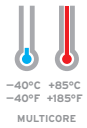
# SEL Computing Platforms


## Rugged, versatile computing platforms for utility and industrial applications

- Configurable as Real-Time Automation Controllers (RTACs), Blueframe® application platforms, or industrial computers with a Microsoft Windows or Linux OS.
- Wide variety of form factors, mounting options, processors, storage capacities, and communications ports.
- Durable design with operating temperature ranges as broad as −40° to +85°C (−40° to +185°F).
- High-quality single-level cell (SLC) SSDs and error-correcting code (ECC) memory.
- Worldwide ten-year warranty, local technical support, and no-charge diagnostic and repair services.

# Advantages of SEL Computing Platforms

| | SEL Computing Platforms | Typical Computers |
|---|---|---|
| | **Operating Temperature Range** | |
|  | SEL computing platforms feature a wide temperature range and up to 95 percent relative humidity resistance for operation in outdoor, industrial, manufacturing, and utility environments. | Typical PCs are designed for use in commercial or light industrial environments—typically +10°C to +35°C (+50°F to +95°F). |
| | **Environmental Operation Conditions** | |
|  | SEL computing platforms are designed to operate in the presence of vibration, seismic, and shock (15 g) events due to nearby equipment or rough handling. They correctly operate during 15 kV electrostatic discharge (ESD) events as well as during electrical surges. | Vibration and shock damage are the result of unsecured components, connectors, or boards common in office or typical industrial computers. ESD and electrical surges often cause typical PCs to restart or misoperate. |
|  | Conformal coating on the internal components provides additional protection in corrosive environments. | Corrosion leads to early failures. |
| | **System Reliability and Availability** | |
|  | SEL computing platforms have a proven reliability ten times greater than that of traditional industrial computers, with a mean time between failures (MTBF) of over 370 years (calculated in March 2024). | The reliability of typical industrial computer systems is 50,000 hours, or a 5.7-year MTBF. |
|  | SEL power supply reliability is greater than 2,000 years MTBF, and each supply can operate on ac or dc inputs. An optional redundant, hot-swappable power supply is available. | Power supplies, fans, and rotating disk drives are the three highest failure points. |
|  | The advanced thermal design eliminates fans and vents, so no dust or dirt is pulled into the device and there are no moving parts to wear out. | Fans contaminate system components with dust. When the fan bearings wear out, high-power components overheat and fail. |
|  | All SEL computing platforms are available with industrial-rated SSDs and configurable with SLC SSDs for maximum endurance and longevity. The SEL-3355 offers up to four drives with RAID 0, 1, 5, or 10 for worry-free storage and easy replacement (hot-swappable). The SEL-3360 SSDs support RAID 0 and 1 and are hot-swappable. The SEL-3350 and SEL-3360 include up to two drives. | Consumer-grade SSDs maximize capacity and minimize price at the cost of endurance and reliability. While non-SLC SSDs are available as an option on SEL computing platforms, they have much lower program/erase cycle endurance, which reduces usable life, and are more likely to corrupt data in hot environments. SEL recommends the use of SLC drives. |
|  | ECC RAM continuously checks for bit errors and immediately corrects them, preventing system crashes. | Standard RAM experiences frequent random bit errors that can result in unexplained OS and application crashes. |

| | SEL Computing Platforms | Typical Computers |
|---|---|---|
| | **System Monitoring, Management, and Recovery** | |
| SYSTEM MANAGEMENT | Critical system functions and the status are monitored and logged using SEL SysMon Software. It provides a watchdog controller, and alerts can be communicated through an alarm contact output. | Basic monitoring and watchdog capability limits health monitoring to "operational" or "nonoperational." Typical PCs have no alarm output contacts. |
| BACKUP AND RECOVERY | SEL computing platforms include an optimized version of the SEL backup and recovery tool (BaRT), which can back up or restore an OS image in just a few minutes.<br>Intel vPro technology in the Intel Xeon processor enables remote and local monitoring, remediation, and repair of computing platforms, even if they are shut down or if the OS is not functional. | Third-party recovery tools are available and can be expensive, hard to use, and time-consuming.<br>Remote monitoring may be available on PCs that include Intel vPro technology. |
| | **Secure Computing** | |
| | Intel vPro technology in the Xeon processors provides remote OS patch management and security measures designed into the chipset, making the SEL-3355 and SEL-3360 less vulnerable to computer viruses and/or loss of sensitive information. | Intel vPro technology may be available in other computers. |
| | **BIOS** | |
| | The Unified Extensible Firmware Interface (UEFI) firmware supports the latest OSs and enhances system management. User administration prevents unauthorized access and settings changes. You can enable and disable individual USB, serial, and PCIe ports in the BIOS to secure unused ports. | A typical BIOS does not offer the ability to disable all USB, serial, and PCIe ports. |
| | **Secure Boot** | |
| | Secure Boot verifies the integrity of UEFI drivers, boot loaders, and OS files to ensure the system will only boot up and give control to the OS if the signatures are valid. | Industrial original equipment manufacturers may also ship their computer BIOS with Secure Boot enabled. |
|  | **Flexible and Powerful I/O** | |
| | The SEL-3355 supports up to 5 PCIe/PCI cards to meet your unique needs.<br>Serial ports provide +5 V power for peripherals, such as fiber converters and modems, and distribute IRIG-B accurate time to connected devices.<br>USB ports provide up to 2,000 mA current to power connected devices. | Typical computers may not allow expansion cards or may require the use of proprietary cards.<br>Typically, computers do not offer +5 V power or IRIG-B time distribution.<br>Standard USB ports are only required to provide 500 mA current. |
| WORLDWIDE 10 years WARRANTY | **Warranty** | |
| | SEL computing platforms come with a standard ten-year, no-questions-asked warranty. | Traditionally, most computers come with a one- to three-year limited warranty. Most manufacturers offer extended warranties of up to five years for an additional cost. |

# Reliable Even in Harsh Environments

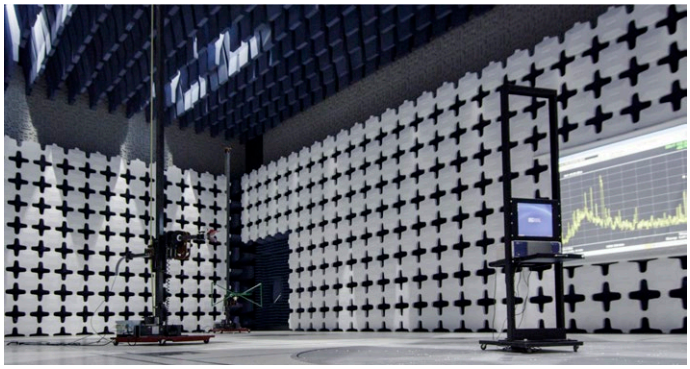
We design and test SEL computing platforms to exceed the rigorous industry standards required for harsh operating environments. We perform stringent type tests at our own facilities, where we are able to understand the root cause of failures and improve designs for reliable operation. Typical industrial computer manufacturers do not verify their designs with this same degree of rigorous testing.

### Electrostatic Discharge

SEL computing platforms maintain normal operation even when exposed to 15 kV of ESD as well as during electrical surges caused by lightning and other events.


### Electromagnetic Immunity

SEL computing platforms continuously perform without error in the presence of large electromagnetic fields or radio frequency (RF) interference, meeting or exceeding industry standards for electromagnetic compatibility/immunity.



### Electromagnetic Emissions

We use our state-of-the-art 10-meter RF test chamber to make sure SEL computing platforms meet or exceed electromagnetic radiated and conductive immunity and emissions standards.

### Environmental

Environmental testing ensures SEL computing platforms reliably operate in extreme temperatures—−40° to +85°C (−40° to +185°F), depending on the CPU—and in up to 95 percent humidity.

Note: The temperature range is dependent on the selected processor.


### Vibration and Shock

We perform rigorous testing to ensure SEL computing platforms operate correctly near vibrating machinery, during seismic and shock events, and after shipping and rough handling, such as dropping. With no moving parts, SEL computing platforms exceed industry standards and operate reliably for years.

# Type Tests Applied to SEL Computing Platforms

| Test Category | Summary | Applicable Standards |
|---|---|---|
| **Environmental** | **Cold Test:** −40°C for 16 hours* | IEEE 1613-2009 (Class 1)*, IEC 60068-2-1:2007, IEC 61850-3:2013 |
| | **Dry Heat:** +85°C for 16 hours (Atom x5-E3940 quad-core)*, +75°C for 16 hours (Xeon E3-1505L)*, +60°C for 16 hours (Xeon E3-1505M)* | IEEE 1613-2009 (Class 1)*, IEC 60068-2-2:2007, IEC 61850-3:2013 |
| | **Damp Heat Cyclic:** 95 percent humidity over +25°C to +55°C, six 12-hour cycles; >93 percent relative humidity | IEEE 1613-2009 (Class 1)*, IEC 60068-2-30:2005, IEC 61850-3:2013 |
| **Electromagnetic Compatibility Immunity** | **Conducted:** Subjected to high levels of conducted RF signals of 10 Vrms* | IEC 61850-3:2013*, IEC 60255-26:2013, IEC 61000-4-6:2013 |
| | **Radiated RF:** Subjected to high levels of radiated RF signals 10 V/m* and 20 V/m** | IEEE 1613-2009 (Class 1)*, IEEE C37.90.2-2004**, IEC 60255-26:2013, IEC 61000-4-3:2006 + A1:2007, IEC 61850-3:2013 |
| | **Fast Transient/Bursts:** Subjected to Class A severity with 4 kV and 5 kHz on power supply and outputs, 2 kV and 5 kHz on communications lines* | IEC 61850-3:2013*, IEC 60255-26:2013, IEC 61000-4-4:2012 |
| | **Magnetic Fields:** Subjected to large magnetic fields of 1,000 A/m for 3 seconds and 100 A/m for 1 minute* | IEC 61850-3:2013*, IEC 61000-4-8:2009, IEC 61000-4-9, IEC 61000-4-10 |
| | **Surge Withstand and Immunity:** Subjected to 2.5 kV common mode and 1 kV differential mode on power supply and outputs, 1 kV common mode on communications ports*; 2.5 kV oscillatory and 4 kV fast transient**; surge immunity severity tests of 1 kV line-to-line and 2 kV line-to-earth*** | IEEE 1613-2009 (Class 1)*, IEEE C37.90.1-2012**, IEC 61850-3:2013***, IEC 60255-26:2013, IEC 61000-4-18:2006 + A1:2010, IEC 61000-4-5:2005 |
| **Electrostatic Discharge** | **ESD:** Subjected to 2 kV, 4 kV, 6 kV, and 8 kV contact-discharge events and 2 kV, 4 kV, 8 kV, and 15 kV indirect discharge events* | IEEE C37.90.3-2001*, IEC 60225-26:2013, IEC 61000-4-2:2008, IEEE 1613-2009 (Class 1), IEC 61850-3:2013 |
| **Electromagnetic Compatibility Emissions** | **Radiated and Conducted Emissions:** Will not cause conducted or radiated emissions above specified levels, which may affect the satisfactory operation of other equipment; tested to Class A standards* | CISPR 11:2009 + A1:2010, CISPR 22:2008, CISPR 32:2015, IEC 61000-6-4:2006, IEC 61850-3:2013, FCC 15.107:2014, FCC 15.109:2014 |
| **Vibration/Shock** | **Vibration:** Subjected to 10—150 Hz, 20 bidirectional sweep cycles (40 unidirectional sweeps) at 2.0 g acceleration (Endurance 200)*; 10—150 Hz, 1 bidirectional sweep cycle (2 unidirectional sweeps) at 1.0 g acceleration (Response 200)*; three 11 ms, half-sine wave pulses in each direction at 15.0 g acceleration (Shock Withstand 100)**; 16 ms half-sine wave pulse, 1,000 pulses each direction at 10.0 g acceleration (Bump 100)**; three 11 ms, half-sine wave pulses at 10.0 g acceleration (Shock Response 200)**; 5—35 Hz, 1.1—2.0 g acceleration (Seismic Quake 2 Horizontal)***; 5—35 Hz, 0.5—1.0 g acceleration (Seismic Quake 2 Vertical)*** | IEC 61850-3:2013*, IEC 60255-21-2:1988**, IEC 60255-21-3:1993***, IEC 60255-21-1:1988, IEEE 1613-2009 (Class 1) |
| **Safety** | **Dielectric Strength:** Subjected to 3,600 Vdc on power supply, 2,500 Vac on contact output, and 1,500 Vac on Ethernet ports for 1 minute* | IEEE C37.90-2005*, IEC 60255-27:2013, IEEE 1613-2009 (Class 1) |
| | **Impulse:** Subjected to 0.5 J, 5 kV impulse on power supply and input/output contacts* | IEEE 1613-2009 (Class 1)*, IEEE C37.90-2005, IEC 60255-27:2013 |

Note: Asterisks designate the test levels and severity of testing that are relative to the specific standards for each test category.

# Ensuring Quality With World-Class Manufacturing

State-of-the-art manufacturing facilities reflect our strong commitment to offering unmatched value in products and services. A focus on lean manufacturing keeps costs low, translating into better value for you. At SEL, we comply with the highest quality standards, such as IPC-A-610 Class 3 and ISO 9001, and constantly strive to exceed those requirements.

We continually strive to exceed your expectations and quality standards by:

- Rigorously monitoring and controlling all processes to exceed the ISO 9001 Quality Management Systems Standard.
- Developing robust, repeatable, and scalable manufacturing processes to continually improve designs and reduce process errors.
- Ensuring that our test and calibration laboratories use the latest equipment and follow National Institute of Standards and Technology traceable standards for accuracy and maintenance.
- Partnering with our suppliers to ensure the highest possible component quality.
- Designing, testing, manufacturing, and repairing our computing platforms in the U.S.A.

### Highly Skilled Employees

Our employees are trained to meet IPC-A-610 Class 3 certification. All manufacturing positions require operator certification, and employees receive both classroom and hands-on training.

### Manufactured in the U.S.A.

All SEL computing platforms are designed, tested, and manufactured in our state-of-the-art facility in Pullman, Washington.

### Product Hospital Improves Reliability

The SEL ten-year warranty means products come back to our Product Hospital for repair and root cause analysis. We feed the information learned back into the design and manufacturing process to further improve product reliability.

### Vertical Integration

We design and build many of the components used in SEL products. Automation and vertical integration allow us to achieve repeatable, high-quality results.

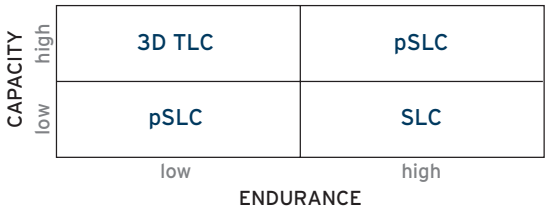
# SSD Selection

We offer three types of SSDs for SEL computing platforms:

- SLC technology provides the highest level of endurance and reliability. SLC drives are suited for the most demanding applications and provide the best value for high-endurance applications.
- Pseudo-SLC (pSLC) drives provide high capacity at a lower cost but with reduced endurance. These drives are suited for applications that require high endurance and a large drive or moderate endurance and a smaller drive.
- 3D triple-level cell (TLC) drives provide the highest capacities and lowest cost but have the lowest endurance. 3D TLC drives are suitable for applications that do not require high endurance.

### Decision Matrix for SSD Memory Types, Weighing Endurance Vs. Capacity

Use the chart and table to determine the appropriate drive type based on your specific application needs.




### SSD Attributes

| | SLC | pSLC | 3D TLC |
|---|---|---|---|
| Write Endurance | 100,000 | 20,000 | 3,000 |
| Temperature Range | −40° to +85°C (−40° to +185°F) | −40° to +85°C (−40° to +185°F) | −40° to +85°C (−40° to +185°F) |
| Conformal Coating | Yes | Yes | Yes |
| Warranty | SEL 10 Years | Manufacturer 5 Years | Manufacturer 5 Years |
| Capacity | 32–256 GB | 120–480 GB | 240–7,680 GB |

# Specifications





| SEL-3350 1U | SEL-3350 3U | SEL-3355 | SEL-3360S | SEL-3360E |
|---|---|---|---|---|
| **CPU and Operating Temperature Range** | | | | |
| Intel Atom x5-E3940 quad-core, 1.6 GHz: −40° to +85°C (−40° to +185°F) | | Intel Xeon E3-1505L quad-core 2.0 GHz 64-bit: −40° to +75°C (−40° to +167°F)<br>Intel Xeon E3-1505M quad-core 2.8 GHz 64-bit: −40° to +60°C (−40° to 140°F) | | Intel Xeon E3-1505L quad-core 2.0 GHz 64-bit: −40° to +60°C (−40° to +140°F) |
| **OS Support** | | | | |
| **SEL OSs**<br>RTAC*<br>Blueframe*<br>**Supported Third-Party OSs**<br>Microsoft Windows 10*<br>Microsoft Windows Server*<br>Red Hat Enterprise Linux (RHEL)<br>CentOS Linux<br>Ubuntu LTS Linux<br>SUSE Linux | | **SEL OSs**<br>RTAC (available via SEL-3533 RTAC Conversion Kit—not a factory-installed option)<br>Blueframe*<br>**Supported Third-Party OSs**<br>Microsoft Windows 8<br>Microsoft Windows 10*, 11*<br>Microsoft Windows Server*<br>Red Hat Enterprise Linux (RHEL)<br>CentOS Linux<br>Ubuntu LTS Linux<br>SUSE Linux<br>VMware ESXi | | |
| **Mass Storage** | | | | |
| Up to 2 SSDs, 32—7,680 GB each, 2.5" SATA III (6.0 GB/s) | | Up to 4 SSDs, 32—7,680 GB each, 2.5" SATA II (3.0 GB/s) | Up to 2 SSDs, 32—7,680 GB each, 2.5" SATA II (3.0 GB/s) | |
| **Storage Redundancy** | | | | |
| N/A | | RAID 0, 1, 5, and 10 (hot-swappable) | RAID 0 and 1 (hot-swappable) | |
| **Trusted Platform Module (TPM)** | | | | |
| Infineon SLB 9670AQ TPM 2.0 | | | | |
| **Power Supply Options** | | | | |
| Single | Redundant: SEL-9325 | Redundant: SEL-9331 | Single (external): SEL-9331 | Single (internal): SEL-9331 |
| **Standards** | | | | |
| IEC 61850-3<br>ANSI/IEEE 1613 (Class 1)<br>ANSI/IEEE C37.90<br>IEC 60255 | | | | |

*Orderable as a factory-installed option.

# Specifications, Continued





| SEL-3350 1U | SEL-3350 3U | SEL-3355 | SEL-3360S | SEL-3360E |
|---|---|---|---|---|
| **Expansion Slots** | | | | |
| None | Expansion option for 32 additional serial ports<br>Expansion option for 24 digital inputs and 8 digital outputs | 5 PCI expansion card slots (1 PCI, 2 PCIe × 1, 2 PCIe × 4) | None | 2 PCI expansion card slots (1 PCIe × 1, 1 PCIe × 4) |
| **Chassis** | | | | |
| 19" rack or panel mount, 1U | 19" rack or panel mount, 3U | | Conductive panel-mount or standard convection wall-mount cooling | |
| **Certifications** | | | | |
| ISO 9001: Designed, manufactured<br>RoHS<br>CE: CE Mark EMC Directive, Low-Voltage Directive<br>UL, cUL: 61010-1, C22.2 No. 61010-1<br>UKCA<br>RCM<br>FCC: 47 CFR 15B, Class A<br>SUSE YES (SEL-3355) | | | | |

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Making Electric Power Safer, More Reliable, and More Economical
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PF00242 • 20250102

WORLDWIDE 10 years WARRANTY