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Section 1
Introduction & Specifications

Introduction

This section includes the following overviews of the SEL-3021 Serial Encrypting Transceiver:

➤ Product Overview

➤ Connections, Reset Button, and LED Indications

➤ Software System Requirements

➤ General Safety and Care Information

➤ Specifications

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Product Overview

The SEL-3021 Serial Encrypting Transceiver is a bump-in-the-wire encryption device designed to add strong cryptographic security to new serial communications links and to provide an easy and effective security solution for existing serial communications networks. It is designed for use on both point-to-point byte oriented communications links and multidrop SCADA networks.

The SEL-3021 provides data confidentiality by encrypting passwords and other sensitive data prior to transport over insecure channels. The SEL-3021 also prevents unauthorized device access by rejecting all communication session requests from sources that cannot pass cryptographic session authentication. *Figure 1.1* shows a typical SCADA connection where a master device retrieves data from a remote device over an insecure communications channel such as a leased phone circuit, a dial-up connection, or a wireless link. Unauthorized individuals could monitor or alter the data these media carry. Someone could also access the channel and inject malicious data to force some type of action such as an unauthorized breaker operation.
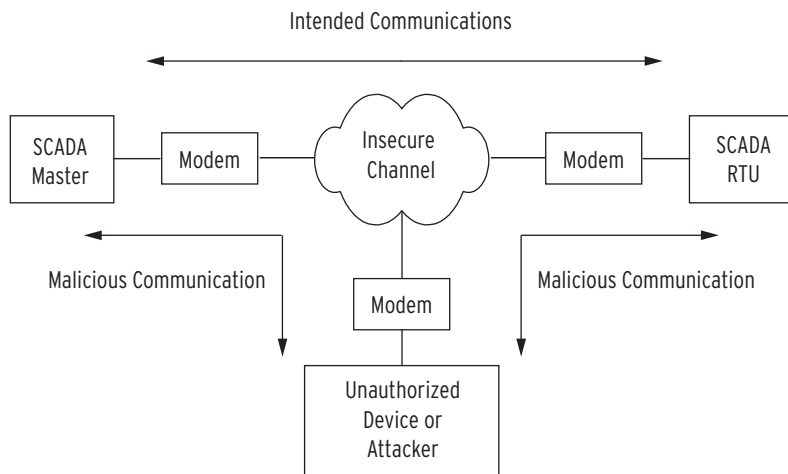
Figure 1.1   Typical SCADA Communications Channel

Figure 1.2 shows the SCADA communications link now secured by two SEL-3021 Serial Encrypting Transceivers. Install the SEL-3021 between the master device and modem at the master location and install an SEL-3021 between the remote device and modem at the remote location to provide electronic security. With the SEL-3021, legitimate communication still flows seamlessly between the master and remote devices, but a potential attacker cannot intercept or interpret the sensitive contents of the encrypted frames. The SEL-3021 transceivers block all unauthorized access to the master or remote device.
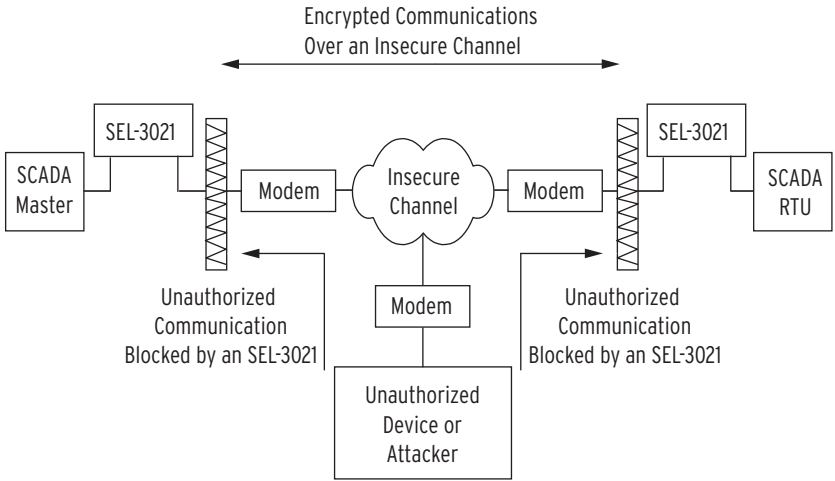
Encrypted Communications
Over an Insecure Channel

Figure 1.2   Secure SCADA Communications Channel

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Connections, Reset Button, and LED Indications

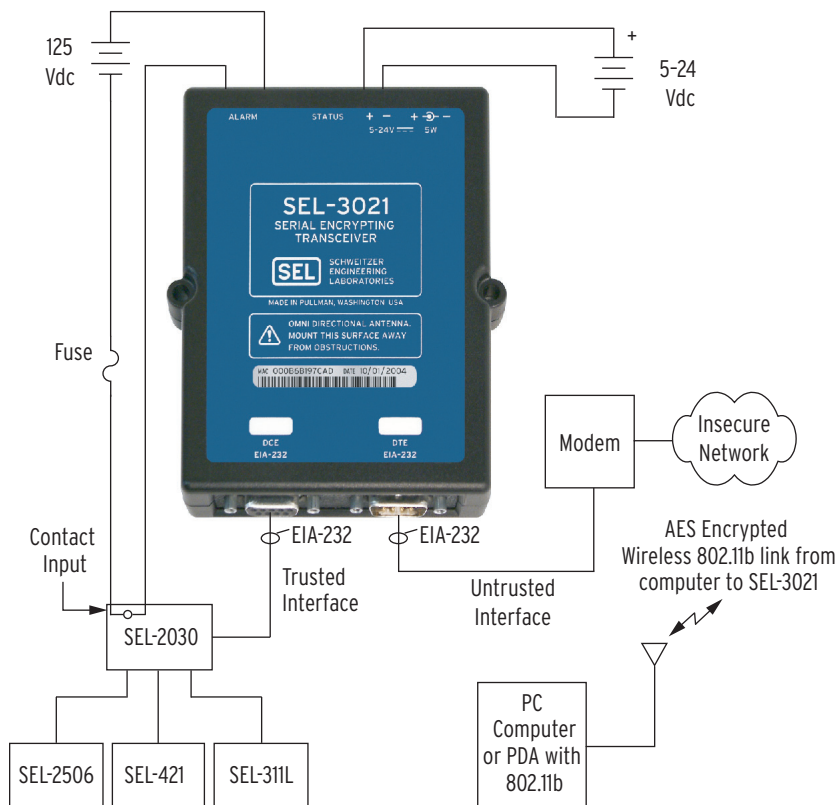The figure below shows typical connections for the SEL-3021.

Figure 1.3   Typical Connections for the SEL-3021

Power Supply Connections

You can apply 5 to 24 Vdc directly to the SEL-3021 power terminals, which are available either as compression terminals or a 2.5 mm jack. You must use an auxiliary power supply to supply a voltage source other than 5 to 24 Vdc. See *Specifications on page 1.10* for power requirements.

> **IMPORTANT:** Use only one power connection at a time.

Alarm Output Connection

Use the solid-state alarm contact to alert you to problems either with the communications channel or the SEL-3021. See *Section 5: Testing and Troubleshooting* for more details. To maintain the UL rating of the SEL-3021, connect the alarm output contact as follows:

1. Use an external load to limit current to less than 100 mA through the alarm contact. There is no means within the SEL-3021 to limit current through the alarm contact. You must ensure that the external circuit connected to the SEL-3021 limits the current. For example, a typical SEL contact input draws 4 mA. *Figure 1.4* shows a typical connection of a wetting source (125 Vdc), the SEL-3021 solid-state output, an SEL-2030 contact input, and an optional load resistor. In this case, because the contact input impedance limits the current to less than 100 mA, the load resistor is not necessary. If the sensing input does not have a means of limiting the current to less than 100 mA, then you must use a high wattage resistor. Select a load resistor with the proper wattage rating to limit the current. For example, assume the wetting source is 125 Vdc and that the sensing input requires 10 mA to assert. You can use the following calculation to determine the load resistor: 125 Vdc/ 10 mA = 12.5 kΩ Calculate the minimum wattage: $(10 \text{ mA})^2 \cdot 12.5 \text{ k}\Omega = 1.25$ W. You would typically double this parameter to 2.5 W to ensure proper operation over temperature and life. You should verify proper derating with the resistor data sheet.

2. Circuit protection should include an in-line fuse rated for 0.5 A or less with a voltage rating greater than the voltage you intend to use.

Figure 1.4 shows a typical alarm output installation.

⚠ **CAUTION:** Current through the alarm output must be limited to less than 100 mA.
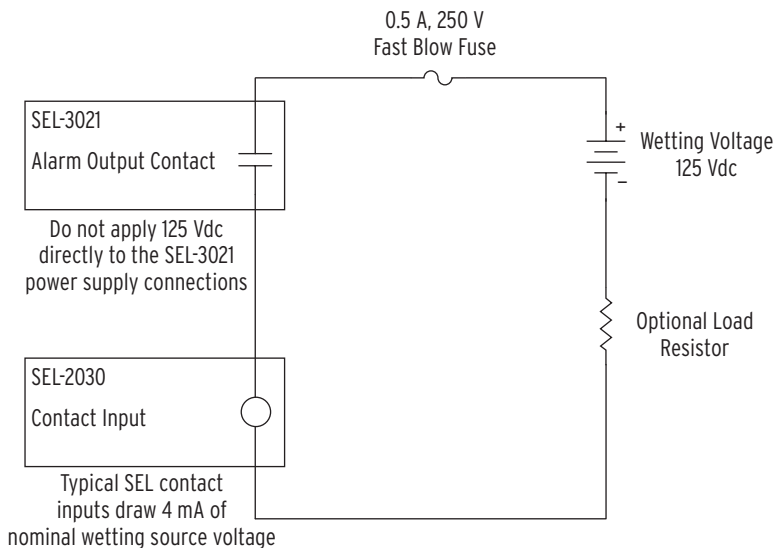
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Figure 1.4   Typical Alarm Output Installation

Serial Port Pin-Out Connection

The SEL-3021 has a fully compliant DTE and DCE serial port. SEL offers many cable configurations for use between the SEL-3021 and other devices.

The serial port pin-out descriptions for the DTE and DCE ports are as follows.

Table 1.1   DTE (Male DB9)

Pin	Description
1	Data Carrier Detect (Input)
2	Received Data (Input)
3	Transmitted Data (Output)
4	Data Terminal Ready (Output)
5	Ground
6	Data Set Ready (Input)
7	Request to Send (Output)
8	Clear to Send (Input)
9	Ring Indicator (Input)

Table 1.2   DCE (Female DB9)

Pin	Description
1	Data Carrier Detect (Output)
2	Transmitted Data (Output)
3	Received Data (Input)
4	Data Terminal Ready (Input)
5	Ground
6	Data Set Ready (Output)
7	Request to Send (Input)
8	Clear to Send (Output)
9	Ring Indicator (Output)

Reset Button

Use the {RESET} button to reset and delete all security related settings. You can access the {RESET} button through the small hole in the end of the SEL-3021 near the status LED. Use a paper clip or other similar device to press the {RESET} button for at least 2 seconds, which resets the SEL-3021 into a default state. Power must be applied to the SEL-3021 for the reset operation to occur.

> IMPORTANT: Pressing the {RESET} button erases all security parameters and interrupts transmission of encrypted data until you initialize the SEL-3021. See Initializing the SEL-3021 on page 2.5 in Section 2: Installation.

Status LED

Use the status LED to determine the state of the SEL-3021. If the status LED is solidly lit, the SEL-3021 is operating correctly. If the LED is blinking, the SEL-3021 is in a failed or reset mode. Refer to *Section 5: Testing and Troubleshooting* for more details.

Software System Requirements

The SEL-3021 comes with configuration and monitoring software, referred to as the SEL-5809 Settings Software. The SEL-5809 Settings Software is the only means to set and monitor the SEL-3021. The software comes in two versions: one version is for a Personal Computer (PC) and one is for a Personal Digital Assistant (PDA) operating system. The following operating systems have been tested with the software.

Table 1.3   Operating Systems Tested With the SEL-5809 Settings Software

Devices	Qualified Systems
PCs	WinXP Professional Edition (Service Pack 1)
	Windows 2000 (Service Pack 4) with .NET framework (Version 1.1) installed
	Windows XP with .NET framework installed
PDAs	Pocket PC 2002/2003 or higher with .NET compact framework (Version 1.0 Service Pack 2)
Wireless (802.11b) Modules	Netgear MA111
	Linksys WPC11

General Safety and Care Information

General Safety Notes

The SEL-3021 is designed for restricted access locations. Access shall be limited to qualified service personnel.

The SEL-3021 should not be installed or operated in a condition not specified in this manual.

⚠ **CAUTION:** The SEL-3021 is an intentional radiator. Changes or modifications not expressly approved by SEL for compliance could void the user's authority to operate the equipment.

⚠ **CAUTION:** The SEL-3021 is an intentional radiator. The radio has been authorized by the FCC for mobile use only. Users and nearby persons must maintain a separation distance of at least 20 cm (8 inches) from the radio during operation.

Cleaning Instructions

The SEL-3021 should be de-energized (by removing the power connection to both the power and alarm connection) before cleaning.

The case can be wiped down with a damp cloth. Solvent-based cleaners should not be used on plastic parts or labels.

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Specifications

Indicators

Green LED: Device Status

Solid-State Output

100 mA continuous
250 Vdc or 120 Vac Operational Voltage
Max. On Resistance: 50 Ω
Min. Off Resistance: 10 MΩ
Insulation: 1500 Vdc
Wiring size: 14 AWG Max.
26 AWG Min.
0.4 mm Min. Insulation
105° C, 250 V Min.

Encryption Protocols

AES: 128-bit encryption

Serial Port

Connectors: DB-9 Male (DTE)
DB-9 Female (DCE)
Data Rate: 300 bps to 38400 bps
Interface: EIA-232

Wi-Fi/802.11b Configuration Port

Protocol: IEEE 802.11b
Modulation: DSSS
Frequency Band: 2.4 GHz
Encryption: 128-bit WEP and
128-bit AES
Authentication: HMAC SHA-1
128-bit key

Power Requirements

+5 to +24 Vdc: <5 W
supplied through compression terminals or a
2.5 mm jack

Operating Temperature Range

–40° to +85° C (–40° to +185° F)
802.11b module (0° to +70°C)
5 to 95% humidity (noncondensing)

Dimensions

3.675" wide
4.8" deep
1" high, without DIN mount

Type Tests

Electromagnetic Compatibility

Radiated Emissions: IEC 60255-25:2000,
Class A
FCC part 15 Class A

Electromagnetic Compatibility Immunity

Conducted
RF Immunity: ENV 50141:1993,
10 V rms
IEC 61000-4-6:1996,
10 V rms
Digital Radio
Telephone RF: ENV 50204:1995,
10 V/m at 900 MHz
and 1.89 GHz
Electrostatic
Discharge: IEC 60255-22-2:1996,
IEC 61000-4-2:1999,
[EN 61000-4-2–1995],
Levels 1, 2, 3, 4
Fast Transient
Disturbance: IEC 61000-4-4:1995,
IEC 60255-22-4:1992,
4 kV at 2.5 and 5 kHz
Radiated Radio
Frequency: ENV 50140–1993,
IEC 60255-22-3:1989,
10 V/m
IEEE C37.90.2–1995,
35 V/m

Type Test Compliance Criteria:

1) The SEL-3021 does not damage or impede
IED operation.
2) The SEL-3021 is allowed to lose data
during testing events.
3) The SEL-3021 must recover without
external intervention.

Environmental

Cold: IEC 60068-2-1:1990
[EN 60068-2-1–1993],
Test Ad: 16 hrs
@ –40° C
Dry Heat: IEC 60068-2-2:1974
[EN 60068-2-2–1993],
Test Bd: 16 hrs @
+85° C
Damp Heat, Cyclic: IEC 60068-2-30:1980,
Test Db: +25° to
+55°C,
6 cycles, 95% humidity
Vibration: IEC 60255-21-1:1988,
Class 1
IEC 60255-21-2:1988,
Class 1
IEC 60255-21-3:1993,
Class 2
Max. Altitude: 2000 m

Certifications

ISO:	Device is designed and manufactured using ISO 9001 certified quality program.
Listings:	CE Mark UL 61010C-1/CSA C22.2 No. 1010-1-92/ EN 61010-1
FCC:	15.247
IC:	ICES-001
FIPS:	140-2, Security Level 2 (pending)

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