### Features and Benefits

- **$960 for 48 Digital I/O Points = $20 Per Point!**
- **Distributed I/O Right Out of the Box**
  - Preprogrammed register maps
  - Select protocol and address via switches behind front panel
- **Fast and Powerful**
  - 2 ms processing interval
  - 7 ms from input to output: auxiliary relay speed
  - Events timed to the microsecond
- **A Great Communicator and Interpreter**
  - Supported Protocols:
    - Serial Ethernet
    - DNP3 ✔ ✔
    - Modbus® ✔ ✔
    - Mirrored Bits® communications ✔
    - SEL Fast Message ✔
    - IEC 61850 ✔
- **Convenient Maintenance and Support**
  - Removable terminal blocks with positive retention
  - Continuous self-monitoring diagnostics
  - LEDs for system status, every I/O point, and communications port
  - Front-panel management port
- **SEL Quality, Standards, and Global Support**
  - 2000 Vac/2500 Vdc HiPot
  - 8 kV contact/15 kV air ESD tested
  - IEEE C37.90-1989
  - IEEE 1613-2003 standard
  - IEC 60255 protective relay standards
Easy Setup

1. Unpack and Inspect

2. Wire It

3. Set Protocol and Address Using Dip Switches

4. Power Up and Verify Status
   - Press lamp test for:
     - LED status
     - Port address check
     - Time-code check

5. Verify Contact Status with Master
Distributed I/O Expandable to Thousands of Points

RTAC
Real-Time Automation Controller

DPAC
Discrete Programmable Automation Controller

PAC
Programmable Automation Controller

Serial or Ethernet Communications

or computer, communications processor, direct SCADA link, RTU replacement

Simplify Settings, Analysis, and Design Using acSELeRATOR® Software

HMI Settings Events Reports Updates IEC 61850
How can SEL deliver all these features for only $960?
By leveraging successful designs for relays and automation controllers with world-class manufacturing. And not by cutting corners on quality.

What if I burn out a relay contact in a DPAC?
First, SEL has a ten-year, no-questions-asked warranty. If you burn out a contact, SEL will repair your DPAC usually within 72 hours. Second, the DPAC is entirely connectorized, so you can easily remove it from service without removing any wires from the connectors. Because of the low price, having a spare on hand for only $960 is affordable. Simply download your settings to the spare and insert the connectors for a fast, simple, and economical repair.

Can I expand the I/O of the DPAC?
Yes! The base product typically has 32 inputs and 16 outputs. Want some more? You can add two SEL-2505 Remote I/O Modules (8 in/8 out), one per serial port, for a total of 32 more points...for a grand total of 80 I/O points! But, the DPAC is so cost effective to begin with, it’s usually most economical to buy another DPAC! Remember, it’s $20 per point for protection quality I/O.

Where is the DPAC designed and made?
It is designed and manufactured in our factory in Pullman, Washington. The DPAC firmware was developed by SEL in Pullman too.

Can I hook two DPACs back-to-back? What kind of performance can I get?
You may be familiar with our SEL-2505 Modules. They communicate 8 points in each direction, so that 8 inputs at one end are 8 outputs at the other, and vice versa. You can do exactly this with 8 inputs and 8 outputs of each DPAC and still have your other I/O. End-to-end delay is about 7 ms. Or, you can use IEC 61850 GOOSE messaging and the Ethernet ports to communicate any desired combination of I/O points; e.g., 16 inputs to 16 outputs one way and 8 inputs to 8 outputs going back.

How can I apply the DPAC in my system?
You can use it as a standalone controller or digital concentrator. Or, you can use the DPAC as a host or I/O expansion for the SEL-2411 Programmable Automation Controller (PAC) that also supports low-level dc or ac analog inputs. For automation and control applications, you can use the SEL-3530 RTAC or our embedded computers. You can also connect your DPAC to SEL-2020, -2030, -2032 communications processors via our SEL protocols, or easily integrate with your existing SCADA infrastructure with DNP3 and Modbus® protocols over Ethernet or serial connections.

This is a new product for me. How can SEL assist me?
If you are already familiar with the SEL-2411 PAC, then you will be right at home with the DPAC. They have the same roots. The DPAC is actually easier, because it doesn’t need to handle analog signals. If you have never used an SEL device, then now is the time! We have field application engineers around the world who are ready to assist you with your designs at no charge. Or, our systems engineering team can develop a detailed custom design for you in accordance with your needs at reasonable fees. Or, if your local consultant wants help, we are prepared to support him or her as well.

Your literature stresses that you guarantee performance to various standards. What does this mean?
The design engineers at SEL understand these standards, and they know that their designs must not only comply but also have margin beyond the standard. For instance, standards require a dielectric strength test (HiPot) of 2000 Vac. SEL adds margin onto the standard and requires the product pass at 2500...for a 25 percent margin above the standard! This requires careful attention to clearances, spacing, and many other parameters. Unfortunately, there are many devices, costing much more and having (understandably) weaker warranties, that say their products are “designed to” the standards...whatever that means. Be assured that when SEL mentions a standard, we meet it! Not only “designed to.” Not only “tested to.” But “tested to and passed with margin!” Standards exist for a reason: these devices are put to work in hostile environments, and you and we need to sleep at night, knowing we have taken every step possible to reasonably assure performance in the substation environment for many years.
### DESIGN

<table>
<thead>
<tr>
<th>DESIGN</th>
<th>SEL</th>
<th>OTHERS</th>
<th>IMPORTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive retention of connectors</td>
<td>✓</td>
<td>no</td>
<td>Control wiring is stiff and heavy. Connectors without positive retention can come off, causing failure or misoperation of your control system.</td>
</tr>
<tr>
<td>2000 V all circuits to ground</td>
<td>✓</td>
<td>??</td>
<td>Faults can stress power supply and I/O to high voltages. Flashover can destroy I/O and cause misoperations.</td>
</tr>
<tr>
<td>2000 V circuit-to-circuit</td>
<td>✓</td>
<td>??</td>
<td>Adjacent circuits can have different references.</td>
</tr>
<tr>
<td>HiPot routine test</td>
<td>✓</td>
<td>??</td>
<td>Every SEL device is HiPot tested in manufacturing before it goes out the door. Others may not be and may fail during HiPot testing of your panels.</td>
</tr>
<tr>
<td>Utility-rated power supply</td>
<td>✓</td>
<td>no</td>
<td>SEL makes its own power supplies, which have a 600-year MTBF. Others may use commercial supplies, as found in computers.</td>
</tr>
<tr>
<td>AC/DC inputs</td>
<td>✓</td>
<td>no</td>
<td>SEL inputs are dual-rated. Others are typically dc only. AC-rated inputs are needed for monitoring ac loads and voltage transformers.</td>
</tr>
<tr>
<td>Level-sensitive inputs</td>
<td>✓</td>
<td>no</td>
<td>SEL input thresholds are near one-half the battery voltage to prevent false assertions. Others may use &quot;universal&quot; inputs, with thresholds as low as 12 V, which may misoperate on battery grounds, transients, and switching events.</td>
</tr>
<tr>
<td>−40°C to +85°C</td>
<td>✓</td>
<td>no</td>
<td>The SEL DPAC will work in outdoor cabinets and when air conditioning fails. Others probably won’t.</td>
</tr>
<tr>
<td>Vibration</td>
<td>✓</td>
<td>??</td>
<td>Designed and tested to work in vibration-prone environments.</td>
</tr>
<tr>
<td>Tested to IEEE C37.90</td>
<td>✓</td>
<td>??</td>
<td>SEL type tests all products. Others may say only “designed to...” Type tests prove secure, reliable performance.</td>
</tr>
</tbody>
</table>

### COMMUNICATIONS

<table>
<thead>
<tr>
<th>COMMUNICATIONS</th>
<th>SEL</th>
<th>OTHERS</th>
<th>IMPORTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SERIAL</td>
<td>✓</td>
<td>no</td>
<td>MOV protection, 5 Vdc pass-through for transceivers, and demodulated IRIG-B pass-through.</td>
</tr>
<tr>
<td>EIA-232</td>
<td>✓</td>
<td>no</td>
<td>MOV protection.</td>
</tr>
<tr>
<td>EIA-485</td>
<td>✓</td>
<td>??</td>
<td>Improves communications reliability and far less susceptible to noise.</td>
</tr>
<tr>
<td>Fiber V-pin connector</td>
<td>✓</td>
<td>??</td>
<td>Improves communications reliability and far less susceptible to noise.</td>
</tr>
<tr>
<td>Fiber ST® connector</td>
<td>✓</td>
<td>??</td>
<td>Improves communications reliability and far less susceptible to noise.</td>
</tr>
<tr>
<td>Dual 1000BASE-T with integrated switch</td>
<td>✓</td>
<td>no</td>
<td>Integrated switch allows easy daisy-chaining of IP-based devices.</td>
</tr>
<tr>
<td>Dual 1000BASE-FX Ethernet with integrated switch</td>
<td>✓</td>
<td>no</td>
<td>Improves communications reliability and far less susceptible to noise.</td>
</tr>
<tr>
<td>IRIG-B input and output</td>
<td>✓</td>
<td>no</td>
<td>IRIG-B input and output connectors allow easy daisy-chaining of devices.</td>
</tr>
<tr>
<td>Microsecond accurate timing</td>
<td>✓</td>
<td>no</td>
<td>Time-critical events, such as breaker mechanism operations.</td>
</tr>
</tbody>
</table>

### PROCESSING CAPABILITIES

<table>
<thead>
<tr>
<th>PROCESSING CAPABILITIES</th>
<th>SEL</th>
<th>OTHERS</th>
<th>IMPORTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math and logic</td>
<td>✓</td>
<td>no</td>
<td>Provides local control and processing.</td>
</tr>
<tr>
<td>Scheduling and timing of outputs</td>
<td>✓</td>
<td>no</td>
<td>Enable scheduling of outputs based on month, day, hour, and minute variables.</td>
</tr>
<tr>
<td>Logic processing interval to less than 2 ms</td>
<td>✓</td>
<td>no</td>
<td>Fast deterministic processing interval.</td>
</tr>
<tr>
<td>Command line response processing</td>
<td>✓</td>
<td>no</td>
<td>All programming and control can be accomplished from a command line.</td>
</tr>
</tbody>
</table>

### SECURITY

<table>
<thead>
<tr>
<th>SECURITY</th>
<th>SEL</th>
<th>OTHERS</th>
<th>IMPORTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong passwords</td>
<td>✓</td>
<td>no</td>
<td>Supports alpha, numeric, and special characters up to 12 characters in length.</td>
</tr>
<tr>
<td>Port enable/disable</td>
<td>✓</td>
<td>no</td>
<td>Set security levels on a per port basis, and turn off unused ports.</td>
</tr>
</tbody>
</table>

### WARRANTY AND SUPPORT

<table>
<thead>
<tr>
<th>WARRANTY AND SUPPORT</th>
<th>SEL</th>
<th>OTHERS</th>
<th>IMPORTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-hassle, ten-year, worldwide warranty</td>
<td>✓</td>
<td>no</td>
<td>Best in the industry.</td>
</tr>
<tr>
<td>Free worldwide technical support</td>
<td>✓</td>
<td>no</td>
<td>SEL maintains more than 80 offices in over 15 countries.</td>
</tr>
</tbody>
</table>

### PRICE PER DIGITAL I/O POINT

<table>
<thead>
<tr>
<th>PRICE PER DIGITAL I/O POINT</th>
<th>SEL</th>
<th>OTHERS</th>
<th>IMPORTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>$20 per point</td>
<td>✓</td>
<td>no</td>
<td>Others may charge up to $60 per point.</td>
</tr>
</tbody>
</table>
Management and setup port.

48 status LEDs, one for every I/O point.

LEDs also show port address and IRIG time code after lamp test.

Industry-leading, worldwide, ten-year warranty.

Powerful 32-bit microcontroller delivers relay-speed I/O, logic, and communications.

Diagnostic LEDs.

Continuous display of network activity with communications port activity LEDs.

Digital outputs.

Lamp test, port address check, and time-code check.

I/O labels match status LEDs.

All outputs are rated for utility grade per IEEE C37.90, eliminating the need for interposing relays.

All connectors have positive retention, so wires and cables cannot pull off.
Widest operating temperature range (-40°C to +85°C), use indoors and in outdoor cabinets.

Supports DNP3, Mirrored Bits®, communications, SEL Fast Messages, Modbus®, and IEC 61850 protocols.

Remove two screws to access configuration switches.

Wide-range universal power source, 19.2–275 Vdc, and 19.2–264 Vac.

Demodulated IRIG-B input synchronizes the microsecond timer to absolute time and drives the demodulated IRIG-B output.

Alarm contact alerts you to self-test failure, communications access, and settings changes.

SEL rugged power supply has an MTBF of 600 years.

Industry standard 2U height.

For simple I/O applications, the SEL-2440 can be configured with switch settings—no computer or software required.

Two standard EIA-232 serial ports, with EIA-485 and fiber options available for one serial port.

All digital inputs are rated for ac and dc and time-stamped to 1 μs accuracy.

All input thresholds are near ½ nominal voltage to avoid false assertions during faults and battery grounds.

Standard 10/100BASE-T Ethernet ports with integrated switch eliminate the need for an external switch.

Industry standard 2U height.
Applications

Substation RTU/PLC System

Substation Security

- Door Sensors
- Panel/Cabinet Sensors
- Motion Sensors
- Fence Sensors
- Visible Alarm
- Audible Alarm
- Station and Yard Lighting

SCADA

SEL-2440

SEL-3530

SEL-2440

SEL-2407®

Cell Phone
Applications

Add Discrete I/O to Legacy Systems

Build High-Density Discrete I/O

Transformer Protection
Applications

Bay Controller

High-Density Substation I/O

DNP3, Conitel 2020, Harris 5000/6000, Recon, etc.

DNP3, Modbus®, IEC 60870-5-103, SEL Fast Messaging

Digital Inputs/Outputs

Analog Inputs/Outputs

Other Device

Digital Inputs/Outputs

Analog Inputs/Outputs

10
Applications

Lockout Relay Contact Multiplier

Busbar

SEL-587Z

87

Trip

52-1 52-2 52-3 52-4

IN01 OUT1 OUT2 OUT3 OUT4

SEL-2440

SEL-9510

Supervisory Control

Protocol Converter

SEL-2440 DPAC

DNP3

SEL Fast Message
SEL Mirrored Bits
IEC 61850

Exchange High-Speed Mirrored Bits® Communications

SCADA

SEL-2440

SEL-2505

SEL-2505

48 I/O

Mirrored Bits

SEL-2440

SEL-2505

SEL-2505

SEL-2505

SEL-2505

SEL-2505

SEL-2505

SEL-2505

SEL-2505

SEL-2505
SEL-2440 DPAC Discrete Programmable Automation Controller

General Specifications

**Standard Features**
- 32 digital ac and dc inputs
- 16 digital outputs (12 Form A and 4 Form C)
- Dual copper 10/100BASE-T Ethernet port with integrated switch
- Dual EIA-232 serial ports (Port 2 and Port 3)
- Demodulated IRIG-B input and output
- Front USB configuration port
- Form C alarm output contact
- LEDs for communications status and port activity

**Optional Features**
- Dual 100BASE-FX fiber Ethernet
- Serial module communications (Port 2) options
  - EIA-485
  - Fiber-optic, 200 µm V-pin connector
  - Fiber-optic, 62.5 multimode ST® connector
- IEC 61850 communications
- Conformal coating

**Programmable Automation and Logic**
- 32 logic variables
- 32 math variables
- 32 timers
- 32 counters
- 32 remote control points
- 128 remote analog points
- 32 latching points

**I/O Configurations**

<table>
<thead>
<tr>
<th>I/O Configuration</th>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Configuration</td>
<td>32</td>
<td>16</td>
</tr>
<tr>
<td>Option 1</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>Option 2</td>
<td>48</td>
<td>0</td>
</tr>
</tbody>
</table>

**Universal Power Supply**

<table>
<thead>
<tr>
<th>Ratings</th>
<th>120/230 Vac</th>
<th>24/48/125/250 Vdc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>19.2–275 Vdc</td>
<td>19.2–264 Vac</td>
</tr>
</tbody>
</table>

**Optional Features**

- Dual 100BASE-FX fiber Ethernet
- Serial module communications (Port 2) options
  - EIA-485
  - Fiber-optic, 200 µm V-pin connector
  - Fiber-optic, 62.5 multimode ST® connector
- IEC 61850 communications
- Conformal coating

**Standard Protocols**
- SEL protocols
- SEL Mirrored Bits communications
- SEL ASCII and Fast Message
- SEL Messenger Points
- Modbus serial and Modbus TCP/IP
- DNP3 and DNP LAN/WAN

**Programmable Automation and Logic**
- 32 logic variables
- 32 math variables
- 32 timers
- 32 counters
- 32 remote control points
- 128 remote analog points
- 32 latching points

**Standards**
- IEEE C37.90-1989
- IEC 60255 and 6100
- IEEE 1613-2003

**Dimensions**
- 2U rack-mount: 88.1 mm H x 482.6 mm W x 158.1 mm D (3.47 x 19.00 x 6.23 in)
- 2U panel-mount: 124.5 mm H x 502.9 mm W x 158.1 mm D (4.90 x 19.80 x 6.23 in)
- DIN rail-mount: 171.1 mm H x 447.0 mm W x 89.4 mm D (6.74 x 17.60 x 3.52 in)
- Surface-mount: 171.1 mm H x 482.6 mm W x 89.4 mm D (6.74 x 19.00 x 3.52 in)

**Digital Input Ratings**
- Optoisolated
- MOV protection
- Level sensitive inputs
- 300 V input maximum

**Digital Output Ratings**
- Pickup time <5 ms
- 6 A continuous carry
- 30 A make per IEEE C37.90
- MOV protection

**Electrostatic Shock (15 kV)**

**Vibration (15 g Shock)**

**Heat (+85°C)**

**Cold (-40°C)**

SEL-2440 DPAC Discrete Programmable Automation Controller