SEL-1102 Computing Platform

Mission-Critical Platform for Windows® or Linux® Software Applications

Help your end-user customers integrate this rugged computing platform in applications that demand highest reliability and lowest maintenance in extreme harsh environments. You can add value by installing the operating system and application software and initializing databases for specific end-user applications. The SEL-1102 is also a comprehensive solution for internal integrators, or "super users," with personnel capable of installing operating systems and integrating their own systems. By eliminating all moving parts, including rotating hard drives and fans, we have added ruggedness well beyond that of typical computers. By eliminating vent holes, the SEL-1102 significantly reduces dust buildup and foreign contaminants. You can install operating system and applications software in internal CompactFlash® drives to customize the SEL-1102 for specific applications. Every SEL-1102 comes with our unprecedented 10-year, worldwide SEL warranty.

Major Features and Benefits

- **Increased Reliability.** The SEL-1102 is designed and built to operate reliably in harsh environments, conforming to IEEE C37.90 and IEC 60255 Protective Relay Standards and the IEEE 1613 Standard for communications networks in substations. The computing platform meets or exceeds specification for vibration, electrostatic discharge, fast transient, radiated emissions, overcurrent, dielectric strength, and pulse magnetic fields disturbances. The SEL-1102 uses the same power supply as SEL protective relays, with observed Mean Time Between Failure (MTBF) of 5,000 years. The computing platform eliminates all moving parts, including fans and rotating hard drives, which are typical sources of computing system failures.
- **Improved Performance.** An independent watchdog microcontroller complements the system microprocessor. The microcontroller detects and alarms for problems, detects operating system interruptions, and restarts the system microprocessor.
- **Flexible System Interconnection.** A choice of 4 USB 1.1 ports and up to 16 EIA-232 ports offer optimized I/O connections to various peripherals.
- **Wide Power Supply Ranges.** Three power supply types, operating over wide supply voltage ranges, provide flexibility in various system applications and eliminate the need for inverters.
- **High-Speed Network Access.** Dual fiber and/or a copper 10/100 Mbps Ethernet connection support high-speed connection to the network.
- **Time Synchronization.** The SEL-1102 distributes incoming IRIG-B to connected devices.

Functional Overview

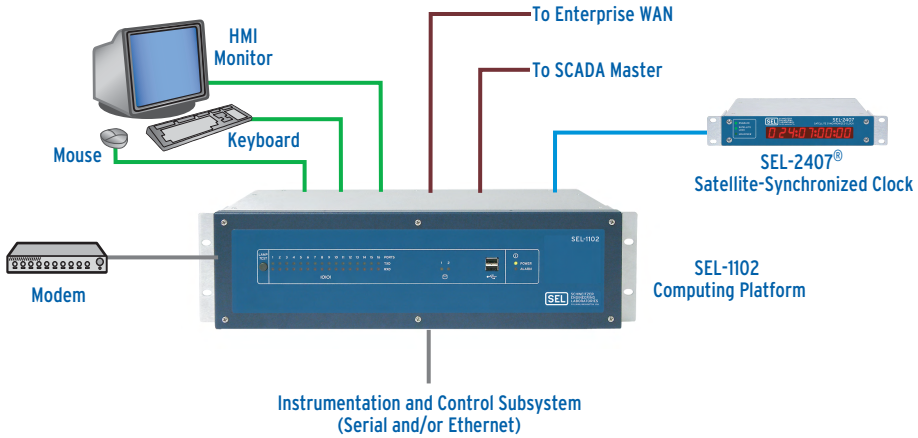


Figure 1 Functional Model in Utility or Industrial Applications

Separate Microprocessor and Watchdog Microcontroller

The SEL-1102 incorporates a separate microprocessor and watchdog microcontroller. The microprocessor performs all operating system functions, and the watchdog assists the system microprocessor with various configurable alarm conditions, system timing, and system recovery.

Time Processor

The IRIG-B time-code input maintains date and time and supplies demodulated IRIG-B time code to all rear-panel serial ports.

Ethernet

Ethernet connections allow the SEL-1102 to connect to two separate, high-speed Ethernet networks via a copper/fiber port and a separate fiber-only port. Dual Ethernet allows separate local area networks (LANs) for control and data access.

EIA-232 Ports

The computing platform supports up to 16 rear-panel EIA-232 ports using standard DB-9 connectors with MOV protection. Two pins on each port supply demodulated IRIG-B time synchronization to connected devices.

Alarm Output

The rear-panel outputs contain an alarm contact output that you can program to signal internal errors and malfunctions. You can program the alarm contact to indicate system faults, errors with collected data, and the results of logical and mathematical calculations the computing platform performs on the data.

Applications

When configured with an operating system and application-specific software, the SEL-1102 may be used for many applications.

Utility Substations

Comprehensive Integration Solution

The SEL-1102 provides a comprehensive solution for station integration as shown in *Figure 1*. With the proper software installed, the SEL-1102 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.

Collect and Format Data for Multiple Clients

You can use the SEL-1102 to collect and format relay data for HMIs, legacy Remote Terminal Units (RTUs), and for Supervisory Control and Data Acquisition (SCADA) systems using legacy protocols. The SEL-1102 provides a uniform data interface to data clients so the respective software for each client does not have to specifically accommodate each IED type.

Access Data Through Multiple Paths

Different departments in a utility may need different data and different data rates. Using available software applications, the SEL-1102 can collect a real-time data set every second from the IEDs and then use any supported protocol to serve these data sets to any client.

Synchronize Relay Clocks in Substations

The SEL-1102 can synchronize time clocks in attached devices, such as protective relays, that accept a demodulated IRIG-B time signal. The SEL-1102 regenerates the demodulated IRIG-B signal from an external modulated or demodulated source, such as a GPS satellite clock receiver. If no IRIG-B source is available, the SEL-1102 generates the demodulated IRIG-B time signal internally. The SEL-1102 also accepts network time protocol (NTP) commands to set the internal computing platform clock.

Expand Analog and Digital I/O Interfaces

Use an SEL-2410/SEL-2411 to process dc values, sense status of contacts, and control external devices.

Compile Relay Event Reports

Install the SEL-5040 Power System Report Manager to detect, gather, and summarize relay event reports.

Assemble Time-Tagged Events

Gather and report time-tagged events from SEL relays and I/O Processors to have the computing platform serve as a station-wide Sequential Event Recorder (SER).

Control Station IED Devices and Relays

Perform automatic control through the use of software logic in the SEL-1102 combined with SELOGIC® control equations in SEL relays, communications processors, and controllers.

Integrate a Complete Solution From SEL

Install a complete SEL-7000 Integrated Substation System for control, automation, monitoring, and protection, that includes an SEL-1102 System Computing Platform. Implement the appropriate applications to meet your requirements.

Industrial and Government System Applications

Use as SCADA Interface and Rugged HMIs

Deploy the SEL-1102 in oil, water, gas, chemical, steel, manufacturing, coal mining, logging, and environmental applications, such as a SCADA interface and rugged HMI for plant/remote locations.

Configure for Harsh Environment Applications

Use the SEL-1102 in Bureau of Land Management, Forest Service, agriculture, DOE, security, and military applications that require versatile power supply ranges and conformance to industry standards in harsh environments. Remote sensing, unattended data collection, and emergency response are a few of the applications that require rugged computers.

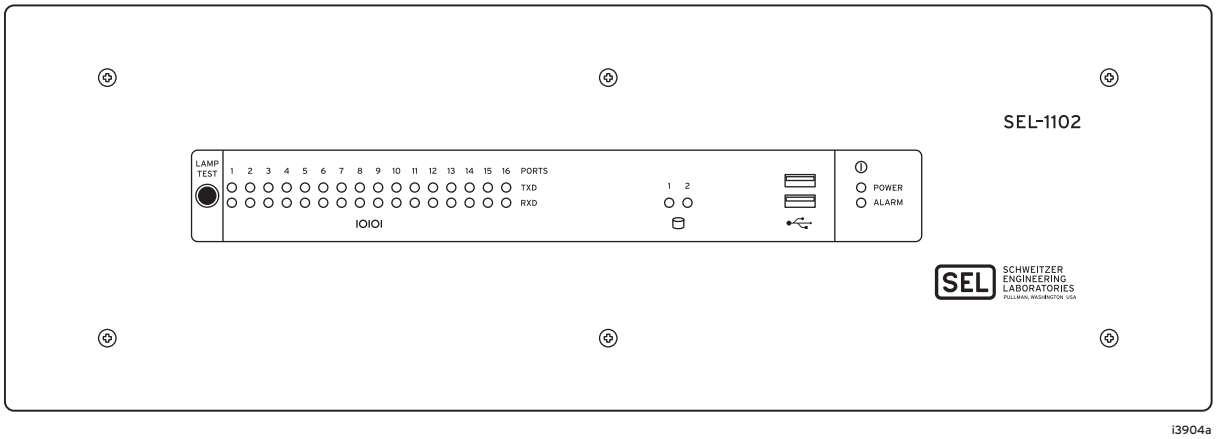
Guideform Specification

The SEL-1102 System Computing Platform shall operate as a computer with network access to provide a combination of functions including, but not limited to, automatic transmission of outgoing messages and parsing of responses, data aggregation, simultaneous collection of data from serial and Ethernet server devices (both SEL and non-SEL devices), and simultaneous data access for multiple client devices. The SEL-1102 shall conform to various industry standards, operate in harsh environments, and provide the operational and functional requirements as described below:

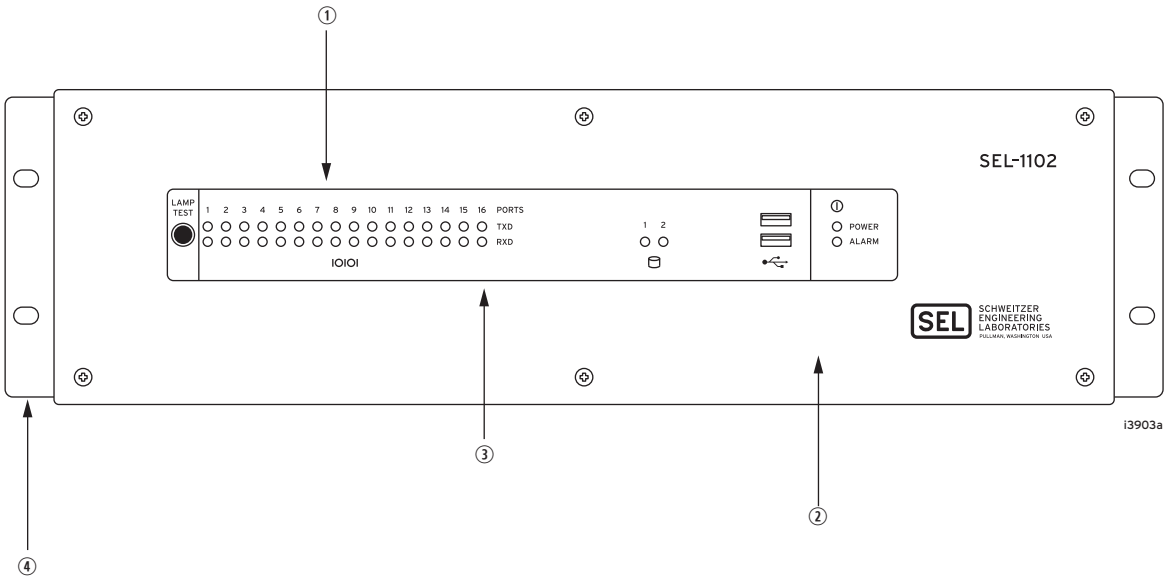
- **Power Supply.** The Computing Platform shall be capable of operating on a wide range of power supply voltages and shall be available with one of three power supply types:
  - 85–300 Vdc or
  - 85–264 Vac, 38–140 Vdc or 85–140 Vac, or
  - 20–60 Vdc
- **Temperature.** The Computing Platform shall be capable of continuous operation over a temperature range of –40° to +75°C (–40° to +167°F) at 50 percent processor burden in order to allow mounting in an outdoor control cubicle. The Computing Platform shall be type tested to IEC 60068-2-1:1990 (Test Ad 16 hr @ –40°C), IEC 60068-2-2:1974 (Test Bd 16 hr @ +75°C), and IEC 60068-2-30:1980 (Test Db 12 + 12-hour cycle @ 25° to 55°C, 6 cycles).
- **Environmental Testing.** The Computing Platform shall be tested to the same standards as protective relays including IEC 60255-21-1, IEC 60255-21-2, IEC 60255-21-3, IEC 60255-22-1, IEC 60255-22-2, EN 61000-4-2, IEC 60255-22-3, IEC 60255-22-4, EN 61000-4-4, and IEEE C37.90.1 (see *Specifications on page 8* for details).
- **Communication Ports.** The Computing Platform shall have two USB front-panel ports. Two USB ports, 16 serial ports, and two Ethernet ports shall be located on the rear panel. Two pins on each serial port shall be available as a demodulated IRIG-B time-synchronization signal. Sixteen rear ports shall have a selectable +5 Vdc output on Pin 1. Each rear serial port shall be capable of operation at 300–115200 bps. Ethernet ports shall be independent. All communication ports shall be ESD and RFI protected.
- **Configuration.** Configuration of messages and data processing functions shall be through a simple GUI interface. Configuration interface shall be through local keyboard, mouse, and monitor port or via Windows Remote Desktop.
- **Alarm Output.** There shall be an alarm contact output to signal internal errors and malfunctions. The alarm contact shall be controlled by an internal watchdog system that independently monitors the operating system.
- **Configuration Storage.** The Computing Platform shall store all settings and configuration in nonvolatile memory, allowing recovery after prolonged loss of power including failure of the internal battery.
- **Nonvolatile Storage.** There shall be flash memory used as nonvolatile storage of incoming and calculated data within the Computing Platform. Data stored in the nonvolatile memory shall be available for retrieval after sustained power outage including failure of the internal battery.
- **Moving Parts and Vent Holes.** The Computing Platform shall exclude all rotating disk drives, fans, moving parts, and vent holes.
- **Warranty.** The Computing Platform shall be warranted for a minimum of 10 years.

Front- and Rear-Panel Diagrams

Panel Mount



Rack Mount



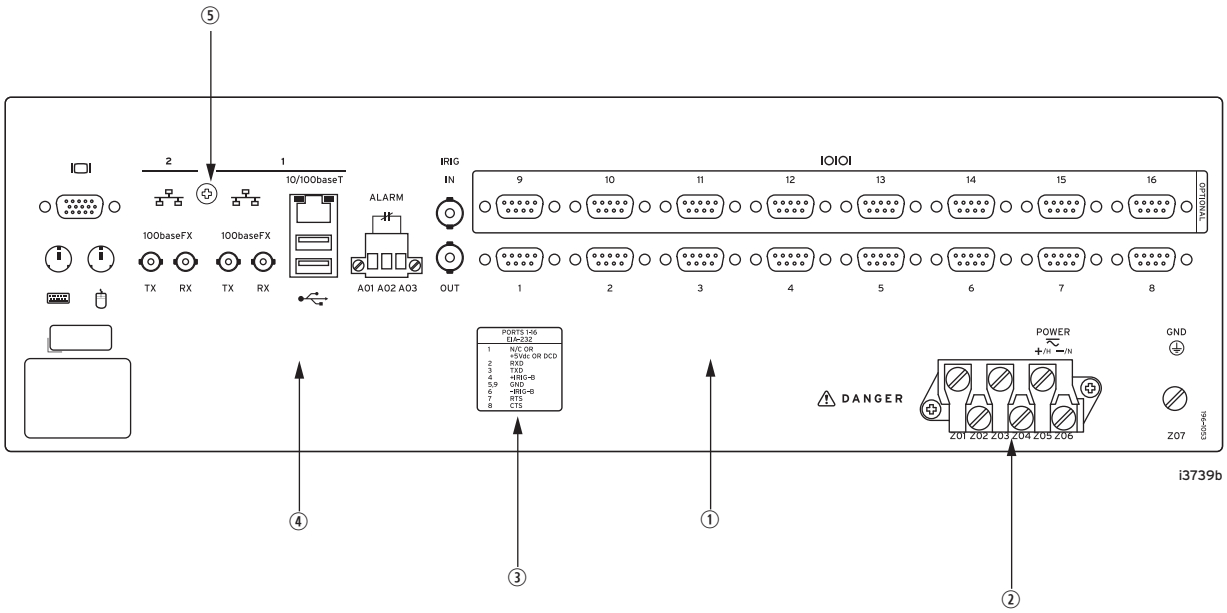
① LEDs indicate transmitted and received activity on each port for easy checkout.

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 cubicles.

④ Reversible flanges for flush or projection mounting.

Figure 2 Front-Panel Diagrams



① All rear serial ports provide communication and time code. Internal clock generates time code and synchronizes to modulated or demodulated time-code input.

② Wide-range power supply.

③ All DB-9 connector pin assignments are clearly identified.

④ High-contrast white-on-blue lettering is highly legible even in dark cubicles.

⑤ Dual Ethernet connection.

Figure 3 Rear-Panel Diagram

Product Dimensions

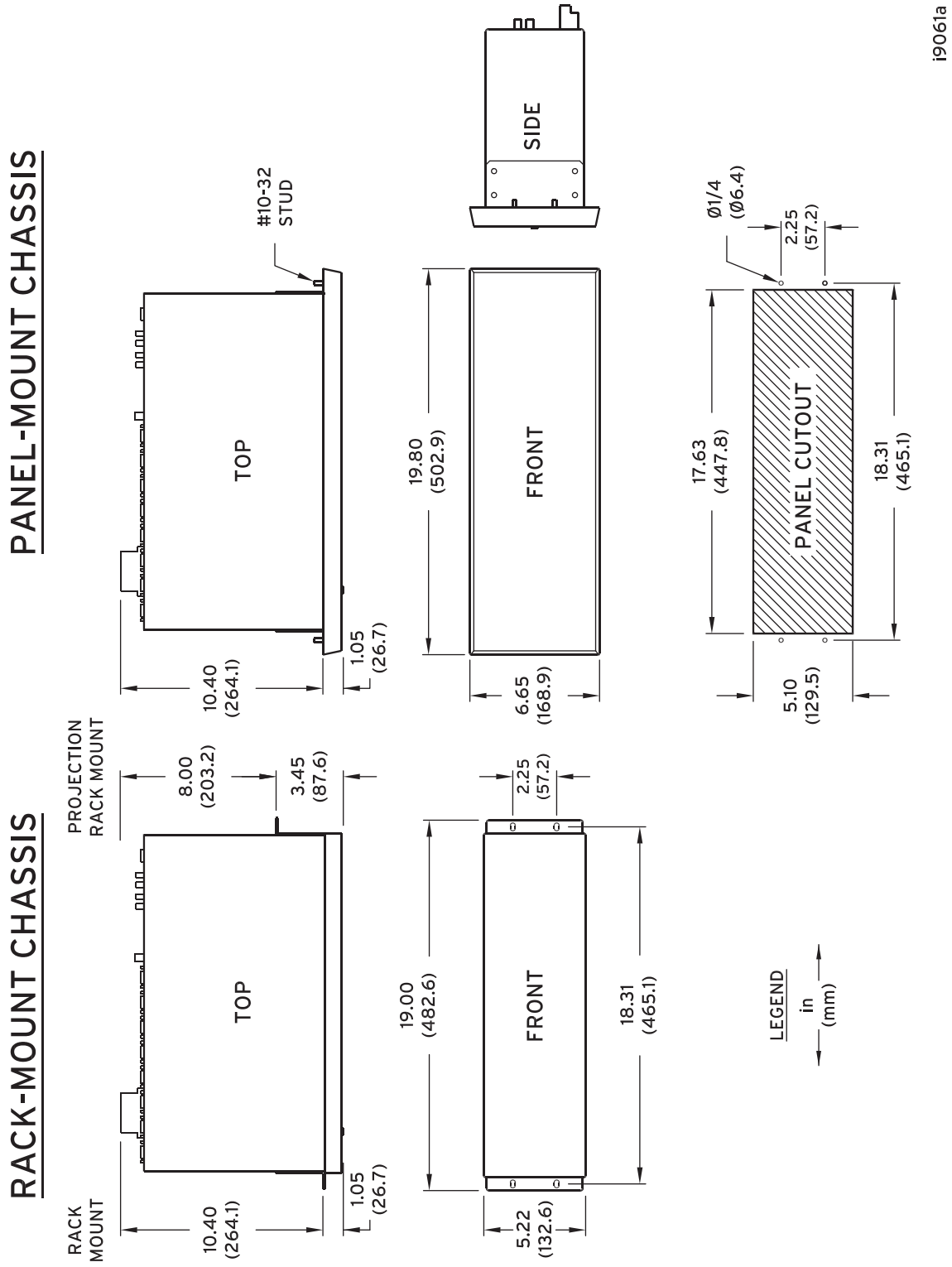


Figure 4 Dimension Diagram

Specifications

General

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. 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:	<40 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:	<40 W
Option:	24/48 Vdc
DC Range:	20–60 Vdc polarity dependent
Burden:	<40 W

Does not support ACPI

Main Supply Voltage Fluctuations:	Up to ±10% of nominal voltage

Operating Temperature, Performance

–40° to +75°C (–40° to +167°F)
(Maximum continuous CPU burden of 50%)

Operating Temperature, Safety

–40° to +75°C (–40° to +167°F)

Storage Temperature

–40° to +85°C (–40° to +185°F)

Relative Humidity

5 to 95% noncondensing

Maximum Altitude

2000 m

Atmospheric Pressure

80 ... 110 kPa

Overvoltage Category

Category II

Pollution Degree

2

Weight (Maximum)

5 kg (11 lbs)

Serial Ports

1, 8, or 16 rear-panel ports, DB-9 connectors

Ethernet Ports

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

Fiber Optic

Max TX Pwr.:	–14 dBm
Min TX Pwr.:	–19 dBm
RX Sensitivity:	–32 dBm
System Gain:	13 dB
Wavelength:	1300 nm
Source:	LED
Connector Type:	ST

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-1102.

Supported Form Factors

PC104, PC104+

CPU Type

Mobile Intel Pentium M

System Speed:	1.4 GHz with 400 MHz FSB
Chipset:	Intel® 855 GME
BIOS:	AMI BIOS
Cache:	2 MB L2 write-back cache
On-Board VGA:	Integrated Intel Extreme Graphics Controller Up to 32 MB Allocated System Memory Maximum Resolution 1600 x 1200
LAN:	Ethernet 1: AMD PCNet—Fast +; Fiber Optic or Copper Ethernet 2: AMD PCNet—Fast +; Fiber Optic
Memory:	1 GB, PC2700 DDR SDRAM, ECC
Super I/O:	SMSC LP47B272
RTC/CMOS:	Intel ICH4-M
Keyboard Controller:	SMSC LP47B272
Local Bus IDE:	Intel ICH4-M, IDE1, 2 Ultra DMA 33/66/100 IDE0 Dual CompactFlash® Type 2 Sockets IDE1 44 pin header, 2.5" HD mounting bracket
USB:	2 rear-panel ports, 2 front-panel ports USB 1.1 Compliant 600 mA current limit for front 600 mA current limit for rear

Type Tests

Electromagnetic Compatibility Immunity

Electrostatic Discharge:	IEC 60255-22-2:1996 IEC 61000-4-2:2001 IEEE C37.90.3-2001 Severity Level: 2, 4, 6, 8 kV contact discharge; 2, 4, 8, 15 kV air discharge
Fast Transient Disturbance:	IEC 61000-4-4:1995 + A1:2000 + A2:2001 IEC 60255-22-4:2002 Severity Level: Class A 4 kV, 2.5 kHz on power supply and outputs; 2 kV, 5 kHz on communication lines
Radiated Radio Frequency:	IEC 61000-4-3:2002 IEC 60255-22-3:2000 Severity Level: 10 V/m IEEE C37.90.2-1995 Severity Level: 35 V/m
Surge Withstand:	IEEE C37.90.1-2002, Severity Level: 4 kV, 2.5 kHz on power supply and outputs; 2 kV, 5 kHz on communication lines
Conducted Emissions:	EN 55011:1998 + A1:1999 + A2:2002 Level: Class A IEC 60255-25:2000
Radiated Emissions:	EN 55011:1998 + A1:1999 + A2:2002 Level: Class A IEC 60255-25
Voltage Fluctuations and Flicker:	IEC 61000-3-3:2002
Harmonic Current Emissions:	IEC 61000-3-2:2001 Level: Class A
Surge Withstand Capability Immunity:	IEC 60255-22-1:2005 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
Surge Immunity:	IEC 61000-4-5:1995 + A1:2001 IEC 60255-22-5:2002 Severity Level: 0.5 1.0 kV Line-to-Line; 0.5, 1.0, 2.0 kV Line-to-Earth
Conducted Immunity:	IEC 61000-4-6:2004 IEC 60255-22-6:2001 Severity Level: 10 Vemf
Power Frequency Magnetic Field Immunity:	IEC 61000-4-8:2001 1000 A/m for 1 s 100 A/m for 1 min.
Pulse Magnetic Field Immunity:	IEC 61000-4-9:2001 Severity Level: 1000 A/m, Level 5
Power Supply Variation and Interruption:	IEC 61000-4-11:2004 IEC 60255-11:1979

Environmental

Cold:	IEC 60068-2-1:1990 + A1:1993 + A2:1994 Test Ad: 16 hours at –40°C
Dry Heat:	IEC 60068-2-2:1974 + A1:1993 + A2:1994 Test Bd: 16 hours at +75°C
Damp Heat, Cyclic:	IEC 60068-2-30:1980 + A1:1985 Test Db: (12 + 12-hour cycle), 95% r.h. 25° to 55°C, 6 cycles
Object Penetration:	IEC 60529:2001 + CRGD:2003, from front of unit.
Vibration:	IEC 60255-21-1:1988, Endurance Class 1 Response Class 1 IEC 60255-21-2:1988, Shock Withstand, Bump Class 1 Shock Response Class 1 IEC 60255-21-3:1993 Quake Response Class 2

Safety

Dielectric Strength:	IEC 60255-5:2000, 3100 Vdc on power supply 2500 Vac on contact output Type tested for one minute. IEEE C37.90-1989, 3100 Vdc for 1 min. on power supply 2500 Vac on contact output Type tested for one minute. IEEE Std 1613–2003
Impulse:	IEC 60255-5:2000 IEEE Std 1613–2003 IEEE C37.90-1989 Severity Level: 0.5 Joule, 5 kV
LED:	IEC 60825-1:1993 + A1:1997 + A2:2001

Real-Time Clock/Calendar

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

Certifications

ISO: SEL-1102 is designed and manufactured using ISO 9001 certified quality program.

Notes

Notes

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