make a change to any settings on the Alarm Settings tab, the previously grayed out buttons become available (see *Figure 4.9*).

Figure 4.9   Save, Undo, or Load Defaults Buttons (All Buttons Available)

Changes will be lost if you select a different tab without saving changes. If you make one or more changes and attempt to navigate away from the **Alarm Settings** tab, SysMon GUI displays a dialogue box (see *Figure 4.10*) warning that you will lose changes. If you choose **Yes**, you will lose any changes you made to the **Alarm Settings**.
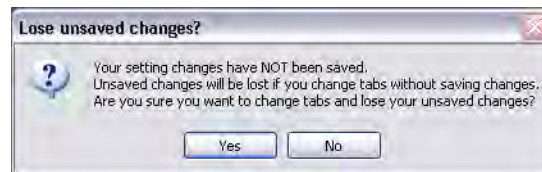

Figure 4.10   Lose Unsaved Changes Dialogue Box

If you choose **No**, you can save or undo changes before switching to a different tab. A similar set of buttons exists at the bottom of the **Time** settings configuration area, and these buttons function identically to those for the Alarm Settings configuration.

Time

Use the **Time** configuration tab (see *Figure 4.11*) to configure how the SEL-3354 synchronizes time. Explanation for each of these configuration options follows.
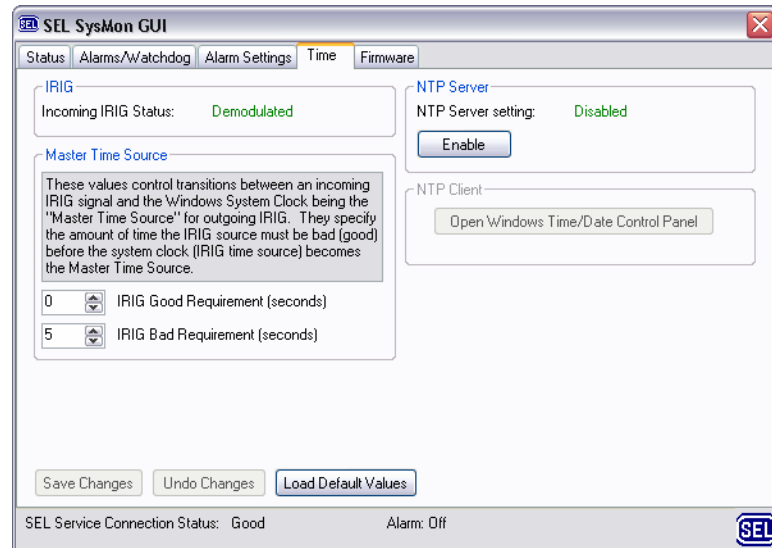

Figure 4.11   Time Configuration Tab

IRIG

The top of the **Time** window indicates the IRIG-B IN (top) BNC at the back of the SEL-3354. The status will read **Not present** (see *Figure 4.11*) if no IRIG-B source is present. If an IRIG-B source is connected to the SEL-3354, the status will read **Modulated** or **Demodulated** depending on the type of IRIG-B signal.

Master Time Source

SEL Service on the SEL-3354 checks the state of the IRIG signal about once a second and keeps Windows system time synchronized with IRIG time via a Windows time provider called the SEL Time Provider.

The SEL Time Provider is the master source on startup if IRIG is present and good; otherwise the SEL-3354 uses the system clock as the master time source on startup. A transition from the SEL Time Provider as the master time source to System Time as the master time source occurs if the IRIG source is consistently bad for the configurable IRIG Bad Requirement period (see *Table 4.2*). A transition from System Time as the master time source to SEL Time Provider as the master time source occurs if the IRIG source is consistently good for the IRIG Good Requirement period (see *Table 4.2*). The SEL-3354 creates an SEL Windows Event Log entry whenever the master time provider transitions between sources.

SEL Service sets the hardware up to source outgoing IRIG if incoming IRIG is present. SEL Service sets the field programmable gate array (FPGA) to source outgoing IRIG from the operating system clock if there is no external IRIG source. See *Date and Time on page B.11* for additional IRIG output settings you can make at the IRIG device properties and registry levels.

NTP Server

The SEL-3354 can serve as an NTP Time Server. The status of the current NTP Server is shown as **Enabled** or **Disabled**. The button toggles back and forth to list the option opposite to the present configuration. There are several seconds of delay while SEL Service makes the necessary changes. A green state message changes between Enabled and Disabled to reflect the present setting.

NTP Client

The **Open Windows Time/Date Control Panel** button displays when there is no IRIG source connected to the SEL-3354. This opens the Windows Date and Time Properties window, from where you can select an NTP server to use in synchronizing the system clock (see *Figure 4.12*). Make sure to check the **Automatically synchronize with an Internet time server** checkbox to allow the System Time to update this way.
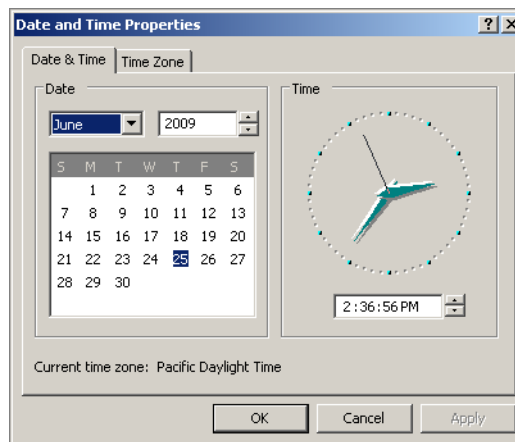

Figure 4.12   Windows Date and Time Properties

It is common when using an NTP time server to have trouble synchronizing with the remote NTP source. Check with your network and system administrator to verify that the necessary ports and protocols (typically UDP port 123) are allowed through any firewalls between the NTP time server and your SEL-3354.

Firmware

From the final SysMon GUI configuration tab labeled **Firmware**, you can update firmware. When you select this tab, SysMon GUI displays the **Firmware Update** dialogue (see *Figure 4.14*), which prompts for the location of a firmware update file (.fwu file). You can then use a Windows Explorer-style interface to select the appropriate firmware update file.
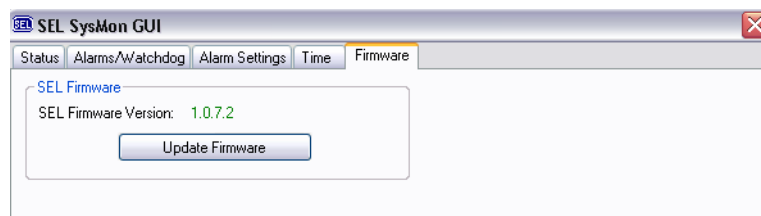

Figure 4.13   SysMon Firmware Configuration Tab

The SEL-3354 will reboot immediately following a successful firmware update. Before you update firmware, SEL recommends that you back up your present operating system and data and close all open applications.

Figure 4.14   Firmware Update Dialogue

SEL Service and SysMon GUI Processes

The Windows Task Manager (see *Figure 4.15*) shows the two running software programs necessary for proper IRIG, Status, and Alarm functionality: **SELService.exe** and **SELSysMonGUI.exe**.
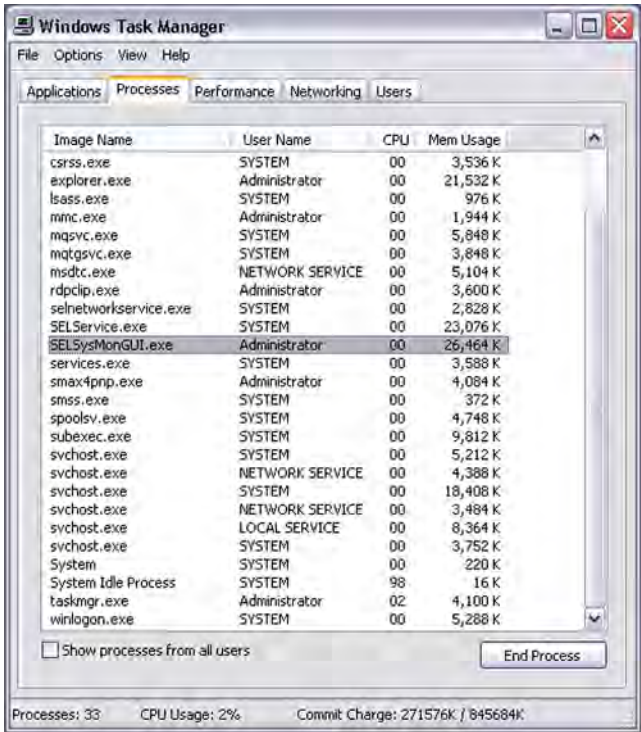

Figure 4.15   Windows Task Manager

SEL Service runs as a Windows service. To display SEL Service settings, open the Windows services control panel. To open the **Services** control panel, click **Start**, click **Run**, type **services.msc**, and click **OK**. The services control panel should display (see *Figure 4.16*). Scroll down to find SEL Service.
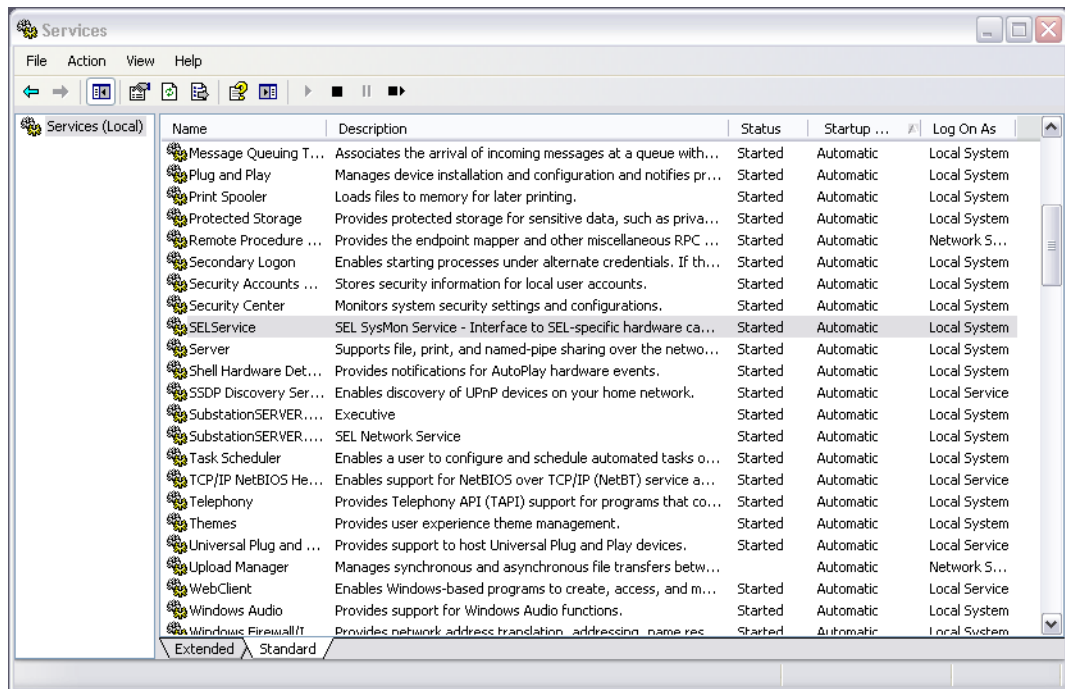
Figure 4.16   SELService in Windows Services List

Right-click on SELService and select **Properties** to verify that SEL Service is configured to start automatically whenever the SEL-3354 boots up (see *Figure 4.17*).

Figure 4.17   SEL Service Properties

Should SEL Service ever stop running or fail to start initially, the Sysmon GUI icon in the Windows system tray will display a balloon tip reminding you to restart SELService (see *Figure 4.18*). Restart SEL Service to fix the problem. You may wish to check event log messages to troubleshoot why the service stopped. If you do not restart the service within the watchdog timeout value, the watchdog will reset the computer.

Figure 4.18   SEL SysMon GUI Balloon Tip

SysMon Default Settings

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

Installing and Updating SysMon

SysMon is factory installed on all Windows and Linux operating systems included with the SEL-3354. If you install your own custom operating system on the SEL-3354, you can install SysMon using the installation files located on the SEL-3354 Product DVD that was included in the box with your SEL-3354. To upgrade an existing installation of SysMon, refer to the installation instructions included with the upgrade.

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Section 5

Troubleshooting

Overview

Please refer to the SEL website (www.selinc.com) for up-to-date troubleshooting information.

Common Operation Oversights

Blank Monitor

The SEL-3354 is compliant with most computer monitors. Video selections are available up to 2048 by 1536 for VGA1. The secondary video connection (VGA2) is fixed at 1024 by 768 60Hz. Ensure that any monitor connected to VGA2 meets this specification. *Table 5.1* lists possible causes and solutions for a blank monitor.

Table 5.1   Blank Monitor Troubleshooting

Symptoms/Possible Cause	Diagnosis/Solution
Ambient temperature below 5ºC (41ºF)	➤ At cold temperatures the SEL-3354 will perform a preheat cycle before booting into the operating system. The preheat cycle may take as long as 20 minutes in extremely cold conditions.
Power saver is activated	➤ Move your mouse to ensure that the screen saver is not activated.
Monitor power is off	➤ Locate and verify that the monitor power indication LED is illuminated. ➤ If the LED is not illuminated, locate the monitor power button and press to turn the power on.
Monitor goes blank during boot up	➤ Ensure BIOS defaults are correct. See *Appendix D: Resetting BIOS* for default BIOS settings.
SEL-3354 power is off	➤ Verify that the SEL-3354 power LED is illuminated. ➤ If the SEL-3354 LED is not illuminated, re-examine the power outlet and power connection to the SEL-3354 monitor. ➤ Ensure that your SEL-3354 is properly being powered. Note that the SEL-3354 is available with multiple voltage levels.
Equipment failure	➤ Contact your computer administrator if you cannot determine the cause. ➤ Verify that the monitor brightness is not turned all the way down.
VGA1 does not output a display	➤ Make sure the monitor is connected when you boot up and when you open the graphics setting.
Video resolution is limited to 1024 x 768	➤ Disable "clone" display mode in the display properties (or in the Intel Graphics Properties or ATI Catalyst).

Windows Fails During Bootup

Undesirable operating conditions such as sudden loss of power, system lockup, or failed software installations, may adversely affect standard Windows installations such as Windows 7 Ultimate or Windows XP Professional, preventing the system from booting up and running properly. Windows Embedded Standard is less susceptible to these failure modes because of the Enhanced Write Filter's ability to protect system files.

Often the system can be restored to a workable state by using the following startup options, accessible by pressing the F8 key immediately before Windows starts to boot:

➤ Repair Your Computer (Windows 7 and Server 2008 R2): 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 checkdisk 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 reboot 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% CPU burden

In Windows, SoftHeater.exe will consume 100% CPU at a low priority to keep the CPU warm while maintaining a minimal impact on system performance. SoftHeater.exe executes complex mathematical routines to generate as much CPU heat as possible. Such behavior, which should only occur at extreme cold temperatures, is acceptable and no cause for concern.

In Linux, the binary file responsible for the software heater functionality is named SoftHeater. As with SoftHeater.exe in Windows, the 100% CPU burden resulting from operation of this file should not be seen as a problem. It is indication your computer is experiencing very low operating temperatures.

Networking

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

Ensure that the Ethernet hub, switch, or router is compatible with the SEL-3354. The SEL-3354 has the ability to connect to 10BASE-T and 100BASE-T copper cable connected equipment. The SEL-3354 has the ability to connect to two 100BASE-FX fiber (selectable as an ordering option) Ethernet connections. Verify that the SEL-3354 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 proper, then ping the SEL-3354 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 computer name.

Ensure that each physically separate network is configured for a different IP range/subnet.

System Clock Behaving Erratically

If the SysMon service consistently displays **Time Jumping Alarms**, it is possible that an external application is adversely affecting the output of IRIG time. In FPGA-based systems an external application that manually sets system time will adversely affect the output of IRIG time. This is because the system time is used to calibrate a pulse per second timer which the FPGA's phase-locked loop uses to generate the electrical signal to precisely indicate the start of a second. When the system time is manually set by an application other than the W32time service, the time is additionally set at the top of the second. This prevents an accurate system frequency and phase measurement.

Ensure that no software programs are trying to set or sync the system time. Examples of some programs that frequently set the system clock on a regular basis are SEL-5860 and SubstationSERVER.NET. In SubstationSERVER.NET slave protocols like DNP3, IEC01/104 & Harris 5000/6000 have the ability to synchronize system time based on time provided by the master protocols.

Factory Assistance

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. 332.1890
Fax: +1.509.332.7990
Internet: www.selinc.com
Email: info@selinc.com

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Appendix A
Software and Manual Versions

Software

Table A.1 lists the software and firmware versions, a description of modifications, and the instruction manual date code that corresponds to these versions. The most recent version is listed first.

Table A.1   Software Revision History (Sheet 1 of 2)

Identification Numbers	Summary of Revisions	Manual Date Code
Firmware: R1.1.3.0 (Windows)	➤ Modified firmware to prevent missing serial port interrupts during rapid read requests.	20140523
Firmware: R1.1.2.0 (Windows)	➤ Added synchronous bit-mode operation to serial ports. ➤ Added DtrRtsSwap serial port feature.	20130501
SEL Service: R2.1.4.0 SEL SysMon: R2.1.2.0	➤ Added 64-bit Windows support. ➤ Corrected software heater failure.	20121019

Operating System:
    R4.1.2.3 (Windows Embedded Standard, Intel Pentium M)
    R4.2.2.2 (Windows Embedded Standard, AMD Athlon 64)
	➤ WES OS images brought up to date with latest Microsoft updates, .NET framework, and Silverlight.	20111111

Operating System:
    R4.2.5.1 (Windows Server 2008 R2, AMD Athlon 64)
Firmware:
    R1.1.0.0 (Windows)
    R2.0.3.0 (Linux)
	➤ Added Windows Server 2008 R2 64-bit operating system option.
	
	➤ Added Serial Port Power jumper function (JMP5 D).
	➤ Raised USB current limit (only affects systems built after May 1, 2011).
		20110422

Operating System: R4.2.4.1 (Windows 7 Ultimate 32-bit, AMD Athlon 64)	➤ Added Windows 7 Ultimate 32-bit operating system option and removed Windows XP Professional operating system option.	20110309

Firmware:
    R1.0.9.0 (Windows)
    R2.0.2.0 (Linux)
	➤ Improved CPU heater startup.	20101201

Firmware:
    R1.0.8.0 (Windows)
    R2.0.1.0 (Linux)
SEL Service: R2.1.0
SEL SysMon: R2.1.0
SEL Sysmond: 1.1.0-3
	➤ Updated firmware revision to improve performance at cold temperatures.
	➤ Added software heater logic to the SEL Service and SysMon (Windows) and Sysmond (Linux) including ability to alarm on temperature and configure temperature thresholds.
		20100929

Table A.1 Software Revision History (Sheet 2 of 2)

Identification Numbers	Summary of Revisions	Manual Date Code

Operating System:
  R4.0.3.0 (Ubuntu Lucid 10.04 LTS i386, Intel Pentium M or AMD Athlon 64)
  R4.2.3.0 (Ubuntu Lucid 10.04 LTS amd64, AMD Athlon 64)
Firmware: R2.0.0.0
	➤ Added Ubuntu Linux operating system option.
	➤ Added firmware to support Linux.
		20100827

Firmware: R1.0.7.0	➤ Improved performance of preheat cycle.	20100520
Firmware: R1.0.6.0	➤ Added preheat cycle at cold temperatures to improve cold reliability.	20100430
Firmware: R1.0.5.0	➤ Improved performance at cold temperatures.	20100317

Operating System:
  R4.1.2.1 (Windows Embedded Standard, Intel Pentium M)
  R4.2.2.1 (Windows Embedded Standard, AMD Athlon 64)
Firmware: R1.0.4.0
	➤ Improved performance at cold temperatures.
	➤ Added Windows® Embedded Standard operating system option.
		20100129

Firmware: R1.0.2.0 SEL Service: R2.0.0.18 SEL SysMon: R2.0.0.12	➤ Update firmware revision to support serial port half duplex operation.	20091105

Operating System:
  R4.1.1 (Intel Pentium M)
  R4.2.1 (AMD Athlon 64 2600)
Firmware: R1.0.1.0
SEL Service: R2.0.0.14
SEL SysMon: R2.0.0.12
	➤ Initial version of operating system, firmware, SEL Service, and SEL SysMon GUI.	20090817

Instruction Manual

The date code at the bottom of each page of this manual reflects the creation or revision date.

Table A.2 lists the instruction manual release dates and a description of modifications. The most recent instruction manual revisions are listed at the top.

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

Revision Date	Summary of Revisions
20150126	**Preface** ➤ Added Safety Information. **Section 1** ➤ Renamed *Certifications* to *Compliance* and moved to the beginning of *Specifications*.
20140523	**Appendix A** ➤ Updated for Firmware version R.1.1.3.0.

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

Revision Date	Summary of Revisions
20130501	**Section 1** ➤ Updated *Specifications*. **Section 2** ➤ Updated *Serial Port Communications*. ➤ Updated *Table 2.1: EIA-232 Serial Port Connector Pin Definition*. **Appendix A** ➤ Updated for Firmware version R.1.1.2.0. **Appendix B** ➤ Updated *Serial Port Configuration*. ➤ Updated *Figure B.20: Dword Settings for Serial Ports*. ➤ Updated *Table B.1: Example Registry Serial Port Settings*.
20121019	**Section 1** ➤ Added fiber-optic cable information to *Specifications*. ➤ Consolidated On-Board VGA specifications. ➤ Corrected Enclosure Protection specifications. **Section 4** ➤ Clarified wording of SysMon GUI and SEL Service. ➤ Corrected default values for Free Memory and CPU Load alarm settings in *Table 4.2*. **Section 5** ➤ Corrected video resolution for VGA1. **Appendix B** ➤ Added fiber-optic Ethernet rear-port information to *Ethernet Port Configuration*. **Appendix C** ➤ Added *Ethernet Port Configuration* section with fiber-optic Ethernet rear-port information.
20111111	**Appendix A** ➤ Updated Windows Embedded Standard, Intel Pentium M operating system version R4.1.2.3. ➤ Updated Windows Embedded Standard, AMD Athlon 64 operating system version R4.2.2.2.
20110926	**Section 1** ➤ Updated CPU module memory in *Models and Options* and *Specifications*.
20110815	**Section 1** ➤ Updated Type Test information in *Specifications*. **Section 2** ➤ Updated *Figure 2.4: Rear-Panel Diagram*.
20110520	**Section 2** ➤ Added reference to *Ethernet Port Configuration* in *Appendix B*. **Appendix B** ➤ Added *Ethernet Port Configuration* section.
20110422	**General** ➤ Added Windows Server 2008 R2 operating system option. **Section 1** ➤ Updated Type Test information. ➤ Added UL certification. **Section 2** ➤ Added serial +5 V Pin1 enable jumper. **Section 4** ➤ Updated USB current limit. **Section 5** ➤ Updated blank monitor troubleshooting.

Table A.2   Instruction Manual Revision History (Sheet 3 of 4)

Revision Date	Summary of Revisions
	Appendix A ➤ Added Windows Server 2008 R2 operating system version R4.2.5.1. ➤ Updated for firmware version R1.1.0.0 and R2.0.3.0. **Appendix B** ➤ Added Windows Server operating system description. ➤ Added *Server Manager (Windows Server 2008 R2 Only)*.
20110309	**General** ➤ Added Windows 7 Ultimate 32-bit operating system option and removed Windows XP Professional operating system option. **Section 5** ➤ Added *Windows Fails During Bootup*. **Appendix A** ➤ Updated for operating system version R4.2.4.1 (Windows 7 Ultimate 32-bit, AMD Athlon 64). **Appendix B** ➤ Removed *Recycle Bin* and *Temporary Internet Settings*. ➤ Added *System Image Backup (Windows 7 Ultimate only)*.
20101201	**Appendix A** ➤ Updated for firmware version R1.0.9.0 and R2.0.2.0.
20100929	**Section 3** ➤ Added mention of Linux drivers on a new DVD-ROM for driver, instruction manual and source distribution. **Section 4** ➤ Added description of the CPU Temperature alarm, Soft Heater and rearranged order of SEL SysMon tab descriptions. ➤ Replaced screens hots and configuration table with rearranged SysMon tab layout and new configuration parameters. **Section 5** ➤ Added SoftHeater troubleshooting note. **Appendix C** ➤ Added Soft Heater and CPU Temperature alarm information. ➤ Updated table of default parameters for Sysmond and new screen shot of default configuration file.
20100827	**General** ➤ Expanded indexing of Linux content. **Section 3** ➤ Explained how to disable watchdog functionality. **Appendix A** ➤ Added Linux 32-bit and 64-bit operating system versions R4.0.3.0 and 4.2.3.0. ➤ Added Linux firmware version R2.0.0.0. **Appendix C** ➤ Described how to change an accounts password. ➤ Explained how to obtain a listing of Ubuntu packages. ➤ Explained correspondence of device nodes to SEL serial port numbers. ➤ Noted need to remove device power before attempting a new FPGA firmware upgrade.
20100520	**General** ➤ Added *Appendix C: Ubuntu Linux System Configuration*. ➤ Moved *Appendix C: Resetting BIOS* to *Appendix D*. **Appendix A** ➤ Updated for firmware version R1.0.7.0.

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

Revision Date	Summary of Revisions
20100430	**Section 5** ➤ Updated *Table 5.1*. **Appendix A** ➤ Updated for firmware version R1.0.6.0.
20100317	**Section 1** ➤ Updated *Specifications* for power supply burden and certifications. **Section 2** ➤ Updated *Table 2.3*. **Appendix A** ➤ Updated for firmware version R1.0.5.0.
20100129	**Section 1** ➤ Updated *Specifications* to include Windows Embedded Standard operating system information. **Section 2** ➤ Moved Windows specific default username and password information to *Appendix B*. **Appendix A** ➤ Updated for operating systems R4.1.2.1 and R4.2.2.1. ➤ Updated for firmware version R1.0.4.0. **Appendix B** ➤ Added Windows Embedded Standard operating system information.
20091105	**Section 1** ➤ Corrected Type Test listings in *Specifications*. **Appendix A** ➤ Updated for firmware version R1.0.2.0.
20090817	➤ Initial version.

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Appendix B
Microsoft Windows System Configuration

Overview

This section describes the features of importance of the Microsoft®
Windows® operating systems available on theSEL-3354 Embedded
Automation Computing Platform.

Standard Windows operating systems such as Windows 7 Ultimate and
Windows XP Professional offer a balance between expandability, security,
reliability, functionality, and maintainability.

➤ **Security**

  Take advantage of proven security tools included in the
  operating system and install off-the-shelf virus protection
  products to protect against cyber attacks.

➤ **Reliability**

  Reliability is achieved by restricting your SEL-3354 to a
  limited set of software application, and drivers that are
  thoroughly tested for compatibility and stability. Refrain from
  adding unnecessary software applications.

➤ **Functionality**

  Microsoft Windows is the industry leader in functionality. Most
  networks, software, and hardware are Windows compliant.

➤ **Maintainability**

  PC-AT compatible hardware and Windows compatible
  software provide virtually limitless opportunity for future
  growth and backward compatibility.

Windows Embedded Standard operating system takes the above standard
Windows qualities, and enhances the data integrity and accessibility to create
a true embedded solution.

➤ **Data Integrity**

  Windows Embedded Standard includes an Enhanced Write
  Filter (EWF) feature to protect the system disk from corruption.
  The EWF caches all write operations to the file system, to
  protect against file system corruption from events like power
  outages and malicious attacks.

➤ **Accessibility**

  The SEL Menu system is a fully customizable XML-based
  menu system to replace the standard Windows Start Menu. The
  system administrator has complete control over what system

applications and settings each user account has access to through the SEL Menu, enabling the creation of a true purpose-built embedded computer.

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 system to become a localized backup domain controller, enabling single-sign-on access in remote locations to AD and LDAP capable devices, even with limited connectivity to the corporate network.

➤ **Network Services**

Services such as DHCP and DNS server, File server, and Web server enable connectivity, integration, and management of devices on the network.

➤ **Virtualization**

Application virtualization enables applications to run on client computers without being installed, and allows applications to be administered from a central location. Remote Desktop Services provides access to centrally managed applications and resources from the network.

System Factory Settings

The SEL-3354 is shipped from the factory with the following modifications to Microsoft Windows operating systems.

Username/Password

The factory default username and password for Microsoft Windows operating systems are listed below.

User name: Administrator

Password: SEL3354

TCP/IP Settings

The factory default TCP/IP settings for the front Ethernet port are listed below.

IP address: 192.168.1.2

Subnet mask: 255.255.255.0

Default Gateway: 192.168.1.1

Use the front Ethernet port to configure the SEL-3354 via Remote Desktop, without a directly connected keyboard, mouse, and monitor. The rear Ethernet ports are set to DHCP by default.

Virtual Memory

Virtual memory utilizes the system disk to expand system memory (RAM) when application demand exceeds the system RAM capacity. Exceeding system RAM greatly diminishes performance, as disk access is orders of magnitude slower than RAM access. Virtual Memory also accelerates wear on the CompactFlash storage. For these reasons, Virtual Memory has been set to "No Page File". If your application requires Virtual Memory, it can be enabled

without concern for system longevity; however performance may be impacted.

Password Security Policies

Specify unique passwords up to 128 characters to secure your system. The SEL-3354 includes Group Policy edits listed below to accommodate the requirements of high-security applications. For additional details on password assignments, see *User Accounts and Passwords on page B.5*.

Password Policy

Log password history	5 passwords remembered
Maximum password age	180 days
Minimum password age	0 days
Minimum password length	8 characters
Password complexity	Enabled

Account Lockout Policy

Account lockout duration	5 minutes
Account lockout threshold	3 invalid attempts
Reset account lockout counter	5 minutes

Audit Policies

Security auditing features aid in tracking computer access, password changes, and ensure password maintenance. The following auditing features are enabled through SEL-3354 Group Policy edits.

Audit account log events	Success, Failure
Audit account management	Success, Failure
Audit logon events	Success, Failure
Audit policy change	Success, Failure

System Configuration

Once logged on, the SEL-3354 provides access to Windows functions and software through the standard Windows desktop interface in Windows 7 Ultimate (see *Figure B.1*), and Windows Server 2008 R2, or the SEL Menu in Windows Embedded Standard (see *Figure B.2*).

Figure B.1   Windows 7 Ultimate Desktop Interface
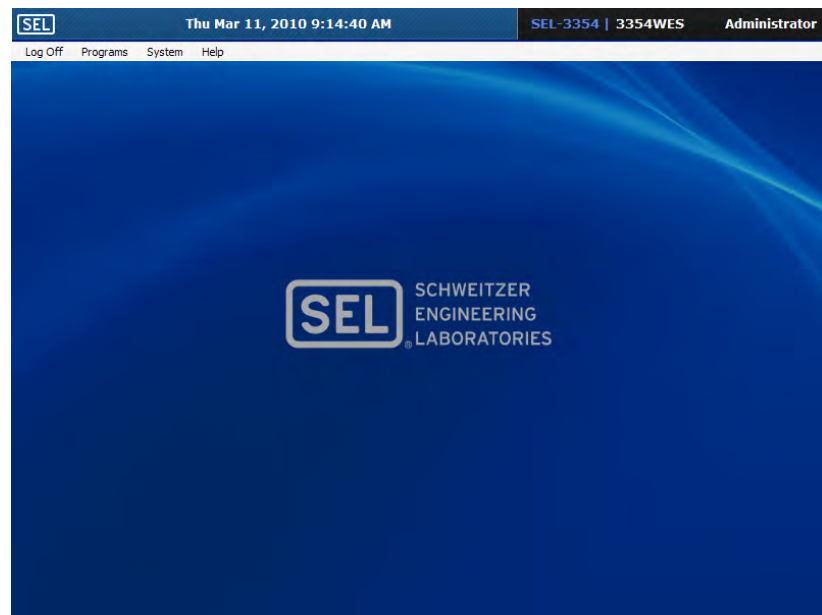
Figure B.2   Windows Embedded Standard SEL Menu Interface

Logging On and Off

The SEL-3354 maintains the standard Windows logon methods. *Figure B.3* shows the Standard Windows logon dialog box.

NOTE: Passwords and user names should be configured during initial setup to ensure device security. Forgetting the Administrator user name or password will require reinstallation of the factory image. See User Accounts and Passwords for instructions on setting user names and passwords.
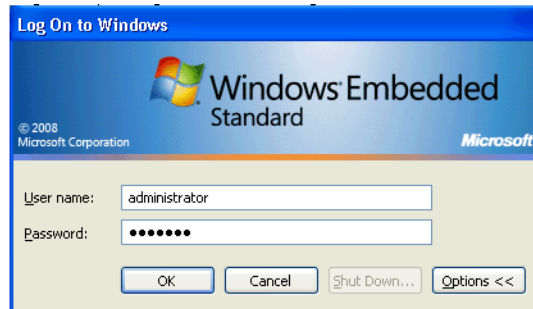
Figure B.3   Logon Dialog

To log off, select the **Log Off** item from the **Start** menu or the SEL Menu.

User Accounts and Passwords

The SEL-3354 contains the standard Windows User Accounts accessible through the Control Panel. Simply open the **Control Panel**, then click on **User Accounts** from the SEL-3354 **Control Panel** window (see *Figure B.4*).

Figure B.4   Selecting User Accounts From Control Panel

The Administrator account is configured during initial setup. Administrators have complete and unrestricted access to the following computer/domain functions:

➤ Upgrade the operating system

➤ Install Windows or software updates from SEL

➤ Configure critical computer-wide operating system parameters

➤ Take ownership of objects

➤ Network configuration

The management of passwords is controlled in the **User Accounts** windows. The SEL-3354 is shipped with high-security password features enabled. User-selected passwords should match the following criteria:

➤ Passwords can be up to 127 characters in length.

  However, if you are operating on a network that also uses Windows 95 or Windows 98, consider passwords no longer than 14 characters. Otherwise, you may not be able to logon to the network.

➤ 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 in the first and last position.

➤ Password does not contain the user ID.

➤ Password does not include the user's own name, other familiar names, employee serial number, Social Security number, birth date, phone number, or any information about him/her that the user believes could be readily learned or guessed.

➤ Password does not, to the best of the user's knowledge, include common words that would be in an English dictionary or from another language with which the user has familiarity.

➤ Password does not, to the best of the user's knowledge, 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 employed by the user on his/her unclassified systems is different than the passwords employed on his/her classified systems.

To update user passwords, open the **Control Panel**, then click on **User Accounts**, then click on **User Accounts** (see *Figure B.5*). Select the user name to edit, or follow the instructions to create a new user account.
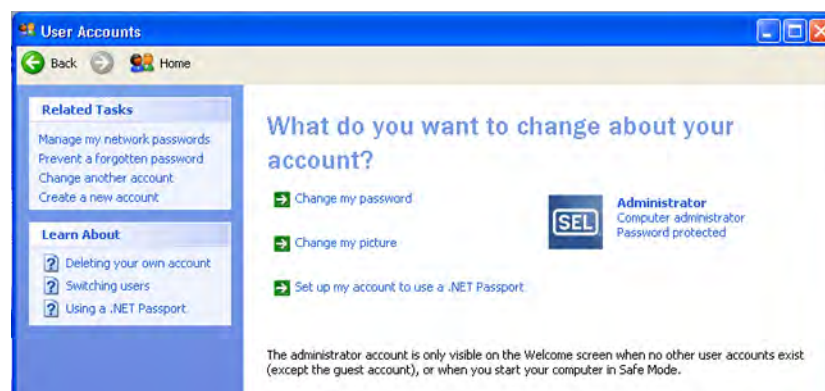
Figure B.5   Change an Account Window

Enter the new password in both the **New password** and **Confirm new password** text boxes (see *Figure B.6*). Follow your company's policies regarding user accounts and passwords. Contact your network or computer administrator if you are unsure of which options or settings need to be made.
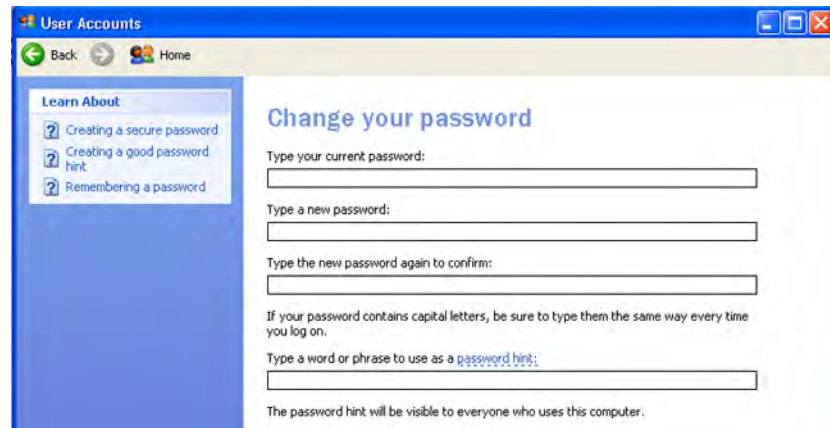
Figure B.6   Change Your Password Window

Display

To access the display property options on the SEL-3354, open the **Control Panel**, then click on **Performance and Maintenance**, then click on **Display**.

The standard Windows display features are available. Refer to Windows operating system information available at most bookstores and online.
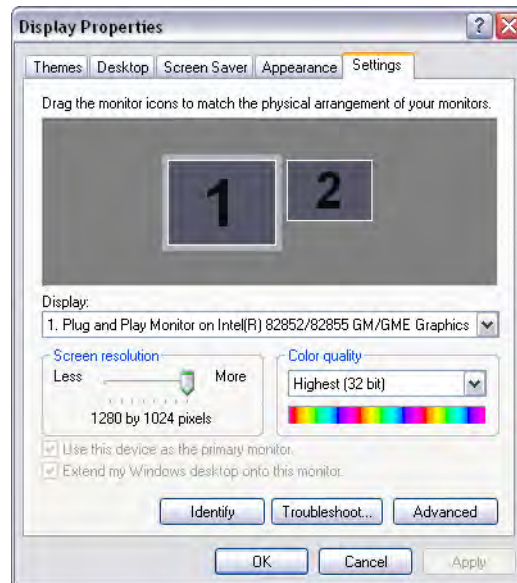
Figure B.7   Display Properties Window (Intel)

You may also use the ATI Catalyst Control Center or Intel® Extreme Graphics 2 applications to control display settings. See the Help available from each of these tools for assistance configuring the display(s).
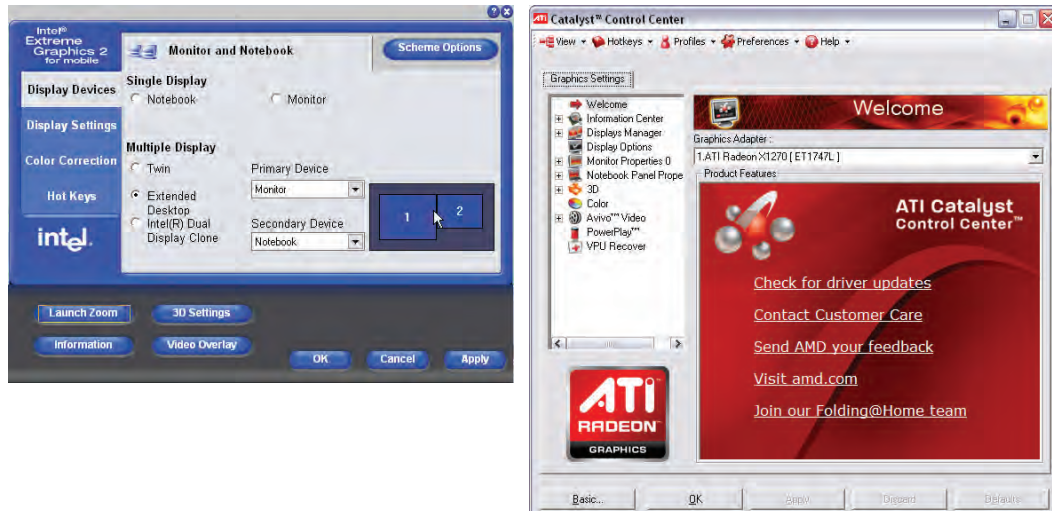
Figure B.8   Intel and ATI Display Setting Tools

Computer Name

Every computer on an Ethernet network must have a unique computer name. The SEL-3354 computer name is configured during the initial setup. This computer name should be changed to something meaningful and easy to remember.

Open the **Control Panel**, then click on **Performance and Maintenance**, then click on **System**. In the **System Properties** window, click the **Computer Name** tab, and enter a computer name according to your company's policies for computer naming (see *Figure B.9*). Contact your network or computer administrator for assistance in setting a computer name.
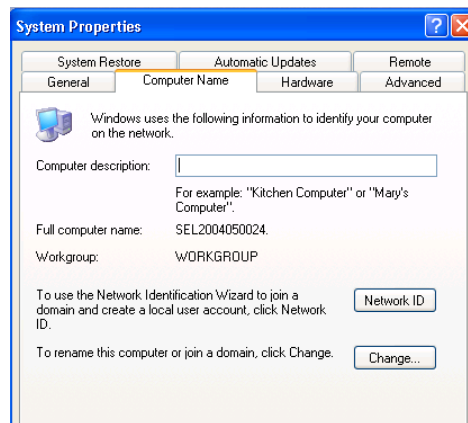
Figure B.9   Setting Computer Name

Network Identification Wizard

The Standard Windows Network Identification Wizard assists you in installing the SEL-3354 on your network. Open the **Control Panel**, then click on **System**. In the **System Properties** window, click on the **Computer Name** tab, and click **Network ID** (see *Figure B.9*) to start the wizard. Contact your network or computer administrator for assistance.

Hardware

The **Hardware** tab is part of the Windows **System Properties** dialog box. Do not attempt to install internal hardware on your SEL-3354.

Performance

The **Performance** options located under the **Advanced** tab of the **Windows System Properties** dialog box (see *Figure B.10*) should not be adjusted. The SEL-3354 has been thoroughly tested with the default settings. For best performance with a Flash-based system, the **Advanced Performance** options include **Virtual Memory** settings set to "No Page File".

User Profiles

Options for User Profiles are located under the **Advanced** tab of the Windows **System Properties** dialog box (see *Figure B.10*). In the **User Profiles** area, select **Settings**. *Figure B.10* and *Figure B.11* illustrate how to gain access to user profiles. Contact your computer administrator for guidance regarding User Profiles.
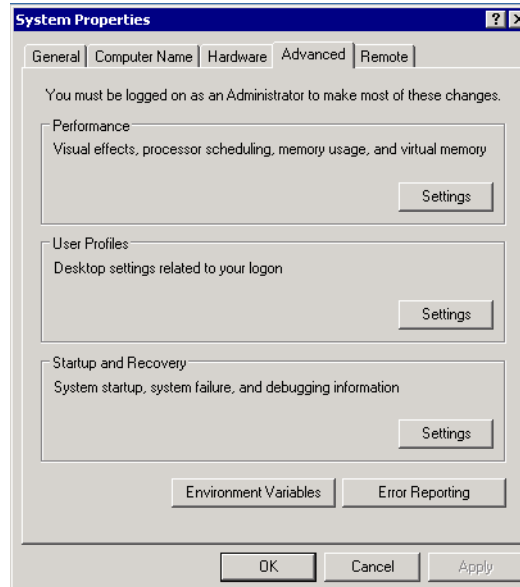
Figure B.10   System Properties Advanced Tab
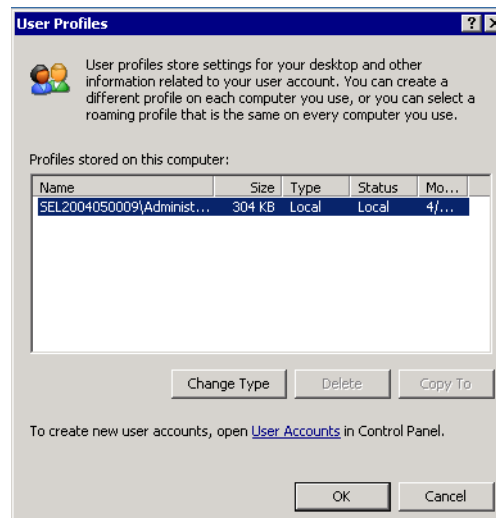
Figure B.11   User Profiles Window

Startup and Recovery

Do not modify any settings located in the **Startup and Recovery** portion under the **Advanced** tab of the Windows **System Properties** dialog box.

Environment Variables

To set an Environment Variable, select **Environmental Variables** from the **Advanced** tab of the Windows **System Properties** dialog box (see *Figure B.12*). Highlight the variable and value line to be modified and select **New**. Paths may be modified (select **Edit**) or deleted (select **Delete**).
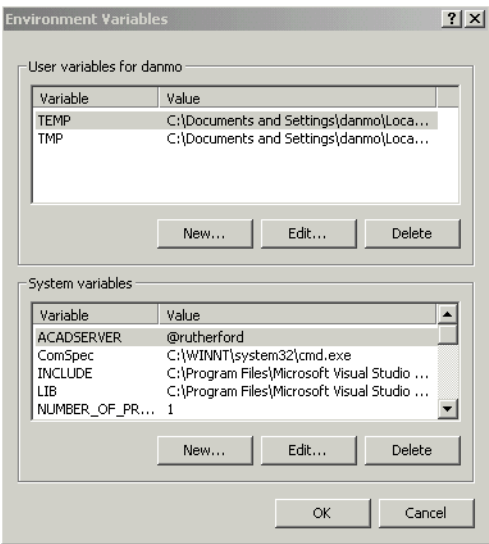
Figure B.12   Environment Variables

Remote Assistance

Remote Assistance is located under the **Remote** tab of the Windows **System Properties** dialog box (see *Figure B.13*). Selecting the **Remote Assistance** check box enables this function. Disable Remote Assistance in high-security applications.

Remote Desktop Server

Remote Desktop may be enabled to permit connections using Windows Remote Desktop Connection from your personal or workplace computer.

To allow access via the Remote Desktop, select the **Remote** tab of the Windows **System Properties** dialog box (see *Figure B.13*). Use the **Select Remote Users** function to limit who may have access to the SEL-3354.
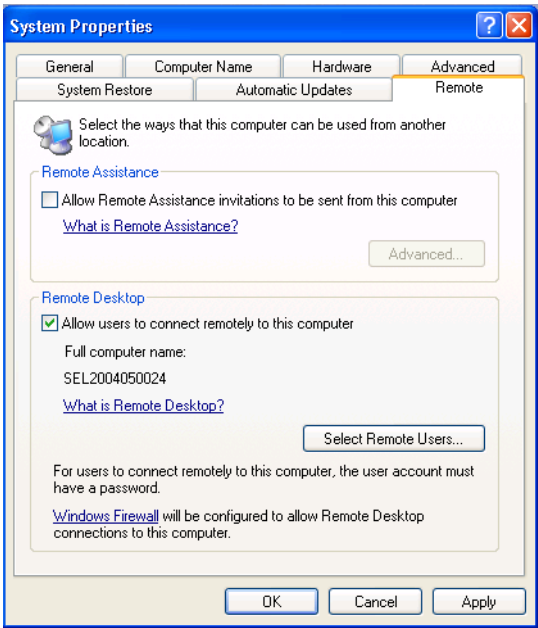
Figure B.13   Remote Desktop Settings

To enable Remote Desktop connections for a particular user, select the **Select Remote Users** function and click **Add** to access remote user rights.
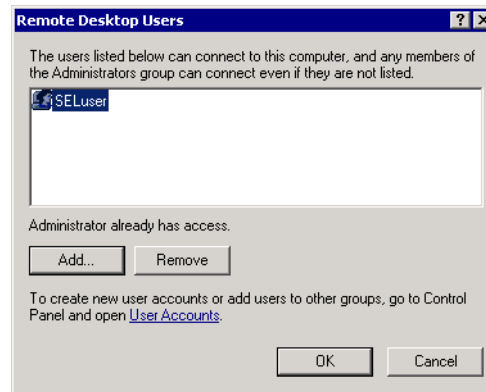
Figure B.14   Remote User Setup

Use a shared folder to move files between the SEL-3354 and other computers.

Remote Desktop Client

Use the SEL-3354 to remotely connect to another computer to view files or other information. Use the Remote Desktop Client (mstsc.exe) when remotely connecting to or from another Windows computer.

Date and Time

The SEL-3354 System Date and Time is adjusted to stay in synchronization with the IRIG-B signal obtained from an external IRIG clock. You will not be able to manually set the System Date and Time when an IRIG-B signal is present.

The computer system clock becomes the master system clock if IRIG-B input is lost or is not connected. Demodulated IRIG-B will then be generated from the computer system clock. Several IRIG-B configurable settings are available from the device manager **IRIG Controller** driver properties settings tab.
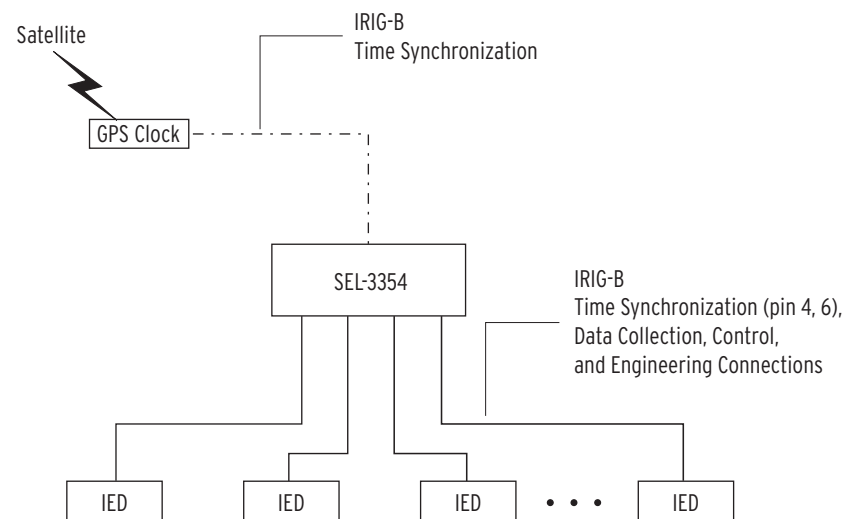
Figure B.15   Time Synchronization With IRIG-B

To make IRIG setting changes open the device manager (**System Properties** dialog box > **Hardware** tab > **Device Manager**) and select **SEL Controllers**. Double-click on **IRIG Controller** and select the **Settings** tab (see *Figure B.16*). From here you may:

➤ Disable IRIG output with the Output Enable setting

➤ Change the IRIG output signal with the Output Selection setting

➤ Ensure the highest accuracy of IRIG output with the System Output Edge Selection setting

➤ Limit IRIG output to BCD time fields only with the Force BDC Only Output setting.

The defaults are shown in *Figure B.16*. A more detailed explanation of these settings follows.
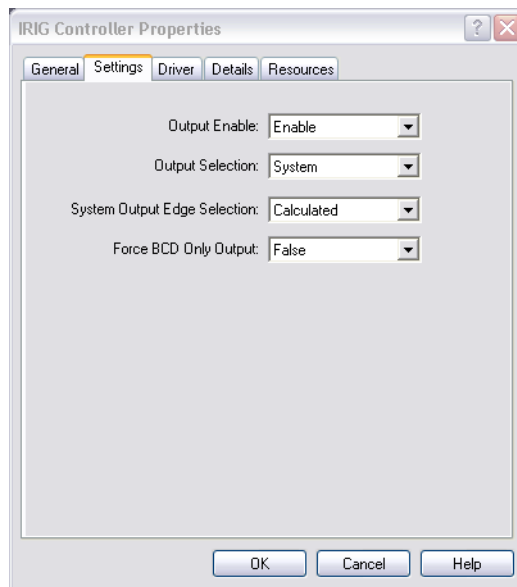
Figure B.16   IRIG Controller Device Properties Settings Tab

Output Enable. Set the **Output Enable** option to **Disable** if you do not want to provide an IRIG signal for the IRIG OUT port.

Output Selection. Selecting **Passthrough** for the **Output Selection** forces IRIG output to match IRIG input.

System. Selecting **System** here forces IRIG output to match the SEL-3354 System Time.

System Output Edge Selection. When IRIG input is present, the preferred setting for **System Output Edge Selection** is to use **Incoming** for output edge selection. This will ensure the highest accuracy of IRIG output.

Calculated. Selecting **Calculated** will precalculate the rising edge of the next second. Use **Calculated** when no IRIG input is connected. By default, IEEE C37.118 extensions are included with the IRIG output generated by the SEL-3354. If you need to limit IRIG output to BCD time fields, only set **Force BCD Only Output** to **True**.

Two final IRIG settings are configurable only through the **IncomingOffset** and **OutgoingOffset** Windows registry keys (see *Figure B.17*) discussed in the next paragraph.
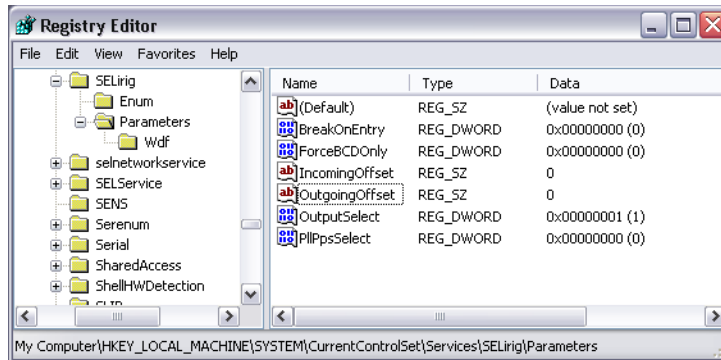
Figure B.17   Registry Settings to Delay or Advance Incoming/Outgoing IRIG

You have the ability to advance or delay IRIG time by making some registry changes and rebooting the SEL-3354. This can prove useful when providing time for multiple systems that may cross a time zone. *Figure B.17* shows the location of the **IncomingOffset** and **OutgoingOffset** registry values (`HKLM\SYSTEM\CurrentControlSet\Services\SELirig\Parameters`). Change these offsets by double-clicking on the desired setting and entering a number of minutes to delay (negative integer) or number of minutes to advance (integer).

For example, you may want to offset your outgoing IRIG time by one hour because your SEL-3354 is located in the Pacific time while the equipment you are providing time for is located in the Mountain time. Open the Registry Editor (regedit) and navigate to the path shown in *Figure B.17*. Double-click on **OutgoingOffset** and set the data value to 60. After closing the registry editor and rebooting your SEL-3354, the IRIG Output from your SEL-3354 will provide the correct time for your equipment living in the Mountain time zone. Similarly you could retard outgoing IRIG by one hour if you set the **OutgoingOffset** to –60.

The SEL-3354 provides network Time Protocol (NTP) CLIENT/SERVER functions. When the SEL-3354 is configured as an NTP Client, the network time updates the system clock. The demodulated IRIG-B signal is generated from the SEL-3354 system clock to synchronize connected Intelligent Electronic Devices (IEDs). This is only true when a local IRIG-B input signal is absent.

Contact your network or computer administrator to determine the acceptable method to connect to a Network Time Server.

The following figures illustrate how to set the system **Date** and **Time**. Using the SEL icon in the system tray, select the **Time/Watchdog** tab (see *Figure B.18*). Click on the **Open Windows Time/Date Control Panel** button and set the time options as needed for your application (see *Figure B.19*).
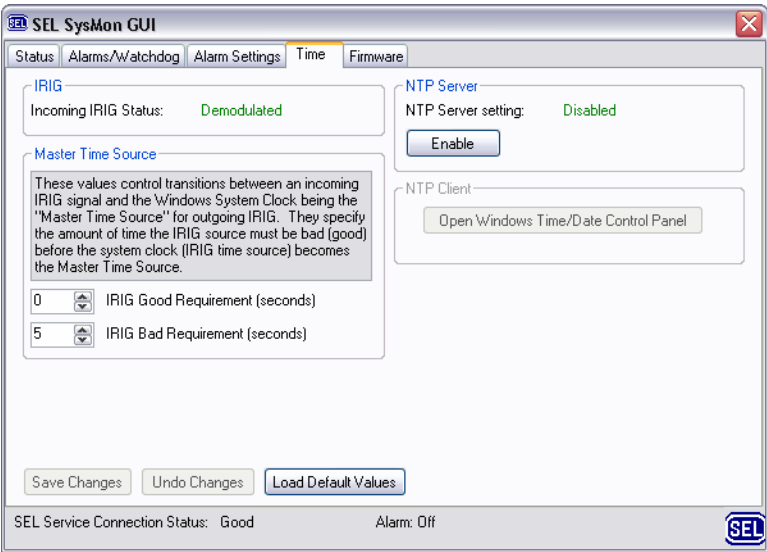
Figure B.18   SysMon Time/Watchdog Tab
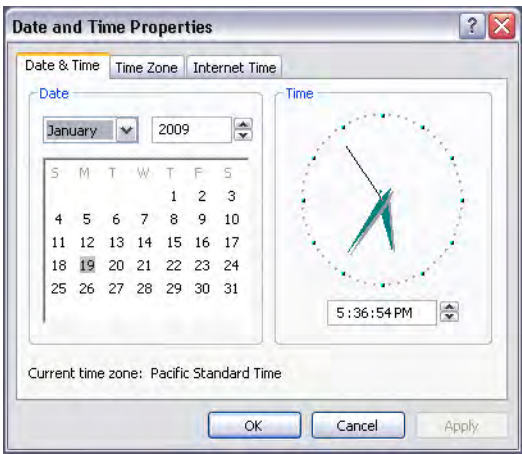
Figure B.19   Windows Date and Time Properties

Serial Port Configuration

The SEL-3354 serial ports have a number of enhanced features that are enabled via software settings.

The port power feature allows Pin 1 of each serial port to supply 5–volt power to connected devices such as fiber-optic transceivers and modems, enabling use of these devices without an external power supply. This feature is configured via the Windows Registry.

The DTR/RTS swap feature is useful when connecting modems and radios. Often either the device or the software application may require use of the DTR and DSR control signals, and RTS and CTS control signals are not required. By enabling this setting and using a custom cable, the DTR and DSR signals are provided through the pins normally used for RTS and CTS. This feature is configured via the Windows Registry. For applications that require all four control signals, Serial Port 1 must be used in combination with the COM1 DSR/DTR jumper setting (see *Table 2.3*).

The 485 mode feature enables EIA-422/EIA-485 communication, with additional settings to accommodate two-wire and four-wire communication schemes. For two-wire EIA-422/EIA-485 communication, the Half Duplex

setting should be enabled, and the software application must enable and disable the transmitter for each transmitted message by asserting and de-asserting the RTS signal. If the software application is unable to control the RTS signal appropriately, the Send Data Control (SDC) feature can be enabled to allow the serial port hardware to automatically control the transmitter. This feature is configured via the Windows Registry.

The synchronous bit-mode feature enables communication using bit-oriented protocols, for example CDC Type II. Under normal serial port operation, the serial port controller processes start, stop, and parity bits with each byte of data that is sent or received by the software application. When synchronous bit-mode is enabled, the serial port controller no longer processes start, stop, and parity bits, and instead simply transmits and receives the raw byte stream to and from the software application. This feature is configured via the software application, by specifying zero data bits in the serial port communication parameters (as opposed to the normal 5–8 data bits for standard asynchronous mode), and as such is only supported by software applications specifically made to support this feature.

The settings for serial port features that are configured via the Windows Registry are listed and described below:

Setting Name	Setting Description
Serial5VPin1	Enable +5 V power on Pin 1 of the serial port.
DtrRtsSwap	Change the RTS/CTS pins to DTR/DSR functionality. Useful for modems and radios that require DTR/DSR signals.
SerialRS485Mode	Enable EIA-485/EIA-422 communication mode.
HalfDuplexEnable	Disable Rx while Tx is active. Enable for two-wire EIA-485 connections. Only applicable when SerialRS485 is enabled.
SdcModeEnable	Automatically control transmitter when sending data. Only applicable when HalfDuplexEnable is enabled.

These settings are stored as Dword data type, which is a 32-bit value. The first 16 bits of the Dword value represent the 16 serial ports, with the least significant bit correlating with Serial Port 1. *Figure B.20* shows the Windows Registry Editor displaying the serial port settings, along with some additional mainboard settings not described here. The settings are displayed in the Windows Registry Editor in a hexadecimal format, where each digit represents four bits (four serial ports) and can have a value from 0–9 and A–F (where A–F correlate with values of 10–15). For example values to turn features on for specific serial ports, see *Table B.1*.
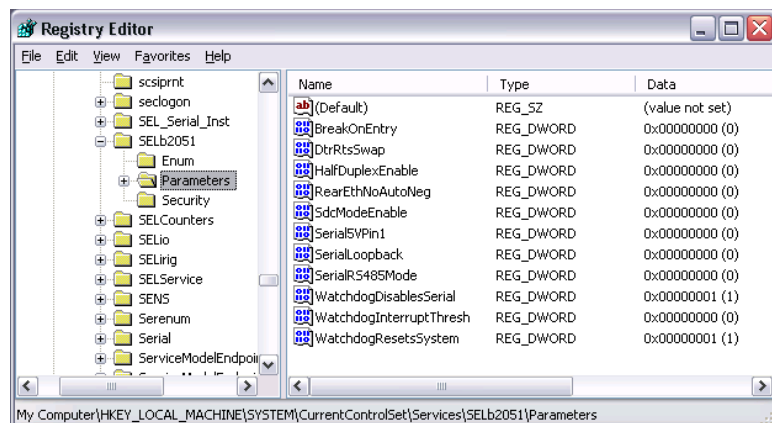
Figure B.20   Dword Settings for Serial Ports

To change these settings, use the following steps.

Step 1. Open the **Command Prompt** from the Start button or SEL Menu.

Step 2. Type **regedit**.

Step 3. Press **Enter**.

Step 4. Navigate to the registry key HKEY_LOCAL_MACHINE\ SYSTEM\CurrentControlSet\Services\SELb2051\Parameters\.

Step 5. Double-click the setting you want to change.

Step 6. Enter the hex value that reflects the setting you want.

Step 7. Close the Registry Editor and reboot for changes to take effect.

Table B.1 shows the default values for the serial port settings, and also some example configurations. One method to easily change these settings is to export the registry key(s) to a .reg file and use a text editor to modify the setting values in the .reg file. The settings can then be saved to the registry by double-clicking on the .reg file to import the changes.

Table B.1   Example Registry Serial Port Settings

Setting	Registry Key	Value (Hex)
0 V Pin 1, all ports[a]	HKLM\SYSTEM\CurrentControlSet\Services\SELb2051\Parameters**Serial5VPin1**	0000
232 mode, all ports[a]	HKLM\SYSTEM\CurrentControlSet\Services\SELb2051\Parameters**SerialRS485Mode**	0000
Full duplex, all ports[a]	HKLM\SYSTEM\CurrentControlSet\Services\SELb2051\Parameters**HalfDuplexEnable**	0000
SDC mode disabled, all ports[a]	HKLM\SYSTEM\CurrentControlSet\Services\SELb2051\Parameters**SdcModeEnable**	0000
DTR/RTS swap disabled, all ports[a]	HKLM\SYSTEM\CurrentControlSet\Services\SELb2051\Parameters**DtrRtsSwap**	0000
+5 V Pin 1, Ports 9–16 0 V Pin 1, Ports 1–8	HKLM\SYSTEM\CurrentControlSet\Services\SELb2051\Parameters**Serial5VPin1**	ff00
485 mode, Port 1 232 mode, Ports 2–16	HKLM\SYSTEM\CurrentControlSet\Services\SELb2051\Parameters**SerialRS485Mode**	0001
232 mode, Port 1 485 mode, Ports 2–16	HKLM\SYSTEM\CurrentControlSet\Services\SELb2051\Parameters**SerialRS485Mode**	fffe

[a] Default as shipped from the factory.

Ethernet Port Configuration

The SEL-3354 has three independent Ethernet ports, one front port (ETH F) and two rear ports (ETH 1 and ETH 2). A separate MAC address is associated with each Ethernet connection. Therefore, each Ethernet connection may have a separate IP address and may be on a separate network.

The default configuration for all ports is to auto-negotiate link speed and duplex. The speed and duplex of ETH F can be manually configured by accessing the network adapters Properties page through the Windows Device Manager. ETH 1 and ETH 2 can be forced to 100 Mbps Full Duplex with Auto Negotiation disabled by setting the registry Dword below to a value of 1 (default value is zero). If your SEL-3354 has fiber-optic Ethernet rear ports, which do not support auto-negotiate, this setting must be set to a value of 1 for correct operation. A reboot is necessary for this setting to take effect.

HKLM\SYSTEM\CurrentControlSet\Services\SELb2051\Parameters\RearEthNoAutoNeg

Instructions on setting up Windows-based networks are beyond the scope of this manual. Refer to your network or computer administrator for assistance. Also, there are many good references online that provide overviews of computer networking.

Local Area Connections

To access the **Local Area Connection Properties** dialog box (see *Figure B.21* and *Figure B.22*), perform the following steps.

Step 1. Open the **Control Panel** from the Start button or SEL Menu.

Step 2. Click **Network and Internet Connections**.

Step 3. Click **Network Connections**.

Step 4. Double-click a Local Area Connection (1, 2, or 3) as shown in *Figure B.21*.
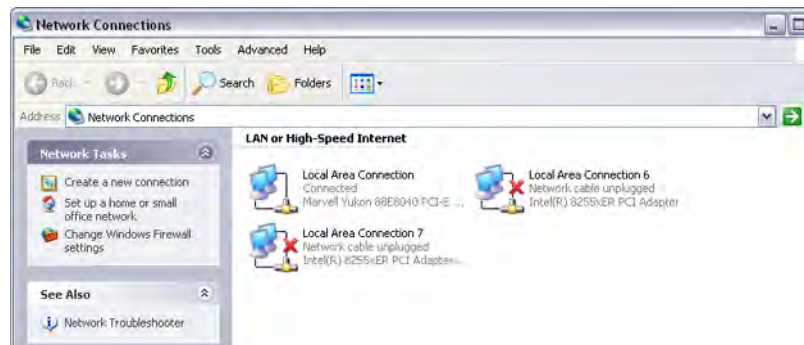
Figure B.21   Network Connections Window
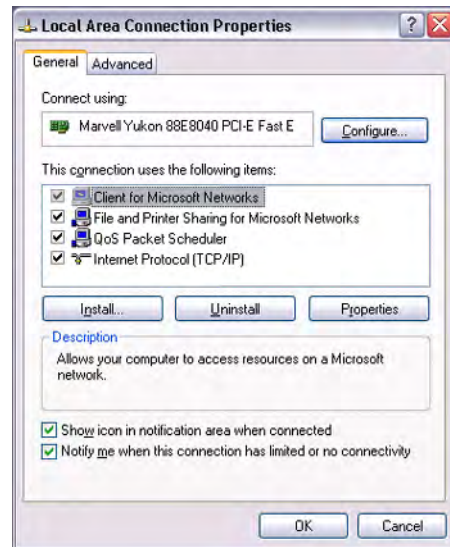
Figure B.22   Local Area Connection Properties Window

Services

Follow these steps to access the Windows Services interface.

Step 1. Open the **Control Panel** from the Start button or SEL Menu.

Step 2. Click **Performance and Maintenance** (see *Figure B.23*).

Step 3. Click **Administrative Tools** (see *Figure B.24*).

Step 4. Double-click on **Component Services**.

Step 5. Select **Services (Local)** in the left navigation bar (see *Figure B.25*).

The Windows Services interface lists all of the processes that are running on the Windows operating system. *Figure B.25* illustrates the **Component Services** window viewing the **Standard** tab.
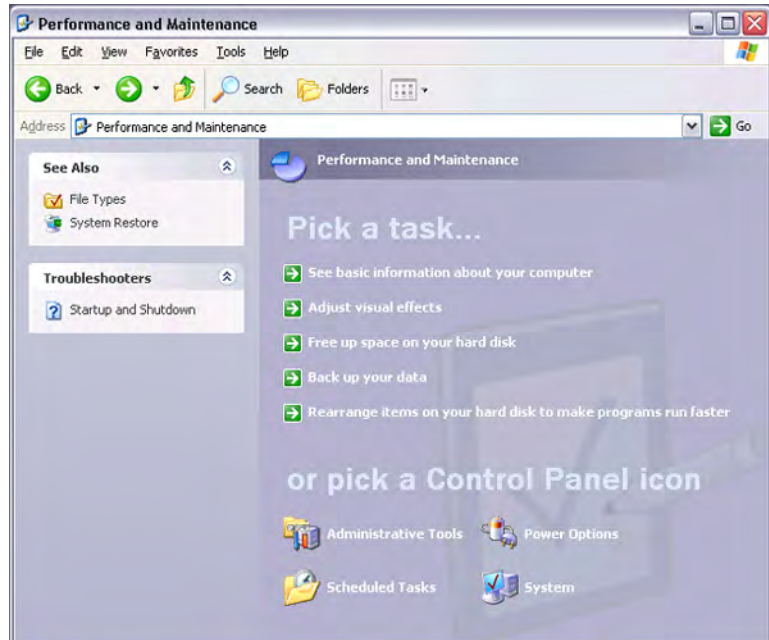
Figure B.23   Accessing Administrative Tools
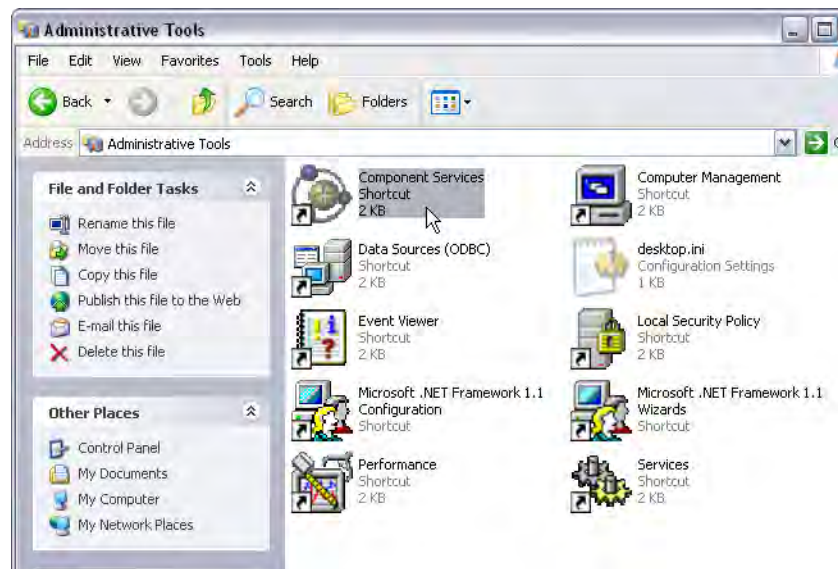
Figure B.24   Administrative Tools Window
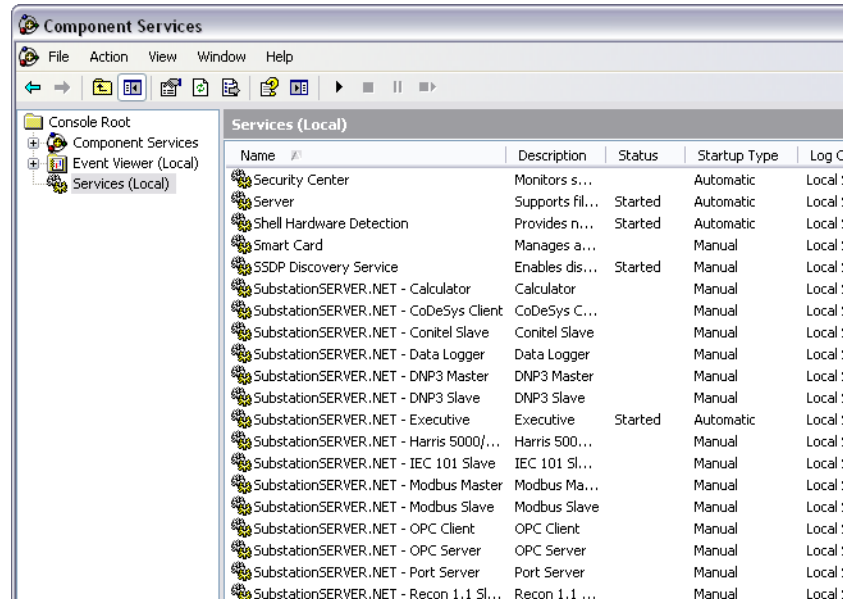
Figure B.25   Component Services Window

Use the **Services** interface to specifically decide what action the SEL-3354 takes during a trouble or failure condition associated with a service.

Use the following steps to set a service to pulse or set the alarm contact.

Step 1.   Select a service row.
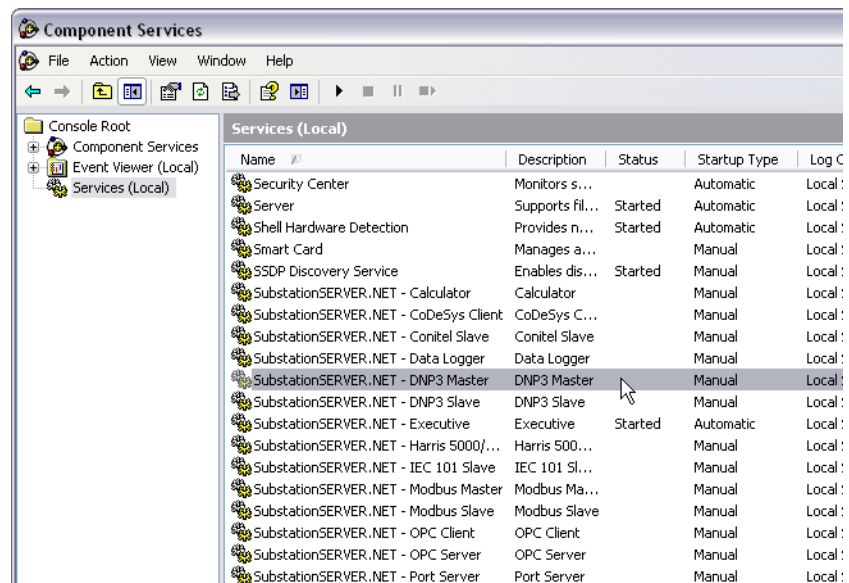
Figure B.26   Selecting a Service

Step 2.   Right-click the highlighted row.

Step 3.   Select **Properties**.
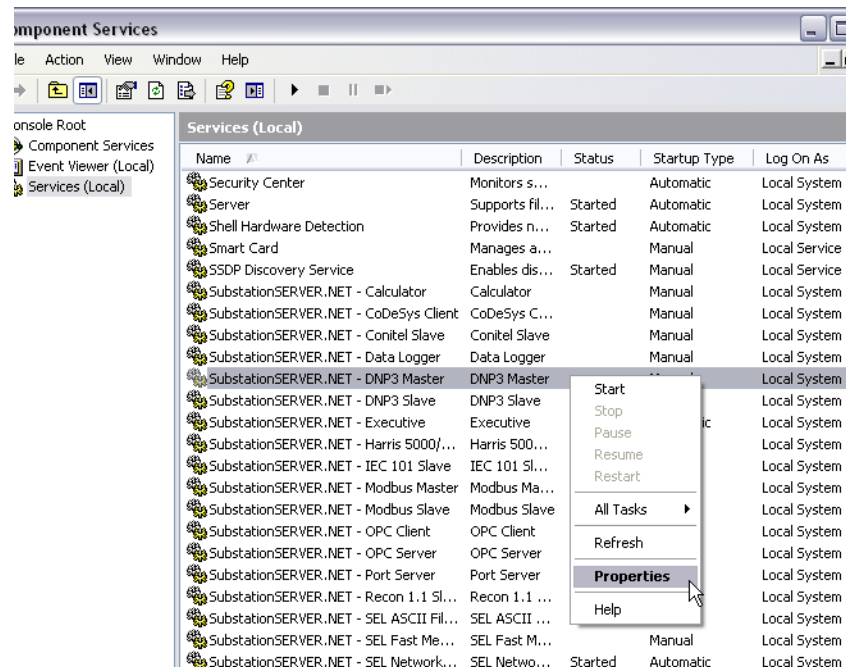
Figure B.27   Selecting Properties Option

> Step 4.   Select the options in *Figure B.28* to set a pulse or set the alarm contact.
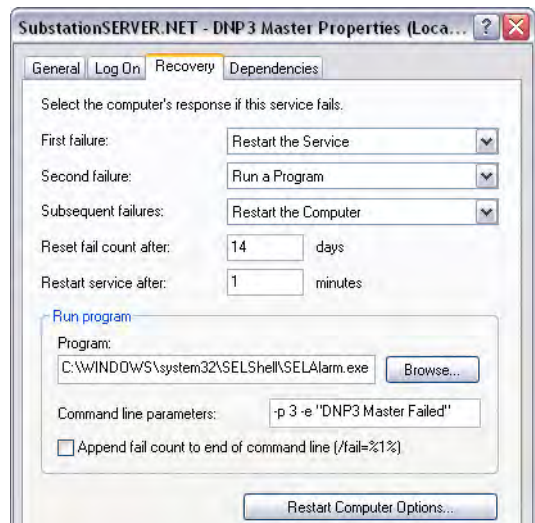
Figure B.28   Setting a Service to Pulse an Alarm Contact

If you chose the settings shown in *Figure B.28*, then the SEL-3354 will try to restart the DNP3 Master protocol service on the first failure within a fourteen-day period. On the second failure, the SEL-3354 runs the application C:\Windows\System32\SELShell\SELAlarm.exe with a command line parameter. This program will pulse the alarm contact. The command line parameter of three, in this example, instructs the SELAlarm.exe application to pulse the contact for three seconds. The command line parameter can be set from 1 to 30. This equates to a pulse duration range of 1 to 30 seconds.

Event Viewer

The main tool for troubleshooting Windows and Windows applications is the Event Viewer. To access the Event Viewer, select **Event Viewer (Local)** from the **Component Services** screen.
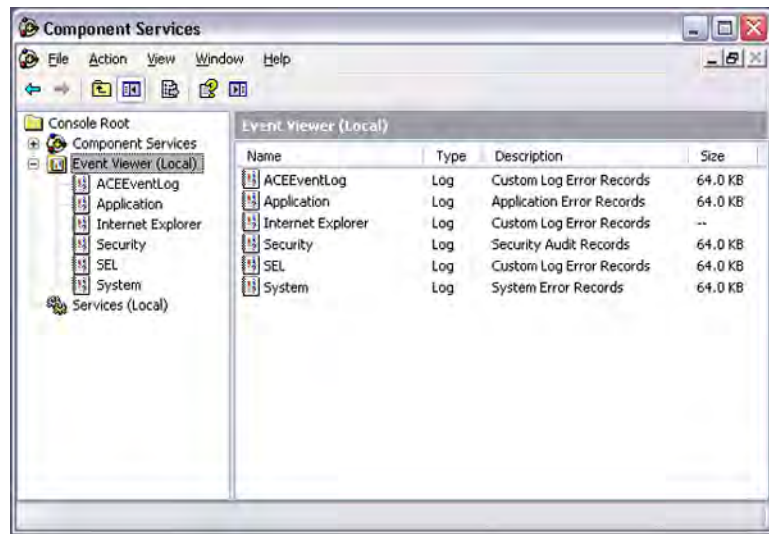
Figure B.29   Event Viewer

In addition to Windows system errors, look to the Event Viewer to see any assertion or deassertion of overcurrent alarms, CPU burden alarms, and IRIG-B status changes. Do not adjust the default log properties for the Application, Internet Explorer, Security, SEL, and System log properties (for example see *Figure B.31*). Access the log properties by selecting the event log, then right-click and select **Properties**.
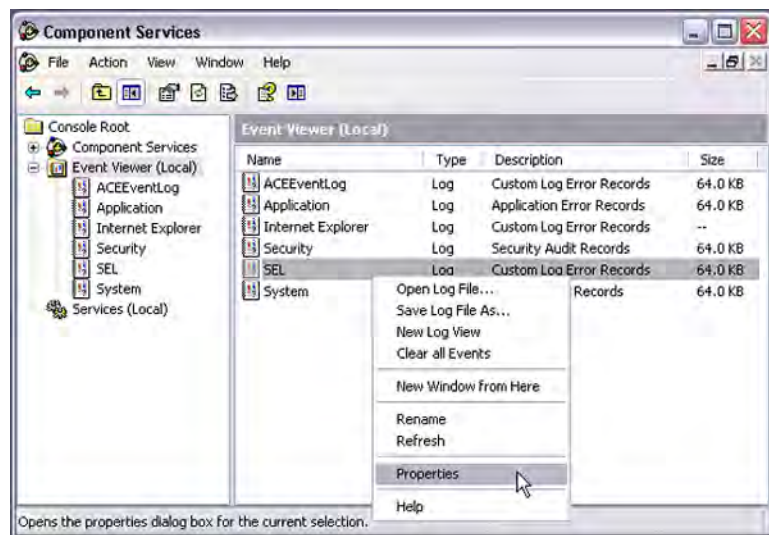
Figure B.30   Accessing Windows Event Log Properties
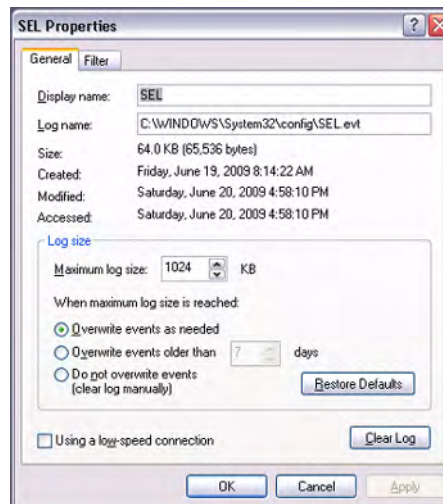
Figure B.31   Example Windows Event Log Properties

Local Security Settings

Follow these steps to access the local security settings.

Step 1.   Open the **Control Panel** from the Start button or SEL Menu.

Step 2.   Click **Performance and Maintenance**.

Step 3.   Click **Administrative Tools**.

Step 4.   Double-click **Local Security Policy** (see *Figure B.32*).

The following illustration shows how to launch the Local Security Settings.
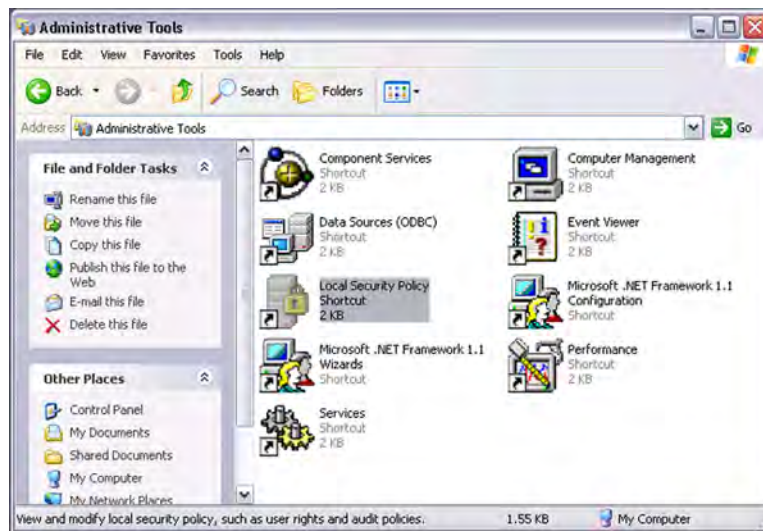
Figure B.32   Administrative Tools Window

Figure B.33   Local Security Settings Window

A detailed discussion of Microsoft Windows security is beyond the scope of this manual. Refer to your computer security administrator for guidelines to setting your SEL-3354. Follow your company's computer security policies.

By default, the SEL-3354 is configured to log the following User Account activities:

> ➤ Account Logon Events

> ➤ Account Management Events

> ➤ System Logon Events

> ➤ Audit Policy Changes

System Image Backup (Windows 7 Ultimate Only)

A system image is a copy of the drives required for Windows to run, and can be used to restore your computer if the drive or computer ever stops working. The System Image backup tool can be found under **Control Panel > System and Security > Backup and Restore**, select **Create a system image**. Because you can capture the system image while the computer is running, it does not require a shutdown or reboot. The image can then be stored to a local drive, USB storage device, or network location. If Windows fails during bootup, you can use the system image to restore your computer by rebooting. To use the system image, access the Windows Recovery Environment by pressing F8 immediately before Windows begins to boot and selecting **Repair Your Computer**, then selecting the Restore a Backup option.

Server Manager (Windows Server 2008 R2 Only)

Server manager (see *Figure B.34*) is the main system management point for Windows Server 2008 R2. From here 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 2008 R2 install 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 through **Control Panel** > **System and Security** > **Administrative Tools**.
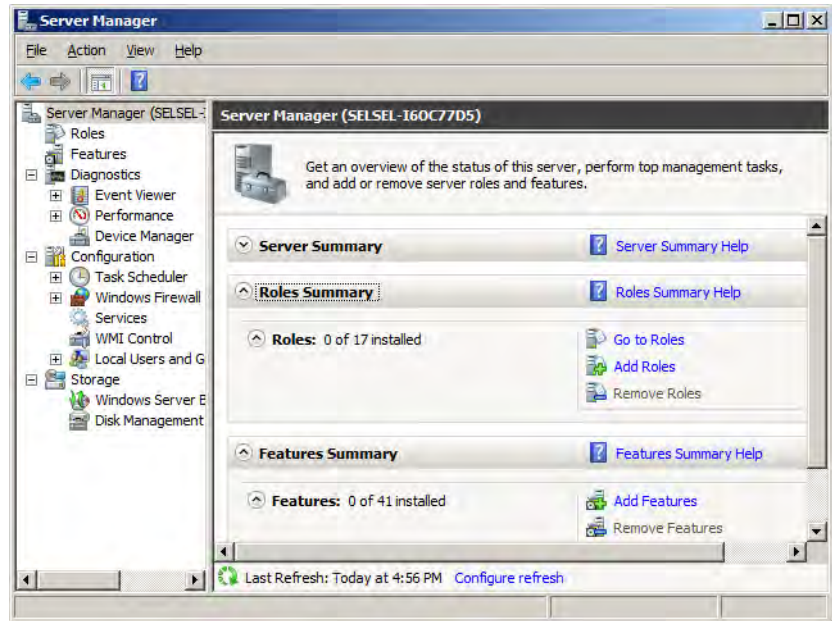
Figure B.34   Windows Server 2008 R2 Server Manager Window

Enhanced Write Filter (Windows Embedded Standard Only)

Any changes to system settings, programs, and files must be committed to protected storage before they become permanent. Failure to commit and reboot will cause all changes to be lost on the next reboot or power cycle. To commit changes to protected storage immediately, from the SEL Menu select **Log Off** > **Commit to Protected Storage**. To check the status or change settings of the EWF, open the EWF control panel from the SEL Menu under **System**> **EWF Control Panel** (see *Figure B.35*).
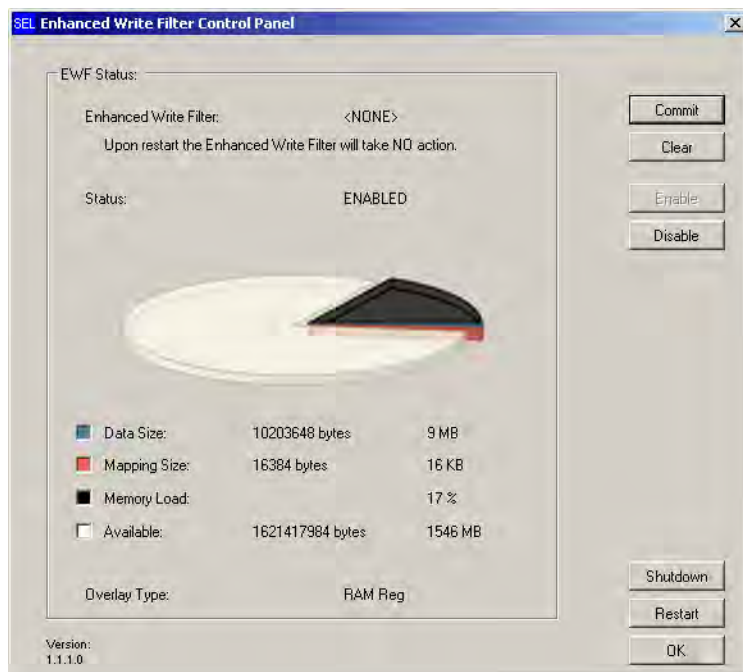
Figure B.35   Enhanced Write Filter Control Panel

During the installation of large software packages or files, you may need to temporarily disable the EWF to avoid overflowing the system RAM capacity. With the EWF enabled, applications that regularly create large data files on

the system drive will cause the EWF to overflow system memory and crash the system. Such applications should be configured to use a secondary storage medium that is not protected by the EWF, such as a secondary CompactFlash, Solid State Drive, USB storage, or Network Addressable Storage.

SEL Menu (Windows Embedded Standard Only)

The SEL Menu (see *Figure B.2*) is configured through Extensible Markup Language (XML) files. Menu items have a configurable display name, graphical icon, executable command line, and command line parameters. The SEL Menu can also be configured to automatically launch specified command lines on user login, for example if a full screen HMI should be run when the operator logs in to the SEL-3354. Specific syntax of the SEL Menu XML file menu items can be found in comments within the XML files.

The Administrator account's SEL Menu contains complete access to factory-installed software applications and system settings. Each user's SEL Menu can be customized by creating a configuration file in the user's profile. If no configuration file has been added to the user's profile, a default SEL Menu configuration file will be used, which only allows the user to log out and open the About dialog box. To create a custom configuration file, the Administrator can either modify the default configuration file, or save a copy to the user's profile and modify the copy to give the user access to the specific applications and system settings necessary. The locations of the configuration files for the Administrator, default configuration, and each user's profile are:

➤ Administrator:
C:\Documents and Settings\Administrator\Application Data\SEL\SELShell\shell_menu.xml

➤ Default:
C:\Documents and Settings\All Users\Application Data\SEL\SELShell\shell_menu.xml

➤ Users:
C:\Documents and Settings\<username>\Application Data\SEL\SELShell\shell_menu.xml

These files can be modified using any standard text editor such as notepad.exe, or third party XML editor. Use care when modifying the Administrator's SEL Menu configuration file, as removing key menu items such as the command prompt and file explorer could significantly restrict access to the system. For maximum security and reliability, SEL strongly recommends reserving the Administrator account for maintenance and administrative purposes only, and a custom user account with a restricted SEL Menu configuration is used as the primary login during normal system runtime.

Application Guides

Check the SEL website (http://www.selinc.com) for application guides with detailed instructions on implementing various technology applications using SEL hardware and software. You will find the Application Guides and Application Notes under the Literature section of the SEL website. Please note that some content may only be available after logging in with your MySEL account. Select the MySEL icon from the main SEL website to create or logon to your MySEL account.

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Appendix C
Ubuntu Linux System Configuration

Overview

This section describes the system factory settings; basic system configuration steps; and the SEL drivers, SEL System Monitor Daemon for Linux® (SELsysmond), and other SEL-provided software tools. We chose the long-term support version of Ubuntu® to minimize the frequency and number of updates necessary over time. Although Ubuntu includes more than 1000 pieces of software, this distribution includes only the base Ubuntu operating system and software. Our intent is for users to have a core Linux operating system on which to build their custom SEL-3354 Linux solutions.

This manual is not intended to be exhaustive of all Linux operating system features. Please use https://help.ubuntu.com/ as the primary source of Ubuntu operating system documentation. You may also see your local or online bookstore for books on using and administering the Linux operating system.
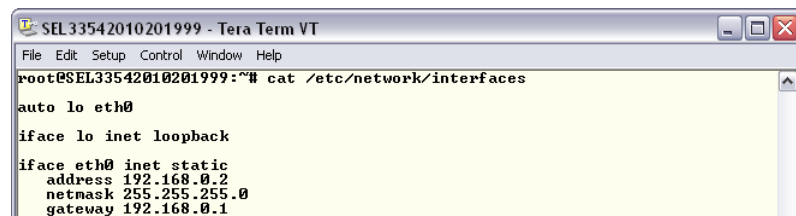
This product also includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (http://www.openssl.org/) and software developed by the OpenBSD Project (http://www.openssh.org/).

System Factory Settings

Certain factory settings to your SEL-3354 operating system should help make initial configuration easier. These are a preconfigured IP address for the front Ethernet port, a default system username and password, default locale and timezone settings, the default hostname, default-enabled Secure Shell (SSH) protocol access, and firewall and TCP Wrappers. This section lists only the default settings configured during the factory build process. For instructions on how to change these settings, please see *System Configuration Settings*.

Static IP Address in Front Ethernet

As *Figure C.1* illustrates, the front Ethernet port (eth0) is set to have a static IP address of 192.168.0.2.

Figure C.1   Static IP Address Settings for the Front Ethernet Port

Default Factory Username and Password

Please use the following default factory password to log on to your SEL-3354 root system account:

➤ Username: root

➤ Password: SEL3354

Please change this default password as soon as possible and according to your company's security policy. Changing the default factory-provided password is an essential first step in guarding the security of your SEL-3354 and the network to which it is connected. Instead of logging in directly as the root or superuser, create all superuser access, when possible, through the sudo tool after creating a less privileged account.

Default Password Policy

The following defaults enforce factory-provided password security and strength:

➤ Passwords must be six or more characters long and contain fewer than 256 characters.

➤ Passwords must contain at least three character classes (uppercase letters, lowercase letters, digits, symbols), except that uppercase letters used as the first character of the password and digits used as the last character of a password do not count toward password complexity.

➤ Passwords must not be easy variations of dictionary words or proper names (i.e., Password1).

➤ The device uses four-character substrings to determine if the password you enter is derived from a small dictionary of common words and names or if it is similar to an old password. If the device detects a four-character substring, then any characters in that substring do not count toward password complexity.

Locale

Locale settings are for formatting output according to a locale and include parameters that define your language, country, and many other special preferences. The default configuration for your SEL-3354 is en_US.utf8.

Timezone

Your SEL-3354 time zone is factory set at Universal Coordinated Time (UTC).

Hostname

The SEL-3354 default hostname is configured to be SEL3354<X>, where <X> is the serial number of the SEL-3354. For example, if your serial number label on the top right side of your SEL-3354 chassis states that the serial number is 2010201999, then your default hostname will be **SEL33542010201999**.

SSH

The sshd (OpenSSH Daemon) is configured to run upon bootup and detect incoming SSH connections. Please use an SSH client (such as PuTTY) for your initial connection to configure the SEL-3354.

Firewall and TCP Wrappers

Your SEL-3354 operating system includes both a host-based firewall (iptables) and TCP Wrappers, but the SEL-3354, by default, configures neither iptables rules nor TCP Wrapper configuration files.

By limiting access to your SEL-3354 and any services accessible over the network, you reduce significantly your exposure to remote threats. Please practice defense in depth by running not only a network-based firewall but also a host-based firewall such as the included iptables host-based firewall.

With a host-based firewall, you can provide extremely fine-tuned control over which remote systems can or cannot access your SEL-3354. SEL makes no recommendation for a vendor or specific firewall configuration, because firewalls are very complex systems. There are, for example, entire books written about iptables. A thorough explanation of firewall configuration and maintenance is beyond the scope of this document, but both are important in providing defense in depth to your SEL-3354 and the services running on it.

System Configuration Settings

As mentioned previously, this manual is not an exhaustive compendium of information on configuring your Linux operating system. Instead, this manual provides only the basic steps for such a configuration. The manual covers the following items:
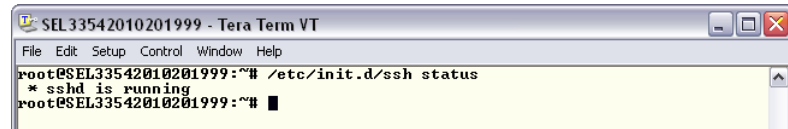
➤ shell

➤ manual pages

➤ user accounts and passwords

➤ logging on and off

➤ configuring remote access

➤ configuring networking

➤ Ethernet port configuration

➤ determining operating system version

➤ changing the computer hostname

➤ setting the date and time

➤ changing your locale or timezone

➤ disabling services, and information on the SEL-included drivers

Please note that, while there are multiple tools and ways to accomplish almost any configuration task in Linux, we include only one example of a command-line tool when giving configuration instructions. For example, as you will see in *User Accounts and Passwords*, we show how to add an account with the **useradd** command. You can do the same thing by using the **adduser** command. If you were to install one of the many graphical user interface (GUI) desktop packages, then there would be still yet another GUI method to accomplish the same addition of a user account. We do not describe GUI methods, because there is no default GUI. Instead, we discuss methods that use the shell.

The Shell

A UNIX® shell or command line traditionally has provided the user interface for the UNIX operating system. When you logged on to your SEL-3354 by entering the default username and password, the prompt you first saw is called the shell prompt. Here is where you tell the computer how to operate by entering input as text commands for the shell to execute. The default shell,
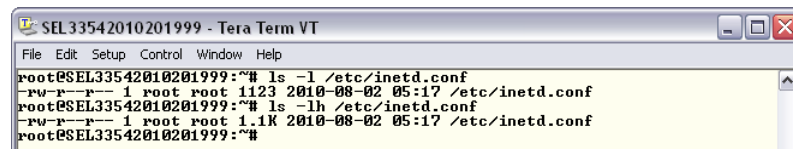
/bin/bash, gives you control over most tasks. Following are a few examples of what you can do from the shell. Note that any commands you list for execution at the shell should end with an **<Enter>**. You can check the status of the SSH daemon by launching the /etc/init.d/ssh script with the status option, as *Figure C.2* illustrates.

Figure C.2   Using the Shell to Execute a Script

Figure C.1 provides an example of executing the **cat** (concatenate) command to display the contents of the /etc/network/interfaces configuration file. Next, we show an example in which we look at the permissions of the /etc/inetd.conf file. The first command in *Figure C.3* uses the **ls** or **list** command to display the file in long format (-l), which shows the file permissions (-rw-r--r--), owner and group (root root), size (1123), and last modification date and time (2010-07-20 10:27).
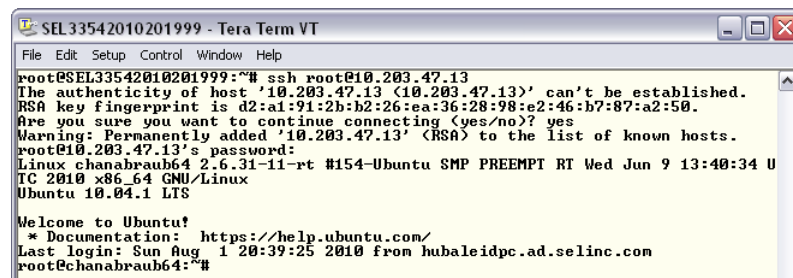
Figure C.3   Using the Shell to Show File Information

The second **ls** command in *Figure C.3* adds an "h" option, which changes the size format from bytes to human-readable (-h) format for display in Kilobytes (1.1K).

Here is an example use of the shell to make an outgoing SSH connection to another SEL-3354 running Linux (*Figure C.4*).

Figure C.4   Making a Remote Connection Through Use of the SSH Program

All application and system utilities are called processes. When we typed the **ssh** command to connect to the remote system in *Figure C.4*, the shell started a new process (child process) that in turn executed the **ssh** command. When we type **exit** or **logout**, this child process ends, returning control to the parent process, which is the original bash shell process. All processes are children of the "init" or master process. Use the **ps** command to view all processes on your SEL-3354, such as in *Figure C.5*.

Figure C.5   Output of the ps -aef Command Lists All Processes

To end a process, you can use the **kill** command. The format is kill <pid>, where pid is the process ID.

    root@SEL33542010201999:~# kill 5440

The command just presented would stop whatever process was executing as process ID # 5440. You can learn more about the bash shell and many other useful Linux commands by using the UNIX **man** command explained in the following text.

Manual Pages

UNIX operating systems include manual page support. Configuration and operation data on commands and services are included in a format that the **man** (manual) command can process and format for display at your console or terminal. For example, you can issue the following command to see more information about the bash shell on your SEL-3354:

    root@SEL33542010201999:~# man bash

Figure C.6   Bash Manual Page

Use the up and down arrow keys to move a line at a time on manual pages, the space bar to advance a page at a time, and the Q key to exit the manual page display and return to your terminal or console. Note that you can also search manual pages with the forward slash followed by typing in the search string and **<Enter>**. Subsequent **/ <Enter>** combinations will continue to move the search from top to bottom through the last entered search term, until the search can find no further occurrences of the term.

User Accounts and Passwords

The following text explains how to add an account for a new user:

> root@SEL33542010201999:~# adduser <username>

Figure C.7   Adding a User With the adduser Command

In *Figure C.7*, we show an example of using the **adduser** command to add a new user and corresponding information for a new user named "tesla". The **adduser** command prompts for all necessary information. The **adduser** command also creates the /home/tesla directory (where the user's files are stored), sets necessary file and directory permissions, and creates the password entry for user tesla. User tesla can now log on to the SEL-3354. Similarly, you can use the **deluser** command to delete user tesla.

To change an accounts password, use the **passwd** command:

> root@SEL33542010201999:~# passwd <userid>

Logging On and Off

To connect a laptop to your SEL-3354 front Ethernet port for initial configuration settings, configure your laptop interface to an IP in the 192.168.0/24 range such as 192.168.0.1 and netmask to 255.255.255.0. The SEL-3354 network port can detect automatically whether you are using a cross-over cable or a standard RJ45 Ethernet cable. A laptop or other computer with a network port is all that is necessary to physically connect and configure your SEL-3354 as shown in *Figure C.8*.
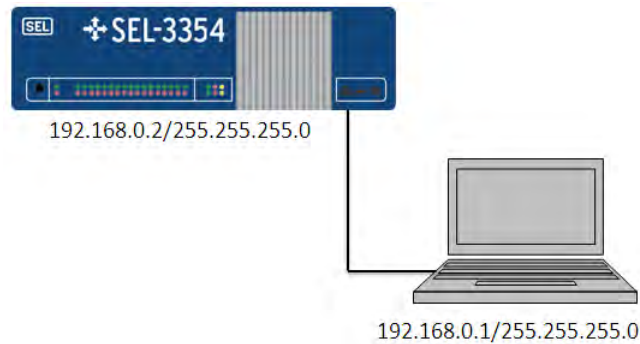
Figure C.8   Laptop and Network Connection for Initial SEL-3354 Configuration

Use SSH to connect from your laptop or computer to 192.168.0.2 (the SEL-3354). Log on as described previously in *Default Factory Username and Password* by using root/SEL3354 as the username and password. To log out, enter **exit** or **logout**.

Remote Access

You can make remote connections to other systems by using the Linux terminal or console and the SSH or Telnet programs, although use of Telnet is generally discouraged because of the non-encrypted nature of the traffic. *Figure C.4* shown previously provides an example of making an SSH connection to another system across the network. There are, of course, more interfaces on the SEL-3354 that can be connected to different networks. In the following text, we discuss how to configure the network interfaces.

Networking

There are three network interfaces on the SEL-3354. The factory-configured eth0 (front interface) and two rear network interfaces (from left to right eth1 and eth2). Edit the /etc/networks/interfaces by using a text editor to make changes to network configuration settings. The next example, *Figure C.9*, shows how to configure a new interface, eth1, to have two IP addresses: 192.168.3.90 and 192.168.3.91, both with a netmask of 255.255.255.0, gateway of 192.168.3.1, network of 192.168.3.0, and broadcast of 192.168.3.255. After entering the details for eth1 and eth1:1, save the configuration file and restart networking services through use of the following command:

root@SEL33542010201999:~/etc/init.d/networking restart

Figure C.9   Configuring Two IP Addresses on the Same Interface

To add a third interface that uses DHCP and comes up automatically, use the following entries in /etc/network/interfaces:

auto eth2

iface eth2 inet dhcp

The first line specifies that the eth2 device should come up automatically when you boot. The second line means that interface eth2 should have an IPv4 address (use inet6 instead of inet for an IPv6 address) and that it should get its configuration automatically from DHCP.

The SEL-3354 sets DNS servers automatically to resolve IP addresses if you use DHCP. For static connections, you will need to set your nameservers in the /etc/resolv.conf file.

search mydomain.example

nameserver 192.168.0.1

nameserver w.x.y.z

The search keyword appends mydomain.example to hostname queries in an attempt to resolve names for your network. The nameserver keyword points to DNS servers you can use to resolve hostnames to IP addresses. If you are using DHCP, the SEL-3354 fills this information out for you automatically.

The interfaces manual page has details on many more options for /etc/network/interfaces.

Ethernet Port Configuration

The SEL-3354 has three independent Ethernet ports, one front port (**ETH F**) and two rear ports (**ETH 1** and **ETH 2**). A separate MAC address is associated with each Ethernet connection. Therefore, each Ethernet connection may have a separate IP address and may be on a separate network.

The default configuration for all ports is to auto-negotiate link speed and duplex. The speed and duplex of **ETH F** can be manually configured using standard port configuration practices. **ETH 1** and **ETH 2** can be forced to 100 Mbps Full Duplex with auto negotiation disabled by installing the Rear

Ethernet Port Configuration Linux package included on the SEL-3354 product DVD. If your SEL-3354 has fiber-optic Ethernet rear ports, which do not support auto-negotiate, this package is necessary for correct operation.

Determining Operating System Version

You can order the SEL-3354 with Linux as a 64-bit or 32-bit operating system. To determine your version of Linux, you can use the **uname -a** command as in the following:

> root@SEL33542010201999:~# uname -a
>
> Linux SEL33542010201999 2.6.32-23-generic #37-Ubuntu SMP Fri Jun 11 07:54:58 UTC 2010 i686 GNU/Linux
>
> root@chanabraub64:~# uname -a
>
> Linux chanabraub64 2.6.31-11-rt #154-Ubuntu SMP PREEMPT RT Wed Jun 9 13:40:34 UTC 2010 x86_64 GNU/Linux

To determine if you have an AMD- or Intel®-based SEL-3354, look for the vendor_id and model name within the /proc/cpuinfo file.

Computer Name

To set your computer name, edit the /etc/hostname file and enter the hostname you want. Use the **hostname** command as in the following example to change the current hostname to what you have set in /etc/hostname:

> root@SEL33542010201999:~# hostname -F /etc/hostname

Or you can reboot your SEL-3354 after making changes to the /etc/hostname file for the changes to take effect.

Date and Time

To view or set date and time, use the **date** command:

> root@SEL33542010201999:~# date
>
> Mon Aug 2 00:25:15 PDT 2010

Here is an example (*Figure C.10*) where we set the date to July 12, 2010, and the time to 13:00.
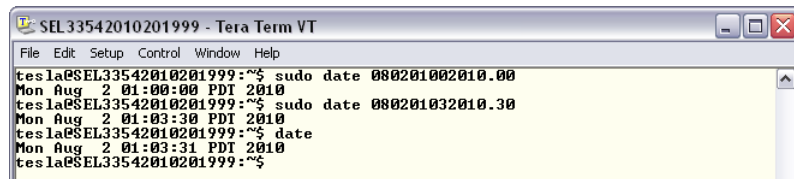
Figure C.10   Using the Date Command to Set Time and Date

Please see the date manual page for other formats you can use for setting the date and time. Your locale and timezone settings can both affect how date and time display.

Locale

Type locale to view your default locale. To see other available locale settings, type: locale -a. To change the default locale to one of those listed, edit or create the /etc/default/locale file with your favorite text editor. Ensure that this file includes LANG="new locale". Save the file, log out, and log on again to see the change in locale.

If your locale is not included, please refer to the /usr/share/i18n/SUPPORTED file to see other available locales and then refer to the local-gen manual page for information on how to add support for your missing locale.

Timezone

Use the **tzselect** command to determine interactively the timezone to which you want to change. Once you know the timezone, you can copy the contents of /usr/share/zoneinfo/US/Pacific to /etc/localtime or delete the old /etc/localtime and create a symbolic link to the file localtime:

    root@SEL33542010201999:~# ln -s /usr/share/zoneinfo/US/Pacific /etc/localtime

Then use the **date** command to verify the change to your timezone.

Disabling Services

It is good practice to turn off any service you are not using. For example, if you are not going to add any services to run out of inetd, then you should stop the inetd service altogether and make sure that it does not run on system startup. To do this, stop the openbsd-inetd service, as in the following:

    root@SEL33542010201999:~# /etc/init.d/openbsd-inetd stop
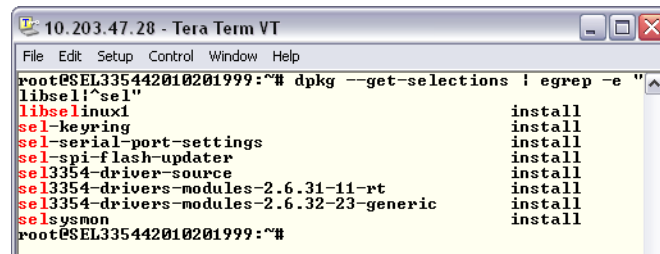
Then, remove the startup and shutdown links in the /etc/rcX.d/ directories, as *Figure C.11* illustrates.

Figure C.11   Removing Startup Scripts for openbsd-inetd Services

SEL Drivers

Figure C.12 shows the SEL drivers, libraries, and tools included in the SEL-3354.

Figure C.12   Listing of All SEL Packages

If you are installing Linux on your own and need to add any of these packages, please find them in the /drivers/linux subdirectory. See the manual page for the **dpkg** command on how to install additional software packages. To install a package from your local directory, the usual method is as follows:

    root@SEL33542010201999:~# dpkg -i <package_file_name>

You can get a list of all Ubuntu packages and whether they are installed or not with the **dpkg --get-selections** command:

    root@SEL33542010201999:~# dpkg --get-selections

SEL System Monitor Daemon for Linux

The SEL System Monitor Daemon (SELsysmond) for Linux controls IRIG, status, and alarm settings. SELsysmond is a standard UNIX daemon, designed to provide a software interface connecting a subset of the hardware available on the SEL-3354 with the host Linux operating system and client programs running under the host Linux operating system. SELsysmond monitors and alerts on the health of the SEL-3354 hardware and operating system, resets the watchdog timer to prevent automatic system reboot, works with the IRIG daemon to set system time from incoming IRIG or NTP, and determines when to set outgoing IRIG based on the quality of system time.
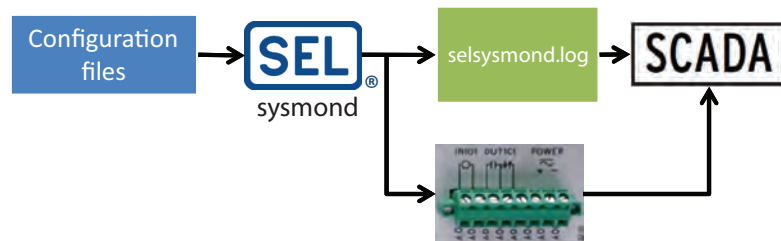
Figure C.13   Overview of Linux SEL System Monitor Daemon

The information in this section describes how to install SELsysmond and the main functions of SELsysmond, including how to configure and use SELsysmond features. The screenshots are from Ubuntu Linux.

Installing SEL System Monitor Daemon (SELsysmond)
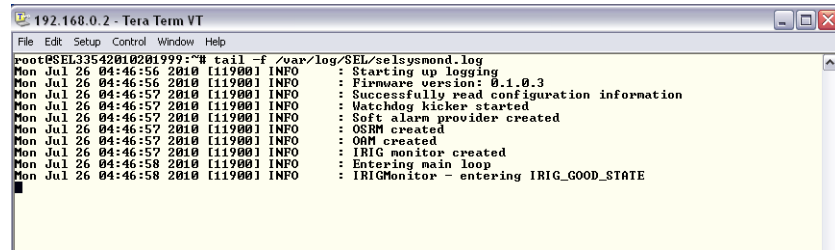
If you purchased your SEL-3354 with the factory-loaded Ubuntu operating system, then SELSysmond has already been installed for you and has been configured to run automatically on system startup. If you are using your own Linux distribution, obtain the latest SEL-3354 drivers package from either the SEL-3354 website or under the /drivers/linux folder on the SEL-3354 Literature and Software DVD and follow the instructions in the ReadMe.txt file.

SELsysmond Functions

SELsysmond provides five main functions: maintaining status information, configurable system monitoring parameters, alarms, and controlling time and the watchdog timer. The following text describes these functions in more detail. If you are already familiar with the Microsoft® Windows XP SysMon version, the primary difference between SysMon on the Windows platform and SELsysmond on Linux is that the Linux SELsysmond has no client GUI available to configure settings and submit and administer alarms. Make configuration changes for the Linux SELsysmond and related time settings by editing the configuration files (/etc/SEL/sysmon_service.xml and /etc/SEL/irigd.conf) described in *Configurable System Monitoring Parameters*.

Maintaining Status Information

SELsysmond logs status changes to the SEL event log file: /var/log/SEL/sysmond.log. The Debian SELsysmond installer creates the /var/log/SEL directory and /var/log/SEL/sysmond.log. For a live view of this status information, you can use a console or terminal and the UNIX **tail** command, as *Figure C.14* illustrates.
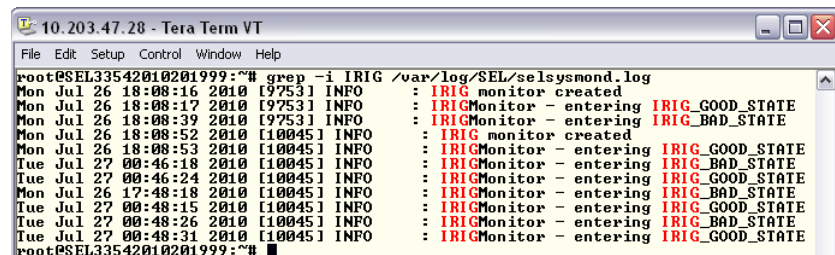
Figure C.14   Use the tail -f Command in a Terminal Window to View Live SELsysmond Status Information

You can also use the UNIX **grep** command, shown in *Figure C.15*, to search for specific types of related log messages. This example shows how to search for all IRIG-related messages.

Figure C.15   Use the grep Command to View a Specific Type of Status Message

The SEL event log is rotated through use of the **logrotate** command. The log is set to keep 10 days' worth of logs and compresses and rotates the logs daily unless the SEL event log is empty. Note that the copytruncate option is necessary in the /etc/logrotate.d/selsysmon configuration file for rotating the log file properly. See the manual page for the **logrotate** command for notes on how to change these settings should you want to modify the log rotation policy for the SEL event log.

Configurable System Monitoring Parameters

The SEL-3354 keeps all persistent configuration information in the /etc/SEL directory in an XML file named sysmon_service.xml, described in the following text. Many monitoring parameters have customizable settings. See *Table C.1* for all configurable SELsysmond parameters. These settings control how SELsysmond interacts with the operating system. You can fine tune these to adjust monitoring parameters, alarm thresholds, global configuration parameters, and the watchdog timeout. To make configuration changes, follow the steps below.

NOTE: Changes need to be made in a timely fashion, and the SELsysmond must be restarted before the watchdog timeout period (default is 5 minutes). If changes are not made before this timeout, the system will reboot.

Step 1.   Stop the SELsysmond through use of the SELsysmond init.d script:

> root@SEL33542010201999:~# sudo /etc/init.d/SELsysmond stop

Step 2.   Edit the SELsysmond configuration file to make your changes:

> root@SEL33542010201999:~# sudo vi /etc/SEL/sysmon_service.xml

Step 3.   Find and change the watchdog_timeout entry in the sysmon_service.xml file from the default watchdog timeout of 5 minutes to 1 minute, as in *Figure C.16*.

Step 4. Save and close /etc/SEL/sysmond_service.xml, and then restart SELsysmond:

root@SEL33542010201999:~# sudo /etc/init.d/
SELsysmond start

Figure C.16   Changing a SELsysmond Configurable Parameter

Table C.1   sysmon_service.xml Default and Allowable Settings (Sheet 1 of 2)

Setting	Description	Default	Minimum Value	Maximum Value
irig_good_req	Time in seconds incoming IRIG-B must be good before SELsysmond uses the incoming IRIG-B signal to set system time and outgoing IRIG-B.	10 s	5 s	1000 s
irig_bad_req	Time in seconds incoming IRIG-B signal has to be bad before SELsysmond stops using incoming IRIG-B to set system time and source outgoing IRIG-B.	5 s	1 s	1000 s
watchdog_timeout	Time in minutes after which the FPGA reboots the system if either SELSysmond does not reset the timeout or the timeout is disabled by bridging jumper 5A on the mainboard.	5 min	2 min	8 min
global_time_to_clear	Time after which an alarm clears if the condition that caused the alarm disappears.	2 s	1 s	30 s
cpu_alarm_enable	CPU load average monitoring switch.	enable	NA	disable
cpu_alarm_threshold	Maximum CPU load average.	50%	10%	100%
cpu_alarm_grace	Time during which the load average can exceed the threshold before an alarm triggers.	180 s	1 s	600 s
cpu_alarm_window	Time during which SELsysmond measures CPU use to check whether this use exceeds the threshold.	180 s	1 s	600 s
memory_alarm_enable	Free system memory monitoring switch.	enable	NA	disable
memory_alarm_threshold	Minimum level of free system memory.	40 MB	40 MB	512 MB
memory_alarm_grace	Time during which SELsysmond can operate with less than the free system memory threshold before triggering an alarm.	180 s	1 s	600 s
disk_alarm_enable	Free disk space monitoring switch.	disable	NA	enable
disk_alarm_threshold	Target amount of free disk space to maintain.	40 MB	40 MB	4096 MB

Table C.1 sysmon_service.xml Default and Allowable Settings (Sheet 2 of 2)

Setting	Description	Default	Minimum Value	Maximum Value
time_jumping_enable	Time jump monitoring switch.	disable	NA	enable
time_jumping_threshold	Maximum time jumps SELsysmond triggers an alarm.	4 jumps	1 jump	100 jumps
time_jumping_window	Time during which SELsysmond counts time jumps.	300 s	1 s	65535 s
cpu_temp_alarm_enable	CPU temperature monitoring switch.	enable	NA	disable
cpu_temp_alarm_max_threshold	Temperature above which the CPU Temperature alarm will trigger.	85° Celsius	0° Celsius	100° Celsius
cpu_temp_alarm_min_threshold	Temperature below which the CPU Temperature alarm will trigger.	0° Celsius	0° Celsius	100° Celsius
cpu_soft_heater_start_temp	Temperature at which the SoftHeater program will start executing to raise the CPU operating temperature.	0° Celsius	NA	NA
cpu_soft_heater_stop_temp	Temperature at which the SoftHeater program will stop execution.	5° Celsius	NA	NA
soft_heater_process_name	The name of the executable that is run to raise the CPU temperature in extreme cold conditions.	/usr/share/sel-sysmond/SoftHeater	NA	NA

Alarms

SELsysmond monitors CPU load, system free memory, system free disk space, time jumping, overcurrent (on the serial, USB, and VGA ports), and CPU temperature, and resets a watchdog timer. The following text summarizes the monitoring and alarming process and then provides a more detailed description of the various alarm types and what they monitor specifically.

For each item it monitors, SELsysmond takes samples in one-second intervals. Alarms trigger according to a combination of the threshold setting for the specific alarm, the window of time in which SELsysmond samples the alarm, and the individual alarm grace period. When an alarm is active, the contact on the rear of the SEL-3354 latches (turns on), the alarm LED on the front of the SEL-3354 illuminates, and SELsysmond creates an entry in /var/log/SEL/SELsysmond.log describing the alarm condition. When the condition that caused the alarm is no longer present and the global time to clear has expired, then the alarm contact on the rear unlatches (turns off), the alarm LED goes out, and SELsysmond creates a message in /var/log/SEL/SELsysmond.log stating that the alarm was cleared.

Overcurrent Alarms

The SEL-3354 supplies power from the serial, USB, and VGA ports. These ports provide current limiting to prevent equipment damage in the event of a short circuit. Shorting the power on these ports will not affect the operation of the SEL-3354. Exceeding the limits shown in *Table C.2* will cause the device to activate an alarm and enter an alarm state.

Table C.2   Current Limited Sections

Ports	Limit
VGA and PS/2	0.4 A, 5 Vdc, 1.0 W total for both
Front- and Rear-USB Ports Combined	0.8 A, 5 Vdc, 4.0 W total for both
Serial Ports	0.6 A, 5 Vdc, 3.0 W total for all

CPU Load

The SEL-3354 will alarm for greater than 50 percent CPU burden longer than three minutes. You can configure these settings, but adjustment of the CPU load setting is not recommended. Contact your SEL representative if the CPU burden in your application is alarming on a routine basis.

Free Memory

The SEL-3354 alarms if the available random access memory (RAM) drops to less than 40 MB for more than three minutes.

Free Disk Space

The SEL-3354 alarms when disk space is less than 40 MB. Delete unused application files if the primary CompactFlash® or solid-state disk space is low. Only the primary disk space is monitored. By default, this alarm is disabled. To enable the alarm, please follow the previous instructions in *Configurable System Monitoring Parameters*.

Time Jumps

The SEL-3354 alarms if there are more than four time jumps in five minutes. A time jump occurs upon modification of the system time to align it with the most accurate time source. This alarm is disabled by default. To enable the time jump alarm, please follow the previous instructions in *Configurable System Monitoring Parameters*.

CPU Temperature

If the CPU temperature alarm is enabled, an alarm message is written to the SEL event log when the temperature is above or below the configured CPU temperature thresholds.

Watchdog

If SELsysmond fails to reset the hardware watchdog timer for 2.5 minutes, it writes a single error message to the SEL event log. If failure to reset the hardware watchdog timer continues for more than 3.75 minutes, then SELsysmond writes one SEL event log message per failure per second until SELsysmond can once again reset the hardware watchdog timer successfully.

Time

SELsysmond keeps system time synchronized with any available time source listed in *Table C.3*. Outgoing IRIG is always sourced from the system time, regardless of whether the system time is being kept in synchronization with one of these master time sources.

Table C.3   Time Sources Used by SELsysmond to Set the System Time (in Order of Preference)

Time Source	Notes
SEL incoming IRIG	Signal must be good for 10 seconds before it is used
Network Time Protocol (NTP) server	Configured in /etc/SEL/ntp_network.conf
Dynamic Host Control Protocol (DHCP) server provided NTP server	Will be used automatically if available and one of the other sources is unavailable

Outgoing IRIG is enabled by default and always set from the system time, regardless of the precision of the system time. Outgoing IRIG can be disabled by editing the output_enabled setting in /etc/SEL/irigd.conf and changing the setting to false or disabled. Edit this file in a fashion similar to editing the /etc/SEL/sysmon_service.xml. With one caveat, there is no need to stop the IRIG daemon (irigd) for changes to take effect. If you change time zones, you do need to restart irigd for the changes to take effect. *Table C.4* lists the configurable IRIG settings available on the SEL-3354.

Table C.4   Configurable IRIG Settings

Setting	Description	Default	Minimum Value	Maximum Value
output_source	Determine whether the outgoing IRIG signal passes through from the incoming IRIG signal or is sourced from the system clock.	internal	internal	passthrough
input_modulation	Set the modulation to match the incoming IRIG signal modulation.	demodulated	demodulated	modulated
output_enabled	Enable or disable outgoing IRIG.	true, 1 or enabled	true, 1 or enabled	false, 0 or disabled
incoming_offset_minutes	Apply this offset to the incoming IRIG value before any other processing.	0	–930 s	930 s
outgoing_offset_minutes	Apply this offset to the time signal before transmission of outgoing IRIG.	0	–930 s	930 s
bcd_is_local_time	If incoming IRIG is BCD-only (not C37.118 compliant) indicate with this setting whether the incoming time is local time or UTC time. The device ignores this setting if C37.118 is present.	local	local or true	UTC or false

An SEL NTP reference clock is configured to use one or none of the sources in *Table C.3*. The preferred source, if available, is always the SEL incoming IRIG source. Following in order of preference are a user-configured NTP server, if provided, and a DHCP-provided NTP server. SELsysmond logs any transitions between reference clock time sources to the SEL event log. On startup, SELsysmond always assumes that the incoming IRIG signal is bad. SELsysmond monitors the IRIG signal state once a second. When the IRIG signal has been good for 10 seconds, SELsysmond sets the SEL NTP reference clock to use the incoming IRIG source. If incoming IRIG is bad, then SELsysmond uses one of the alternate time sources, if they are configured. By default, the Ubuntu-provided ntp.ubuntu.com time source is configured in /etc/SEL/ntp_network.conf.

Please see your ntp.conf Linux manual page for more detailed information on how to edit the ntp.conf file. Note that the normal Linux /etc/ntp.conf file is a symbolic link to either /etc/SEL/ntp_network.conf or /etc/SEL/ntp_selrefclock.conf and that SELsysmond takes care of restarting the NTP daemon when there are any changes.

Watchdog

SELsysmond resets the watchdog timeout to 300 seconds (5 minutes) every second. The watchdog hardware (FPGA) decrements the watchdog timeout value and forces a reboot of the SEL-3354 if SELsysmond fails to reset the watchdog timeout once a second. To configure the watchdog_timeout, refer to *Table C.1*. The forced reboot is to bring the SEL-3354 back to a known good state after problems such as memory exhaustion, disk space depletion, or CPU issues.

Should you want to disable the watchdog functionality for your intended use of the SEL-3354, please refer to *Table 2.3* and *Figure 2.8* for the location of JMP5 A. This jumper must be ON (bridged) to turn the watchdog off. Bridging JMP5 A keeps the watchdog timeout at 300 seconds so that the FPGA will never reboot the system.

sysmond, irigd, and ntpd Processes

Three processes should be running for proper operation of SELsysmond: sysmond, irigd, and ntpd. You can use the **ps** command, as *Figure C.17* illustrates, to verify that these processes are running.

Figure C.17   Using ps Command to Verify Running Sysmond Processes

If one of these processes is not running, check your /var/log/SEL/selsysmond.log and /var/log/messages log files for a cause. If you cannot determine why a necessary process is missing, please contact your SEL support representative.
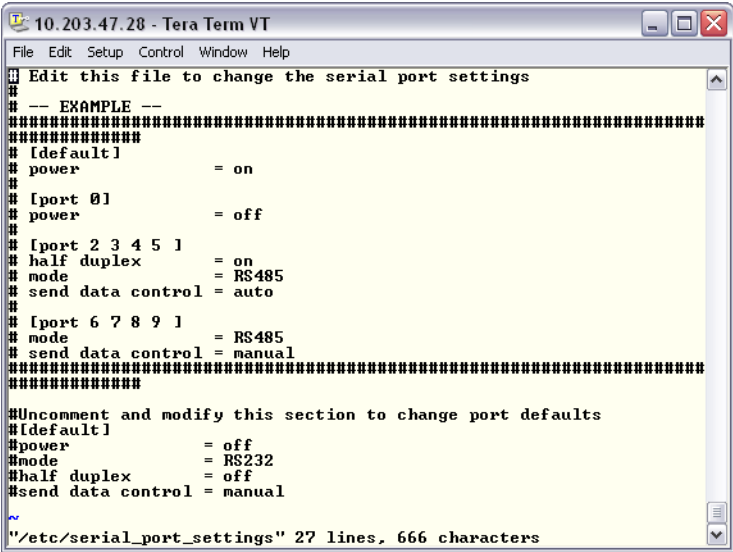
SEL Software Tools

Two tools are necessary for configuring serial ports and for updating the SPI flash in SEL devices. These are the sel-serial-port-settings and the sel-spi-flash-updater. These are factory installed in the /usr/sbin directory. Here is a description of how to use these tools.

Configuring Serial Port Settings

To make serial port changes:

Step 1.   Edit the serial port configuration file /etc/serial-port-settings.

Step 2.   Modify or create the port settings you want, and then save and exit the file.

Step 3.   Run /usr/bin/sel-update-serial-ports to modify serial ports with any new settings.

You can also specify an alternate configuration file with the -c option to sel-update-serial-ports. A # symbol in the first column of /etc/serial_port_settings designates the entry as a comment.

Figure C.18   Serial Port Settings Configuration File

Several settings are only meaningful when a port is set to RS485 mode. These settings are half-duplex and send data control. *Figure C.18* documents the default settings and provides several examples to get you started. You will note that, unless changed in the configuration file, the default setting for all serial ports is RS232 mode with power off.

When a port is in RS485 mode with half-duplex mode on, the port will operate in two-wire mode. Likewise, when a port is in RS485 mode with half-duplex mode off, the port will operate in four-wire mode.

An RS485 port with send-data-control setting set to auto asserts the RTS pin when there are data available to send. The port deasserts the pin at all other times. Valid serial port numbers are zero based (0–15). These numbers correspond to the numbers used in the serial device nodes (/dev/ttySEL<0–15>).

Upgrading Firmware

Depending upon your platform, instructions vary for upgrading the RTL image for the FPGA on the SEL-3354 mainboard. You need to know your PCI device information for AMD and Intel. *Table C.5* documents these IDs and other necessary input parameters.

Table C.5   Inputs to Use When Updating RTL Image

Platform	PCI Device Address for SPI Device	SPI Device Resource ID	Page Size of SPI Flash
Intel	0000:02:05.0	1	528
AMD	0000:06:05.0	1	528

Perform the following steps to update your FPGA firmware:

Step 1.   Obtain the RTL release image (.mcs Intel HEX file) and digital signature (.sign file) from SEL.

Step 2.   Copy the firmware image and digital signature file to your SEL-3354, or mount a USB thumbdrive with the firmware image and digital signature file on the drive.

Step 3. Note the PCI device address (-d), resource ID (-r), and page size (-p) from *Table C.5* for your hardware platform.

Step 4. Run the /usr/sbin/sel-spi-flash-updater program with the appropriate arguments, as in *Figure C.19*.

Figure C.19   Updating the Firmware on an AMD SEL-3354

Step 5. Shut down your SEL-3354 (shutdown -h now) and remove power.

Step 6. Reapply power, log on, and verify the existence of new firmware, as in *Figure C.20*.

Figure C.20   Verifying the New Firmware Version

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Appendix D
Resetting BIOS

Overview

The SEL-3354 ships with the proper BIOS settings. Do not modify BIOS settings at the risk of rendering your SEL-3354 inoperable. Do not modify the BIOS settings unless either of the following has occurred.

➤ The ETX single board computer has been replaced or removed.

➤ The baseboard battery has been replaced.

➤ A troubleshooting step suggests you return the BIOS to factory defaults.

Resetting Bios

IMPORTANT: Read the following steps before attempting to reset the BIOS. Contact your computer administrator if you have any concerns.

Reset the BIOS using the following steps.

Step 1. Connect a keyboard and monitor.

Step 2. Apply power to the SEL-3354.

Step 3. Press **<F2>** to enter BIOS while the SEL-3354 boots up.

The BIOS boot menu should be display.

Step 4. With the down arrow key highlight the **EXIT** menu and press **<Enter>**.

Step 5. Select **Load Defaults**.

Step 6. Select **Save Change and Exit**.

Step 7. Select **Ok** and press **<Enter>**.

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Glossary

10/100BASE-T   10BASE-T is a variant of Ethernet that allows devices to be connected via twisted-pair cable. 100BASE-T incorporates any of several Fast Ethernet standards (under IEEE 802.3) or planned standards for twisted-pair cables. Fast Ethernet is a version of Ethernet capable of 100 Mbps, instead of the 10 Mbps data transfer speed for standard Ethernet.

100BASE-FX   Fast Ethernet over optical fiber. Fast Ethernet is a version of Ethernet capable of 100 Mbps, instead of the 10 Mbps data transfer speed for standard Ethernet.

3U   The designation of the vertical height of a device in rack units. One rack unit, U, is approximately 1.75 inches or 44.45 mm.

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

ac   Abbreviation for alternating current.

ACPI   Advanced Configuration and Power Interface. An open industry standard developed by Intel®, Microsoft®, and Toshiba® for configuration and power management.

ASCII   Abbreviation for American Standard Code for Information Interchange. Defines a standard set of text characters. The SEL-3354 uses ASCII text characters to communicate through the use of serial ports.

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.

CMOS   Complementary Metal Oxide Semiconductor. A semiconductor fabrication technique that makes use of n- and p- doped semiconductor material to achieve low-power dissipation.

CompactFlash®   A type of nonvolatile relay memory used for storing large blocks of nonvolatile data.

CPU   Central processing unit.

CRT   Cathode ray tube. A type of monitor.

CTS   Clear to send.

Current Limiting   Keeping current within a specified threshold.

dc   Abbreviation for direct current.

DCD	Digital Control Design Language. A language for simulating computer systems.
Dry Contact	An initially available contact that is neither connected to nor energized by voltage (such voltage is usually supplied externally).
DSR	Dynamic Service Register.
DTR	Data Terminal Ready. A wire in an EIA-232 connection that tells data communications equipment (typically a modem) that the computer 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.
EIA-485	Electrical serial line standard which specifies two-wire, half-duplex differential line, multipoint communications. Formerly known as RS-485.
EIA-422	Electrical serial line standard which specifies four-wire, full-duplex, differential line, multidrop communications.
EMI	Electromagnetic Interference.
Environment Variables	Environment variables are part of Windows® System Properties. Adding, deleting, and editing these variables changes your Windows system configuration.
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.
FPGA	Field-programmable gate array. A gate array where the logic network can be programmed into the device after manufacture.
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.
LCD	Liquid Crystal Display.
LED	Light-Emitting Diode. Used as indicators on the SEL-3354 front panel.
MAC Address	The hardware address of a device connected to a shared network medium.
MOV	Metal-Oxide Varistor.

Network Time Server	A device that provides system-wide time synchronization for distributed computer network/client server applications.
Null-modem Cable	A serial cable for direct connection of computers 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 waits 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.
RC Filter	Resistive-Capacitive Filter. A filter composed of a resistor and capacitor.
RFI	Radio-Frequency Interference.
RTS	Request to Send.
RXD	Received data.
SCADA	Supervisory Control and Data Acquisition.
Star Topology	Connection scheme in which multiple devices connect to one common node device.
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.
VESA	Video Electronic Standards Association.
W	Abbreviation for watts; unit of electrical power.
Write Leveling	Technique by which information written to CompactFlash card is spread throughout the storage area to prevent exhausting individual memory locations.

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