A Quantum Switch for the Better
Precision 4164 Switch Matrix
High-Density Programmable 64 x 64 Switch Matrix System

The Precision 4164 switch matrix system is a reliable solid-state switch matrix system in a compact, rack-mountable or benchtop package, providing computer-controlled connections between any input and any output. Connect between 64 input and 64 output channels with 4,096 crosspoints.

Save time and reduce errors on your switch system setups. Program your switch configurations on a host computer, download them to your switch system over the network—and your tests are ready to go. With system health monitoring, fault diagnostics, and exhaustive self-tests, you can have confidence in the integrity of your switch system.

Salient Features

Switch Matrix Characteristics
- Solid-state switch matrix
- High density: 4,096 crosspoints

Matrix Size
- 64 x 64, all in a compact 2U (3.5 in. high) mainframe

System Control
- Front-panel control or remote host PC control via Ethernet
- Spreadsheet-style graphical user interface (GUI) for host PC control
- Nonvolatile storage of switch configurations: Store up to eight setups in the system; store unlimited setups on the host PC

System Integrity
- System health monitoring of power supply and internal temperatures
- Built-in self-tests, with reports, exhaustively test switch settings

Signal Switching
- ±10 Vpk for each signal path

Input Characteristics
- Differential input

Frequency Response
- DC to 400 kHz

Output Characteristics
- Single-ended with manually selectable ground sense

Switch System Specifications

Matrix Size
- 64 x 64, nonblocking solid-state switch

Input Characteristics
- Type: Balanced differential
- Differential Input: ±10 Vpk, linear
- Common Mode Input: ±10 Vpk, linear
- Impedance: 1 MΩ // 150 pF per side
- Max Level (AC + DC + Common Mode): ±10 Vpk for f ≤ 200 kHz
- ±10 Vpk x (200 kHz/f) for f > 200 kHz
- Protection: ±35 V continuous
- ±100 Vpk transient (1 ms pulse, 10% duty cycle)
- CMRR: 70 dB, DC to 500 Hz

Transfer Characteristics
- Frequency Response:
  - 0 dB ±0.01 dB, DC to 16 kHz
  - −0.1 dB ±0.05 dB at 50 kHz
  - −0.35 dB ±0.05 dB at 100 kHz
  - −3 dB ±0.35 dB at 350 kHz
- Phase Match: 1°, DC to 100 kHz
- Group Delay: 750 ns typical
- Total Harmonic Distortion:
  - ±0.1% at 7 Vrms and 10 kHz

Crosstalk:
- 70 dB to 100 kHz, all hostile

Output Characteristics
- Type: Single-ended with manual switch-selectable ground sense
- Maximum Output: ±10 Vpk, ±10 mApk
- Output Noise: 100 µVrms in 200 kHz BW
- DC Offset: ±1 mV, input shorted
- Output Impedance: 10 Ω
4164 Switch Matrix System Operation

Switch settings can be entered or verified using the graphical user interface, front panel, or remote interface. Running the built-in Go/No-Go self-test verifies that the unit has made the expected connections. Tests can be run unattended, and diagnostics will isolate problems.

Setting up Your Switch Matrix System

The IN x OUT columns indicate a current input-to-output connection. The number on the left side is the input. The number on the right side is the output. The 64 x 64 matrix has 64 inputs (0 through 63) and 64 outputs (0 through 63). In the menu below, six pairs of inputs and outputs are shown. Connections are entered at the keypad using the up and down arrow keys.

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>60*60</td>
<td>61*61</td>
</tr>
<tr>
<td>62*62</td>
<td>63*63</td>
</tr>
</tbody>
</table>

A switch setup can be constructed easily by listing inputs and outputs and identifying the desired crosspoints. It's easy to enter the crosspoints into memory. With the list, use the IN/OUT key to switch between the IN and OUT fields, enter the input or output using the arrow keys, then press the Enter key to save the setting. Step to the next output and enter the input. You can quickly enter the crosspoints for a large matrix. Up to eight setups can be stored in the 4164 system.

The front-panel menu and controls provide a convenient way to set up the switch system. There's computer control available, of course, via the remote interface. Setups programmed at the front panel can be uploaded to the host computer and stored. A stored setup can be downloaded from the host computer, eliminating programming effort altogether. Remote commands are in plain English and are similar to the front-panel menu. The following command sequence defines two switch closures for Set 1 of Matrix 1.

<table>
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<tr>
<th>Command</th>
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<tr>
<td>SET:1;</td>
<td>Select Set 1 for configuration reset; Reset (open) all switches in Set 1</td>
</tr>
<tr>
<td>15*0;</td>
<td>Connect input 15 to output 0</td>
</tr>
<tr>
<td>12*2</td>
<td>Connect input 12 to output 2</td>
</tr>
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Verifying Setups

You can read and verify from the front panel that the switch settings are in memory. Or you can call for status via the host computer.

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<td>Report the active setup</td>
</tr>
<tr>
<td>*0;</td>
<td>Report the input connection for output 0</td>
</tr>
<tr>
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System status information can also be accessed via the remote interface using the temp and ps commands.

Remote Operation

Programming the switch system from a host computer is as easy as operating it at the front panel. System setups programmed at the front panel can be uploaded to the host computer and stored. A stored setup can be downloaded from the host computer, eliminating programming effort altogether. Remote commands are in plain English and are similar to the front-panel menu. The following command sequence defines two switch closures for Set 1 of Matrix 1.

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System Health and Maintenance

The system control monitors the status of the power supply and internal temperature. If a failure is detected, an audible warning and front-panel FAULT LED are activated. Fault reports can be displayed using the Status key or read by the host computer.

The 4164 front-panel SOURCE connector is used to place an external test signal on the internal test bus that can be injected to a selected switch input. The front-panel SCOPE BNC is connected to the internal monitor bus and allows the user to monitor the output of any selected output.

The menu is used to select the channel connected to the internal test bus or to select the channel connected to the internal monitor bus and output at the front-panel SCOPE connector.

Two types of test are available. FAT testing (Factory Acceptance Test, Option F) can be used to perform an exhaustive test of all switch settings, internal switch connections, and input/output connectors. The Go/No-Go test checks the integrity of the current setup and can be performed in situ, with all input and output cables connected.
System Components

Controls, Indicators, and Connectors

Front Panel

Menu Display and Programming Keys:
The front-panel menu display and keypad provide a convenient way to set up the switch system.

Source Connector:
The coaxial BNC external test source connector provides a connection for an external test signal from a programmable function generator.

Scope Monitor Output Connector:
The coaxial BNC scope monitor output connector provides a means for viewing the output of a selected channel using a scope or other measurement device without disconnecting signal cables.

Monitor Hi and Low Jacks:
The monitor HI and LOW banana jacks provide connections to a high-performance multimeter.

Fault Indicator:
The warning LED indicates a system fault, such as over temperature or a power voltage out of factory specifications.

Ethernet Connector:
An RJ45 Ethernet connector provides the control link to a host computer.

Power Switch and Indicator:
The on/off power switch, located on the front panel, includes a Power On LED that indicates when the system is powered up.

Standby Indicator:
The Standby LED indicates that the system has power and that the primary power switch, located on the rear of the frame, is in the on position.

Rear Panel

Analog Input and Output Connectors:
Eight 26-pin D input connectors.
Eight 26-pin D output connectors.

Power Connector & Primary Power Switch:
The power connector provides a connection for an AC power source and includes a power cord restraint. The primary power switch applies power to the system and puts the system in standby mode.

Chassis Ground and Signal Ground Posts:
The chassis ground post and the signal ground post provide a means for connecting chassis ground to the signal ground.

Control Module

The 4164 switch matrix control module provides programming commands to the I/O stages. The control module operates the front-panel display, reads input keys, and processes commands from the remote interface(s).

The control module also provides 10/100 baseT Ethernet interface. IP address and port configurations are set using a front-panel menu sequence. IP assignment is static.

The control module also monitors the status of the power supply and internal temperature. If a failure is detected, a front-panel FAULT LED is activated.
### Power Requirements

The standard power supply lets you select 120 or 240 VAC operation. The power frequency may range from 47 to 440 Hz.

**Connector:**
- IEC 320

**Voltage:**
- 120 VAC, +10% –15%
- 240 VAC, +10% –15%

**Power:**
- 100 W

**Fuse:**
- 2 amp Slo Blow @ 120V
- 1 amp Slo Blow @ 240V

### 4164 Switch Matrix System General Characteristics

#### Physical Characteristics

- **Size:**
  - 19 x 19 x 2U (3.5 inches) (WDH)
- **Weight:**
  - 16 lb. 2 oz.

#### Environmental Requirements

- **Operating Temperature:**
  - 0°C to 40°C
- **Storage Temperature:**
  - -20°C to 70°C
- **Relative Humidity:**
  - Less than 80%, noncondensing

### Mating Connectors, Cables, and Test Accessories

**CONN-OUT-26D-MTL**
- 26-pin mating connector with crimp pins and strain relief, 20–24 gauge
- (PF part number A9405G1)

**CONN-OUT-26D-SC-MTL**
- 26-pin mating connector with solder cup pins and strain relief, 20–24 gauge
- (PF part number A9405G4)

**CB-HD26P/8BNCF-BH-L**
- Cable set for bulkhead panels;
  - 26-pin D-shell with eight BNC connectors

**CB-HD26P/HD26P-1.5**
- Spare 4164 test cable, one included with Option F
  - (PF part number A10903G1)

### Accessories

**Mounting**

- **PF4164-SM18 Slide Mount Kit**
  - Accommodates cabinet depths of 18 to 23 inches
  - (PF part number B11618G1)

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**Ordering Information**

- **PF4164-<F>**
- Option F: Factory Acceptance Test and Test Cable

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### Precision Product Solutions

For over 40 years Precision Filters has been a global provider of instrumentation for test measurements. You can rely on a single source for signal conditioning and switching—a complete range of instrumentation—products optimized to work together to provide high performance at a reasonable cost.

### Precision Products

#### 28000 Analog Signal Conditioning System

The 28000 system makes it easy to manage a test, with up to 256 channels of fully programmable transducer conditioning. Choose a mix of bridge, charge, IEPE w/TEDS, voltage (filter/amplifier), strain, thermocouple, RTD/potentiometer, frequency, or other transducers.

#### 464kB High-Density Programmable Switch Matrix

Computer-controlled analog matrix switching replaces tedious manual patch panels.

The 464kB is a reliable solid-state switch matrix system that provides computer-controlled connection between 256 inputs and 256 outputs, all in a single mainframe. Save time and reduce errors on test system setup. Download switch configurations from the host computer over the network. Built-in self-test with fault diagnostics.