

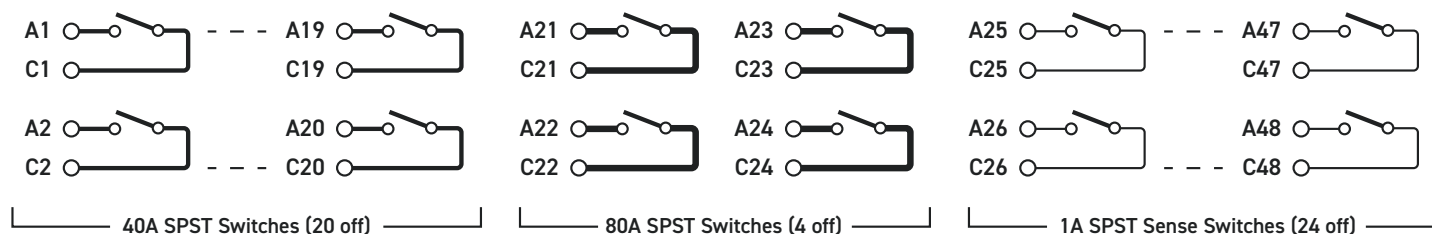


- Contactor Based High Current Switching
- Up to Four 80 A & Twenty 40 A Switches
- Complementary Quantity of Low Current Switches
- LED Indication
- Compact 4U Form Factor
- Relay Cycle Counting Included
- Built-In Scan List Sequence Stores With Triggering Capability
- LXI Standard 1.5 Compliant
- IVI & Direct I/O Drivers
- 3 Year Warranty

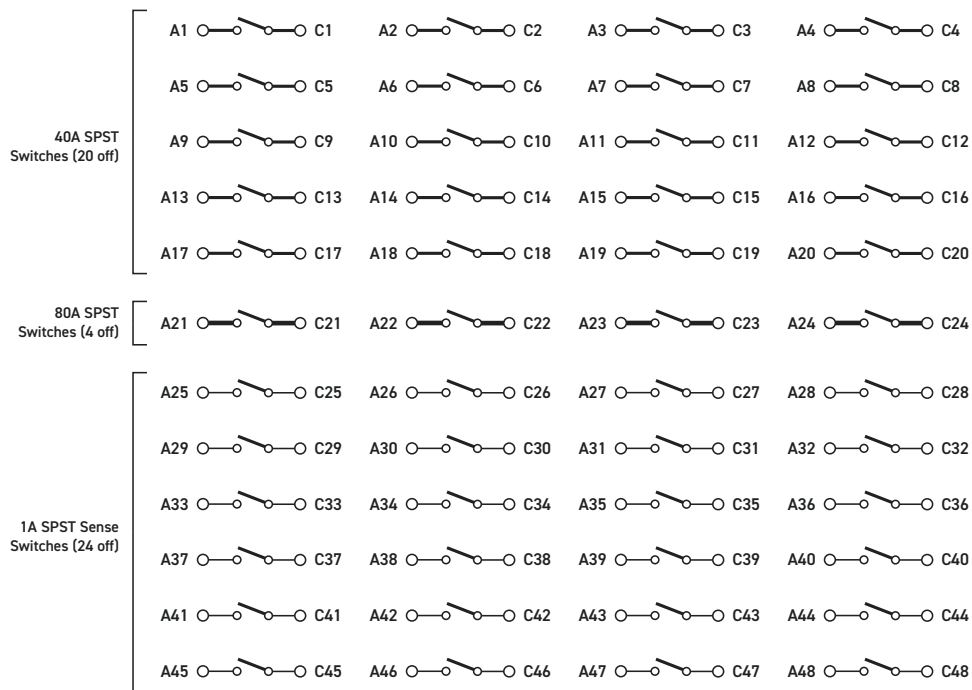
The 60-191 SPST family provides a number of high current switches rated to either 40 A (up to 20) or 80 A (up to 4) with an equal quantity (up to 24) of low current 1 A switches. The mixed & equal quantities of high and low current relays are ideally suited to power supply switching applications allowing the typical four connections ("+", "-", "sense +" & "sense -") from PSUs to be routed through the 60-191.

To support PSU switching requirements, the 60-191 can operate groups of two high current + two low current relays simultaneously. To maintain flexibility, an alternate mode of operation is provided allowing the individual control of each relay within the unit.

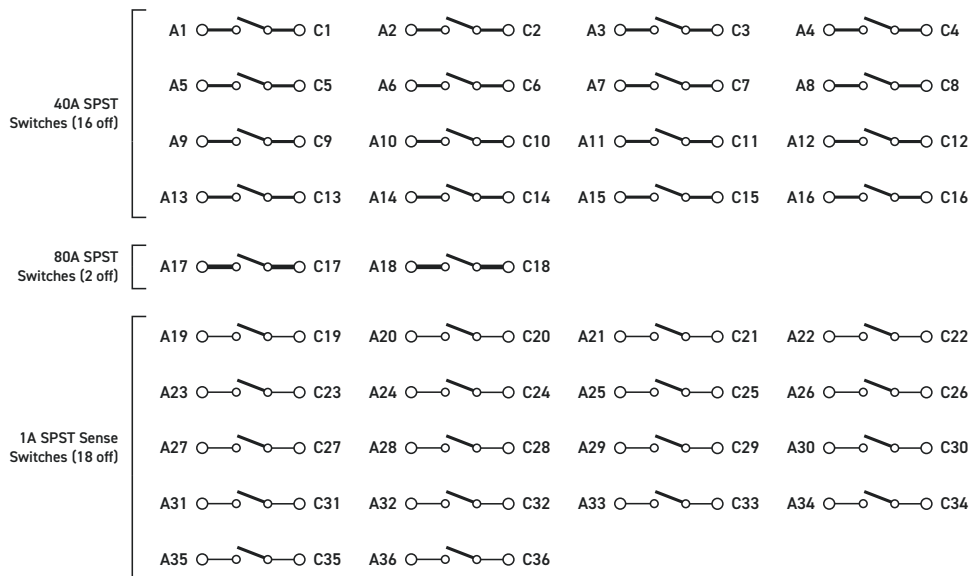
Connections are via front panel mounted screw terminal type connectors; one connector type is provided for each of the three switch current ratings to minimise the overall unit height



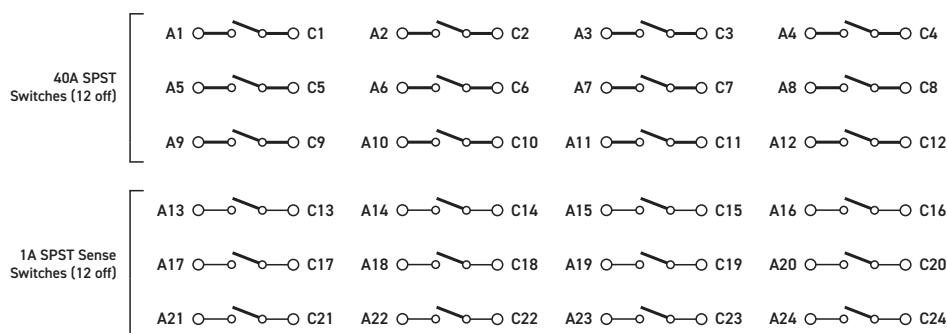
Simplified Switching Diagram for the 60-191-002-204 High Current & Sense SPST Unit  
(20x SPST 40 A, 4x SPST 80 A & 24x SPST 1 A Sense Switches)



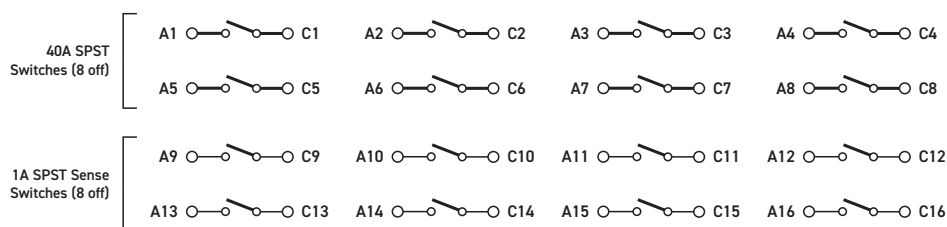
Switching Diagram for the 60-191-002-204 High Current &amp; Sense SPST Unit



Switching Diagram for the 60-191-002-162 High Current &amp; Sense SPST Unit



Switching Diagram  
for the 60-191-002-120  
High Current & Sense  
SPST Unit



Switching Diagram  
for the 60-191-002-080  
High Current & Sense  
SPST Unit

## Controlling the Switch

The 60-191 is controlled through an LXI interface based on 1000Base-T Ethernet. This provides a quick and easy method of installing the unit and a simple way of controlling it at a remote location through its API or built in soft front panel. The ability to control the unit at a distance aids the testing of systems without the need for a physical presence.

## LED Indication

Each SPST switch fitted to the 60-191 has an associated front panel LED to show when the signal path is active.

## Relay Type

The 60-191 is fitted with hermetically sealed SPST-NO (Form X) contactors for 40 A & 80 A signals plus electro-mechanical signal relays with palladium-ruthenium, gold covered contacts for the 1 A signals.

## Relay Cycle Counting

To aid with "health" monitoring this unit is provided with a relay cycle counting feature. The number of operations per contact are stored on the unit and can be used to determine if a relay is approaching EOL. This information could allow system connections to be revised so that signals applied to heavily used contacts are swapped with lightly used contacts to prolong the working life of the relay(s).

## Sequencing Service and Triggering

The Sequencing service provides the user with the ability to set a series of pre-determined sequences on an LXI unit. These sequences can be triggered by software or one of the sixteen software configurable open collector triggers.

As the operations are grouped together, it will minimize the number of control transactions required to achieve a composite change of target switch state, condensing multiple operations in a single sub-unit into a single operation, thus reducing the overall system switch settling time.

For example, in the case of a matrix, if a user wants to operate crosspoints X1-Y1, X4-Y1, X2-Y2, in the first sequence, only one operation, and one delay, will be used.

Additionally, as the switch state sequences are stored within the LXI controller, the burden on the Host CPU and Ethernet traffic is greatly reduced, and so the overall system latency is also reduced.

This unit features a software reset line which provides the ability for a user supplied reset to be applied to the unit, triggering a software reset of the relays, returning all relays in the unit to their default state. There is also a software fault line available that will be triggered if there is any error detected within the unit. Please note that while these reset and fault lines use dedicated physical connections to the unit, they are software control lines and as such should not be used for safety interlocks etc. For more information on the [Pickering Sequence Manager](#) please refer to our website.

## Switching Specification - High Current, 80 A

|                                  |                                   |
|----------------------------------|-----------------------------------|
| Switch Supplier - 80 A Switches: | Sensata Technologies, GV21 series |
| Switch Type:                     | Electro-mechanical                |
| Max Switch Voltage:              | 300 V*                            |
| Max Switch Current:              | 80 A                              |
| Max Continuous Carry Current:    | 80 A                              |
| On Path Resistance:              | 225 mΩ (max @ 1 A)†               |
| Operate Time:                    | 28 ms                             |
| Expected Life (operations):      | 1x10 <sup>6</sup>                 |

\* For full voltage rating, signal sources to be switched must be fully isolated from mains supply and safety earth.

† 1 A is not a minimum current, but for signal levels below this the path resistance may be higher.

## Switching Specification - High Current, 40 A

|                                  |                                               |
|----------------------------------|-----------------------------------------------|
| Switch Supplier - 40 A Switches: | Sensata Technologies, MiniTactor™ P195 series |
| Switch Type:                     | Electro-mechanical                            |
| Max Switch Voltage:              | 300 V*                                        |
| Max Switch Current:              | 40 A                                          |
| Max Continuous Carry Current:    | 40 A                                          |
| On Path Resistance:              | 260 mΩ (max @ 1 A)†                           |
| Operate Time:                    | 28 ms                                         |
| Expected Life (operations):      | 1x10 <sup>6</sup>                             |

\* For full voltage rating, signal sources to be switched must be fully isolated from mains supply and safety earth.

† 1 A is not a minimum current, but for signal levels below this the path resistance may be higher.

## Switching Specification - Low Current, 1 A

|                               |                                                                      |
|-------------------------------|----------------------------------------------------------------------|
| Switch Type:                  | Electro-mechanical                                                   |
| Contact Type:                 | Palladium-Ruthenium, Gold Covered Bifurcated                         |
| Max Switch Voltage:           | 300 VDC/250 VAC*                                                     |
| Max Power:                    | 62.5 VA, 60 W from 30 V to 220 VDC, 30 W to 300 VDC (resistive load) |
| Max Switch Current:           | 1 A                                                                  |
| Max Continuous Carry Current: | 1 A                                                                  |
| Initial On Path Resistance:   | < 500 mΩ                                                             |
| Off Path Resistance:          | >10 <sup>9</sup> Ω                                                   |
| Minimum Voltage:              | 100 μV                                                               |
| Thermal Offset:               | <10 μV                                                               |
| Operate Time:                 | 28 ms                                                                |
| Expected Life (operations)    |                                                                      |
| Very low power signal load:   | >10 <sup>8</sup>                                                     |
| Low power load (2 W):         | >1.5x10 <sup>7</sup> (0.1 A, 20 VDC)                                 |
| Medium power load (30 W):     | >5x10 <sup>6</sup> (1 A, 30 VDC)                                     |
| Full power load (60 W):       | >1x10 <sup>5</sup> (0.1 A, 300 VDC)                                  |

\* For full voltage rating, signal sources to be switched must be fully isolated from mains supply and safety earth.

## Power Source

|                                                      |                    |
|------------------------------------------------------|--------------------|
| Universal AC mains supply, 90-120/200-240 V 50-60 Hz |                    |
| Power Inlet:                                         | Male IEC connector |
| Power Rating:                                        | 100 VA maximum     |
| Fuse Rating:                                         | 5 A, 250 V         |

## LAN Interface

Compliant to LXI Standard 1.5, the 60-191 has a 1000Base-T Ethernet Interface via a standard RJ-45 connector mounted on the rear panel with a display showing the unit's IP address.

## LXI Status Indicators

Front panel mounted LEDs:

- Power
- Ready
- Error
- LAN
- Active

## Mechanical Characteristics

Supplied with front panel ears to enable rack mounting on a shelf or other rear support mechanism.

Dimensions: Full 19" rack width, 500 mm depth, 4U high.

Unit weight: 18.5 kg

3D models for all versions in a variety of popular file formats are available on request.

## Cooling

Fan assisted cooling, front and side air intakes, rear exhaust.

## Signal Connectors

Signals via front panel mounted connectors:

- 80 A signal paths - Phoenix Contact, UW 25-POT/S series screw terminal
- 40 A signal paths - Phoenix Contact, UW 10/S series screw terminal
- 1 A signal paths - Phoenix Contact, DFK-MC 1,5 & MC 1,5 series screw terminal

## Scan List Sequencing

Capable of storing 5000 predefined test sequences, loaded from the host Controller to the LXI unit at process initialization, with the ability to be triggered through software or from any of the sixteen software configurable triggers.

For more information on the Pickering Sequence Manager, please go to: [pickering-sequence-manager](#)

## Triggering

- 16x Software Configurable Bidirectional Open Drain Triggers
- 1x Dedicated Software Reset Line
- 1x Dedicated Software Fault Line
- 1x Dedicated Interlock Line

Sequencing/Triggering port: 25-pin male micro-D connector mounted on the rear panel.

## Operating/Storage Conditions

Operating Temperature: 0 °C to +55 °C

Humidity: Up to 90 % non-condensing

Altitude: 5000 m

Storage/Transport Temperature: -20 °C to +75 °C

Humidity: Up to 90 % non-condensing

Altitude: 15000 m

## Safety & CE Compliance

All products are fully CE compliant and meet applicable EU directives:

Low-voltage safety EN61010-1:2010,

EMC Immunity EN61326-1:2013,

Emissions EN55011:2009+A1:2010.

## Product Order Codes

|                                             |                |
|---------------------------------------------|----------------|
| LXI High Current & Sense SPST               |                |
| 80 A (4 off) + 40 A (20 off) & 1 A (24 off) | 60-191-002-204 |
| 80 A (2 off) + 40 A (16 off) & 1 A (18 off) | 60-191-002-162 |
| 40 A (12 off) & 1 A (12 off)                | 60-191-002-120 |
| 40 A (8 off) & 1 A (8 off)                  | 60-191-002-080 |

## Product Customization

Pickering LXI units are designed and manufactured on our own flexible manufacturing lines, giving complete product control and enabling simple customization to meet very specific requirements.

Customization can include:

- Alternative relay types
- Mixture of relay types
- Alternative number of relays
- Different performance specifications

All customized products are given a unique part number, fully documented and may be ordered at any time in the future. Please contact your local sales office to discuss.

## Mating Connectors & Cabling

The 60-191 connectivity is via screw terminals, it is suggested that suitably rated pin crimp / ferrule type connectors are used for all signal levels. The low current signals are interfaced to the 60-191 via a 2-part connector with the required quantity of mating halves provided with the unit.



The 60-191-002-204 LXI High Current & Sense SPST Switching Unit with Top Cover Removed

## Connectivity Solutions

We provide a full range of supporting cable and connector solutions for all our switching products—20 connector families with **1200+** products. We offer everything from simple mating connectors to complex cables assemblies and terminal blocks. All assemblies are manufactured by Pickering and are guaranteed to mechanically and electrically mate to our modules. These accessories are detailed in Connector Accessories data sheets, where a complete list and documentation can be found for each accessory.



Connectors  
& Backshells



Multi-way  
Cable Assemblies



RF Cable  
Assemblies



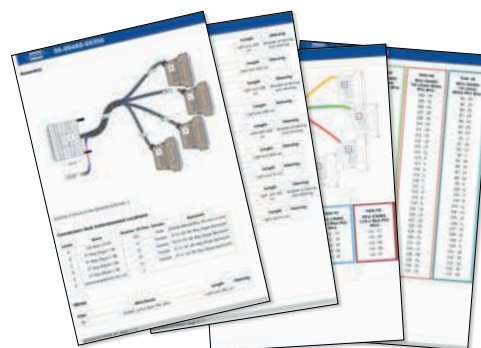
Breakouts



Connector  
Blocks

We also offer customized cabling and have a free online **Cable Design Tool** that can be used to create custom cable solutions for many applications.

- Fully supported on modern browsers and tablet operating systems.
- Built-in tutorials and videos allow you to get quickly up to speed.
- Store cable assemblies in the Cloud and develop over time.
- Each cable design has a downloadable PDF documentation file detailing all specifications



Start designing your custom cabling, go to [pickeringtest.com/cdt](http://pickeringtest.com/cdt)

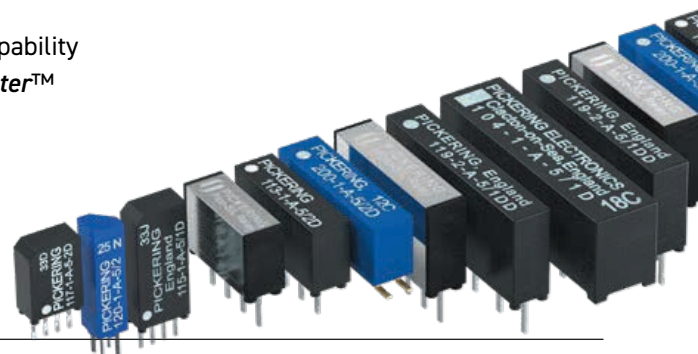
## Mass Interconnect

We recommend the use of a mass interconnect solution when an Interchangeable Test Adapter (ITA) is required for PXI/LXI based test systems. Our modules are fully supported by Virginia Panel and MacPanel.

## Pickering Reed Relays

We are the only switch provider with in-house reed relay manufacturing capability via our Relay Division. These instrument grade reed relays feature **SoftCenter™** technology, ensuring long service life and repeatable contact performance.

To learn more go to [pickeringrelay.com](http://pickeringrelay.com)



## Programming

Pickering provide kernel, IVI and VISA (NI & Keysight) drivers which are compatible with all Microsoft supported versions of Windows and popular older versions.

For more information go to [pickeringtest.com/os](http://pickeringtest.com/os)

The VISA driver support is provided for LabVIEW Real Time Operating Systems (Pharlap and Linux-RT). For other RTOS support contact Pickering. These drivers may be used with a variety of programming environments and applications including:

- **Pickering Interfaces Switch Path Manager**
- **National Instruments** products (LabVIEW, LabWindows/CVI, Switch Executive, MAX, TestStand, VeriStand, etc.)
- **Microsoft Visual Studio** products (Visual Basic, Visual C++)
- **Programming Languages** C, C++, C#, Python
- **Keysight VEE** and **OpenTAP**
- **Mathworks MATLAB, Simulink**
- **Marvin ATEasy**
- **MTQ Testsolutions** Tecap Test & Measurement Suite

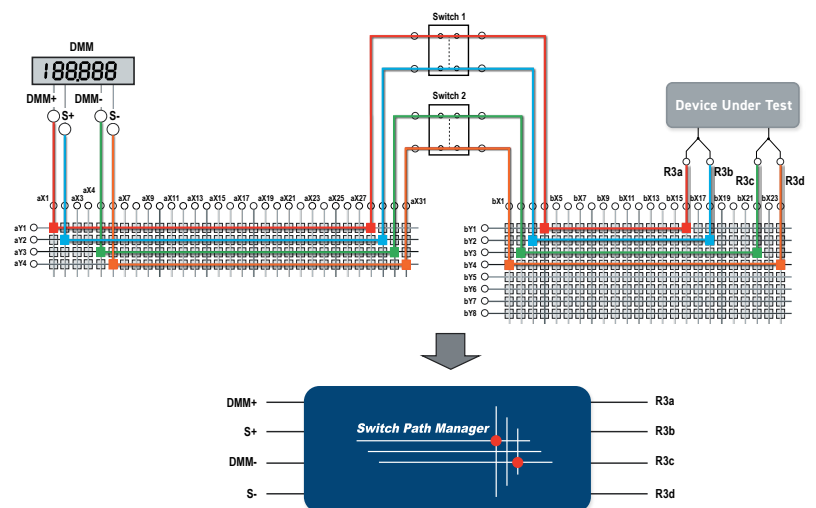
Drivers for popular Linux distributions are available, other environments are also supported, please contact Pickering with specific enquiries. We provide Soft Front Panels (SFPs) for our products for familiarity and manual control, as well as comprehensive documentation and example programs to help you develop test routines with ease.

To learn more about software drivers and development environments go to [pickeringtest.com/software](http://pickeringtest.com/software)

## Signal Routing Software

Our signal routing software, Switch Path Manager, automatically selects and energizes switch paths through Pickering switching systems. Signal routing is performed by simply defining test system endpoints to be connected together, greatly accelerating Test System software development.

To learn more go to [pickeringtest.com/spm](http://pickeringtest.com/spm)



## Diagnostic Relay Test Tools

**eBIRST** Switching System Test Tools are designed specifically for our PXI, PCI or LXI products, these tools simplify switching system fault-finding by quickly testing the system and graphically identifying the faulty relay.

To learn more go to [pickeringtest.com/ebirst](http://pickeringtest.com/ebirst)



## Three Year Warranty & Guaranteed Long-Term Support

All standard products manufactured by Pickering Interfaces are warranted against defective materials and workmanship for three years from the date of delivery to the original purchaser. Extended warranty and service agreements are available with various levels for your requirements. Although we offer a 3-year warranty as standard, we also include guaranteed long-term support—with a history of supporting our products for typically 15-20 years.

To learn more go to [pickeringtest.com/support](http://pickeringtest.com/support)

## Available Product Resources

We have a library of resources including success stories, product and support videos, articles and white papers as well as application-specific brochures to assist you. We have also published reference books on switching technology and the PXI and LXI standards.

To view, download or request any of our product resources go to [pickeringtest.com/resources](http://pickeringtest.com/resources)

