



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.



Description

The Precision 4164 solid-state switch matrix system provides 64 x 64 rectangular coordinate switching with 4,096 crosspoints.

The 4164 switch matrix is robust. When power is applied to the system, it provides unidirectional signal paths from input to output channels. When power is removed, switch settings are maintained in nonvolatile memory and restored at power up.

The system is controlled from the front panel, remotely (using command line control), or by running a GUI on the host computer.

The 4164's internal test subsystem verifies system integrity. The FAT (factory acceptance test, Option F) exhaustively tests all possible switch connections and reports faults. The Go/No-Go test checks the current switch setup and may be run in place, with all input/output cables connected to the 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

4164 Solid State Switch Matrix System

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 M Ω // 150 pF per side

Max Level (AC + DC + Common Mode):

± 10 Vpk for $f \leq 200$ 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:

$\pm 0.1\%$ 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 μ Vrms 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.

```
IN * OUT SETUP 4 |Remote:
60*60      61*61      62*62 |CONNECT
63*63      open * 00      01*01 |Status:
Enter Inlet | OK
```

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 can be uploaded and downloaded in text format through the remote interface so you can do your programming offline and download to your switch system. Unlimited setups can be stored in the host computer via the graphical user interface.

The menu also displays system status information. The Remote field indicates whether the system is operating under front-panel control or via the remote interface. The Status field is updated to indicate system faults. To review switch settings, step through the outputs by pressing the keypad's plus and minus keys, and note the displayed input connections.

The SET: field indicates which of eight setups is selected as the active set for the matrix. The eight setups, Set 1 through Set 8, are stored locally on the switch in nonvolatile memory. The system always powers up with the programmed settings for the set that was active when power was removed.

The MENU key provides access to the menus used to perform other system functions, such as setting the network address or switching sets.

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.

Command	Description
SET:1;	Select Set 1 for configuration
reset;	Reset (open) all switches in Set 1
15*0;	Connect input 15 to output 0
12*2	Connect input 12 to output 2

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.

Command	Description
SET:?	Report the active setup
?*0;	Report the input connection for output 0
?*2;	Report the input connection for output 2

System status information can also be accessed via the remote interface using the **temp** and **ps** commands.

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

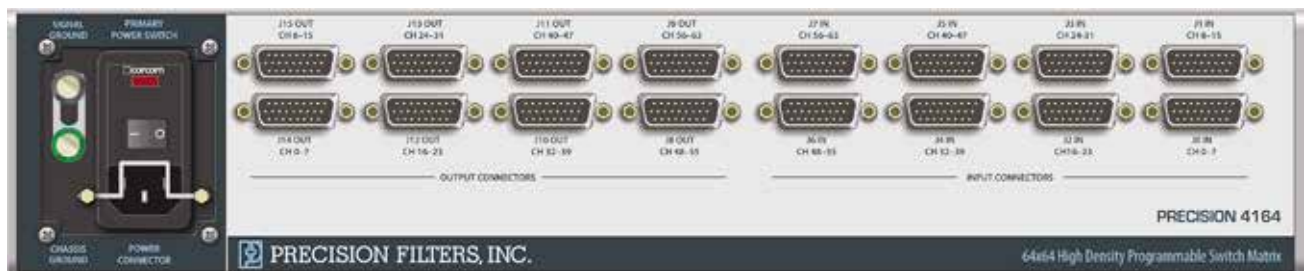
The 4164 switch matrix control module provides programming commands to the I/O stages. The control module operates the front-panel display, reads input keys, and processes commands from the remote interface(s).

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.



4164 Switch Matrix Front Panel



4164 Switch Matrix Rear Panel

4164 Switch Matrix Specifications

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)

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 new standard for the world's most discriminating test labs.

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 signal 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.

Ordering Information

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