Switching System Solutions

Electromechanical Solid State PXI

There is No Substitute for Experience

Dow-Key Microwave Corporation
A Dover Company
Company Profile

Dow-Key’s state-of-the-art facility presently consists of a single building totaling 36,000 square feet. Dow-Key houses a Class 100,000 and a Class 100 clean room in order to support their high reliability space and military projects. To accomplish the engineering, manufacture, and test of Dow-Key’s products and assemblies, Dow-Key invests heavily in capital equipment. This state-of-the-art equipment includes a wide array of vector network analyzers and synthesized sources, phase noise test sets, noise figure measuring equipment, passive inter-modulation (PIM), thermal/vacuum chambers, RF power, and shock & vibration station for environmental screening, to name just a few.

Company Description

Dow-Key Microwave Corporation, the world's largest manufacturer of electromechanical switches, is part of Ceramic & Microwave Products - a subsidiary of Dover Corporation. Dover is a multi-billion dollar, NYSE-traded, diversified manufacturer of a wide range of proprietary products and components for industrial and commercial use. Dow-Key is committed to provide unparalleled customer service, competitive pricing, on-time delivery, and switch products that are distinguished by quality and reliability. Founded in 1945, Dow-Key is the oldest continuously operational switch manufacturer in the United States.

Quality Assurance

Dow-Key Microwave Corporation is a renowned world class manufacturer, with an unparalleled reputation for product quality. Dow-Key’s commitment to continuous improvement initiatives within its products and processes along with the extensive series of internal and external assessments ensures compliance in accordance with the AS9100 and ISO-9001:2000 standards requirement, which facilitates the registration process and continued certification in order to secure their future as a primary source for advanced RF switching products.

Design Capabilities and Applications Support

The best in the RF switch industry, Dow-Key's engineering team is dedicated to support customers through product selection, custom solution design, and RF system integration. From the telegraph key to the space qualified switching arrays, Dow-Key's engineering team has been and will remain dedicated to work with the customer's specific needs to create the optimum RF switching solution. Backed by decades of industry experience, their highly skilled technical staff is continuously improving the quality and variety of their product offering based on customer requests. Dow-Key offers customers the best solution for their applications within customers’ budget and delivery time. Since 1945, there is no substitute for experience.
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## Overview:
The PXI family offers three modules with different RF coaxial switching configurations: 4x4, 2x5, SP3T, SP4T, SP6T, DPDT, Dual SPDT. Depending on the model, the PXI solutions operates either between DC -18 GHz or DC - 26.5 GHz. Each switch can be controlled via Dow-Key LabView, LabWindows, or Visual Basic GUI. The software is VISA and IVI compatible.

### PXI Switching Modules:

<table>
<thead>
<tr>
<th>Family</th>
<th>Configurations</th>
<th>Type</th>
<th>Frequency</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>14F3S</td>
<td>4 by 4</td>
<td>Crossbar</td>
<td>DC - 18 GHz</td>
<td>1</td>
</tr>
<tr>
<td>14F3S</td>
<td>2 by 5</td>
<td>Crossbar</td>
<td>DC - 18 GHz</td>
<td>3</td>
</tr>
<tr>
<td>12K3S</td>
<td>SP3T, SP4T, SP6T, DPDT, Dual SPDT</td>
<td>Switches</td>
<td>DC-26.5 GHz</td>
<td>4</td>
</tr>
</tbody>
</table>

## Overview:
Dow-Key has both the expertise and the capability to custom design full rack systems with complex switching requirements. In this catalog only two of past products are introduced. Model 5096 is built using 6 switching modules together with software and fan controller units. A more sophisticated solution is Model 5190/5191 duplex Teleport system. It is composed of two full loaded 19" racks with 12x48 and 48x12 switching modules, master-slave controller, fiber optics modules, signal attenuation control, and L-band amplifiers across both transmitter and receiver racks.

### Full Rack Switching Systems:

<table>
<thead>
<tr>
<th>Family</th>
<th>Configurations</th>
<th>Type</th>
<th>Frequency</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5096</td>
<td>32 by 64</td>
<td>Full Fan-Out</td>
<td>3.4-4.2 GHz (C-band)</td>
<td>5</td>
</tr>
<tr>
<td>5190/5191</td>
<td>12 by 48 / 48 by 12</td>
<td>Full Fan-Out / Full Fan-In</td>
<td>950-2050 MHz (L-band)</td>
<td>7</td>
</tr>
</tbody>
</table>

## Overview:
Dow-Key offers a wide range of different coaxial electromechanical switching units, enclosed from 1U to 4U (sometimes 6U) and with many different switch configurations. It meets most application needs: all from testing signals, sending/receiving antenna signals, multiplexing capability needed in larger system integrations, mobile use out on the field, and etc. If you cannot find what you are seeking, we can custom make RF systems to your spec.

### Electromechanical Switching Systems:

<table>
<thead>
<tr>
<th>Family</th>
<th>Configurations</th>
<th>Type</th>
<th>Frequency</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4012</td>
<td>2 by 8</td>
<td>Crossbar</td>
<td>DC - 18 GHz</td>
<td>9</td>
</tr>
<tr>
<td>4013</td>
<td>2 by 6</td>
<td>Crossbar</td>
<td>DC - 18 GHz</td>
<td>10</td>
</tr>
</tbody>
</table>
Table of Contents

Electromechanical Switching Systems (continue):

<table>
<thead>
<tr>
<th>Family</th>
<th>Configurations</th>
<th>Type</th>
<th>Frequency</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4028</td>
<td>4 by 8 (4 dual outputs)</td>
<td>Crossbar / Fan-Out</td>
<td>20 - 300 MHz</td>
<td>11</td>
</tr>
<tr>
<td>4038</td>
<td>40 by 1</td>
<td>Crossbar</td>
<td>DC - 14 GHz</td>
<td>12</td>
</tr>
<tr>
<td>4039 (75 Ω)</td>
<td>32 by 1</td>
<td>Blocking</td>
<td>DC - 1 GHz</td>
<td>13</td>
</tr>
<tr>
<td>4047</td>
<td>1 by n (1x8, 1x16, 1x24, 1x36, 1x48)</td>
<td>Switches</td>
<td>DC - 26.5 GHz</td>
<td>14</td>
</tr>
<tr>
<td>4061</td>
<td>n by 4 (max. 10x4)</td>
<td>Crossbar</td>
<td>DC - 18 GHz</td>
<td>15</td>
</tr>
<tr>
<td>4101</td>
<td>n by m (max. 10x10)</td>
<td>Crossbar</td>
<td>DC - 18 GHz</td>
<td>16</td>
</tr>
<tr>
<td>4104</td>
<td>SP6T, SP10T, or DPDT (max. 4 of each)</td>
<td>Switches</td>
<td>DC - 40 GHz</td>
<td>17</td>
</tr>
<tr>
<td>4118</td>
<td>6 by 1</td>
<td>Switches</td>
<td>DC - 200 MHz</td>
<td>19</td>
</tr>
<tr>
<td>4141</td>
<td>2 by 32</td>
<td>Crossbar</td>
<td>DC - 18 GHz</td>
<td>20</td>
</tr>
<tr>
<td>4159</td>
<td>10 by 8 (expandable to 10 by 28)</td>
<td>Crossbar</td>
<td>DC - 18 GHz</td>
<td>21</td>
</tr>
<tr>
<td>4166</td>
<td>n by m (max. 6x12)</td>
<td>Crossbar</td>
<td>DC - 18 GHz</td>
<td>22</td>
</tr>
<tr>
<td>4169</td>
<td>n by m (max. 10x10 on the front panel)</td>
<td>Crossbar</td>
<td>DC - 18 GHz</td>
<td>23</td>
</tr>
<tr>
<td>4201</td>
<td>1 by n (1x10, 1x20, ... , 1x100)</td>
<td>Switches</td>
<td>DC - 18 GHz</td>
<td>24</td>
</tr>
<tr>
<td>4203</td>
<td>1 by 12</td>
<td>Switches</td>
<td>DC - 18 GHz</td>
<td>25</td>
</tr>
<tr>
<td>4301</td>
<td>n number of 1x10 (max. 16)</td>
<td>Switches</td>
<td>DC - 18 GHz</td>
<td>26</td>
</tr>
<tr>
<td>4501</td>
<td>n number of 1x6 (max. 4)</td>
<td>Switches</td>
<td>DC - 18 GHz</td>
<td>27</td>
</tr>
<tr>
<td>4601</td>
<td>n by n (4x4, 5x5, ... , 7x7, 8x8)</td>
<td>Full Fan-Out</td>
<td>DC - 40 GHz</td>
<td>28</td>
</tr>
<tr>
<td>4701</td>
<td>n by n (9x9, 10x10, ... , 12x12)</td>
<td>Full Fan-Out</td>
<td>DC - 18 GHz</td>
<td>29</td>
</tr>
</tbody>
</table>

Overview:
Dow-Key offers a broad range of solid state switching systems ranging from 2 MHz (HF-band) up to 2500 MHz (L-band) frequencies. Since the units are equipped with solid state switches, the switching time is much faster compared to the coaxial units, but the trade off is in a limited frequency band; up to L-band. These units are provided with LCD Touch Screen and with a built in CPU loaded with MS Windows XP Professional operating system, in contrary to the electromechanical units. If you cannot find what you are seeking, we can custom make solid state switching systems to your spec.

Solid State Switching Systems:

<table>
<thead>
<tr>
<th>Family</th>
<th>Configurations</th>
<th>Type</th>
<th>Frequency</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3095</td>
<td>16 by 16</td>
<td>Full Fan-Out</td>
<td>100 - 1250 MHz</td>
<td>30</td>
</tr>
<tr>
<td>3202</td>
<td>n by m (6x6, ... , 12x12)</td>
<td>Full Fan-Out</td>
<td>800- 2500 MHz (L-band)</td>
<td>31</td>
</tr>
<tr>
<td>3203</td>
<td>8 by n (8x8, ... , 8x16)</td>
<td>Full Fan-Out</td>
<td>20 - 1100 MHz (VHF-band)</td>
<td>32</td>
</tr>
<tr>
<td>3204</td>
<td>n by m (6x6, ... , 12x12)</td>
<td>Full Fan-Out</td>
<td>20 - 200 MHz (IF-band)</td>
<td>33</td>
</tr>
<tr>
<td>3205</td>
<td>6 by n (6x6, ... , 6x12)</td>
<td>Full Fan-Out</td>
<td>2 - 32 MHz (HF-band)</td>
<td>34</td>
</tr>
</tbody>
</table>
Overview:
The Build Your Own Matrix solution offers an ideal setup for engineers who are looking for a low-cost switching solution. It allows the user to design a switching matrix in any way desired by choosing CANBus switches per Table 1 together with a package: Silver or Gold Package. Either package provides both hardware and software that allows the user to interact and control each individual switch using SCPI commands. Refer to applications notes on software control.

Solid State Switching Systems:

<table>
<thead>
<tr>
<th>Family</th>
<th>Configurations</th>
<th>Package</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5060</td>
<td>CANbus Address Box</td>
<td>Silver / Gold Package</td>
<td>35</td>
</tr>
<tr>
<td>5188</td>
<td>ENET Kit</td>
<td>Silver Package</td>
<td>35</td>
</tr>
<tr>
<td>5189</td>
<td>GPIB Kit</td>
<td>Silver Package</td>
<td>35</td>
</tr>
<tr>
<td>6101</td>
<td>ENET or GPIB Controller Module</td>
<td>Gold Package</td>
<td>35</td>
</tr>
</tbody>
</table>
**14F3S-1/4x4**

**Features**

**DC - 18 GHz**
Reconfigurable Bidirectional Non-Blocking Matrix:
- 4 inputs and 4 outputs

*By removing external cables, the switch can be reconfigured*

**Software Control:**
- **Custom GUI** in LabVIEW, LabWindows/CVI and Visual Basic
- VISA/IVI drivers (for advanced programming)

**Part Number**
14F3S-1/4x4

**Description**

**Overview:**
The 14F3S-1/4x4 Model is a bidirectional PXI (PCI eXtensions for Instrumentation) RF switching module. It is configured as a non-blocking crossbar with 4 inputs and 4 outputs. The coaxial switch operates between DC to 18 GHz and the module occupies 4 slots of a 3U PXI chassis. NI PXI-1036 chassis, provided by National Instrument, is recommended; however, the module is compatible with any desired PXI chassis. It is design for complex test setups and for sophisticated switching requirements.

**Software Control:**
Graphical User Interfaces (GUIs) are provided in LabVIEW, LabWindows/CVI, and Visual Basics to allow the user to control the switch easily. For advanced programming, VISA and JVI drivers are included such that one can program and control the switch in any way desired using e.g. LabWindows/CVI (NI developed ANSI C-based programming), LabVIEW, Visual Basics, C or any other desired programming language or platform.

**Other Switch Configurations:**
The switch is equipped with (5) external semi-rigid cables that are arranged such that a 4x4 matrix configuration is created. By removing some or all cables, it allows the user to reconfigure the module to sets of standard coaxial switches e.g. SPDT, DPDT (Transfer), SP4T etc. Further by adding external 50 Ohm loads one can configure the matrix to a terminated switch. Note that the provided software package supports any reconfiguration that is possible within the 4x4 matrix.

**RF Characteristics**

- Impedance: 50 Ohms
- Operating Frequency: DC – 18 GHz
- Switching Speed*: 25 ms (max)
- Operating Life: 1,000,000 cycles (Cold Switching)

* software delays are not taken into account

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**Power Consumption Backplane Supply**

<table>
<thead>
<tr>
<th>Voltage</th>
<th>+12 VDC</th>
<th>+5 VDC</th>
<th>+3.3 VDC</th>
<th>-12 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>1 A</td>
<td>0.15 A</td>
<td>0.1 A</td>
<td>0 A</td>
</tr>
</tbody>
</table>

**Physical**

- Relay Type: Electromechanical
- Contact Material: Beryllium copper, gold-plated
- I/O Connector Type: SMA Female
- Dimensions: 4-slots wide 30 maximum height (5.25") 7" maximum depth (NI chassis compatible)
- Front Panel Color: Gray
- Weight (max): 1.32 lbs

**Shock and Vibration**

- Operational Shock: 30 g peak, half-sine, 11 ms pulse
- Random Vibration:
  - Operating: 5 to 500 Hz, 0.3 g rms
  - Non-operating: 5 to 500 Hz, 2.4 g rms

**Environment**

- Operating Temperature: 0 °C to +55 °C
- Storage Temperature: -20 °C to +70 °C
- Relative Humidity: 5% to 85% Non-Condensing
- Operating Altitude: 5,000 m
- Storage Altitude: 15,000 m

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**Frequencies (GHz)**

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-4</th>
<th>4-8</th>
<th>8-12</th>
<th>12-16</th>
<th>16-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSWR (Voltage Standing Wave Ratio)</td>
<td>1.30:1</td>
<td>1.35:1</td>
<td>1.40:1</td>
<td>1.50:1</td>
<td>1.80:1</td>
</tr>
<tr>
<td>Insertion Loss (dB)</td>
<td>0.3</td>
<td>0.4</td>
<td>0.6</td>
<td>0.8</td>
<td>0.9</td>
</tr>
<tr>
<td>Open Channel Isolation (dB)</td>
<td>80</td>
<td>80</td>
<td>70</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>RF CW Power (W)</td>
<td>100 W</td>
<td>70 W</td>
<td>60 W</td>
<td>50 W</td>
<td>50 W</td>
</tr>
</tbody>
</table>
Platforms

PXI Compliance:
All Dow-Key PXI modules support full PXI/cPCI bus interface and complies with both PXI 2.1 specifications and CompactPCI specification (from the PCI Industrial Computer Group - PICMG).

Drivers:
>> VISA driver
>> IVI driver

Supported Platforms:
>> Windows 98/2000/XP
>> NI platforms: LabVIEW, LabWindows, CVI (ANSI C-based)
>> Any programming language using VISA drivers

Developed GUIs (Graphical User Interfaces):
>> LabVIEW GUI
>> Visual Basic GUI
>> LabWindows GUI

Reconfiguration

By removing the external semi-rigid cables and actuating the correct coils, one can reconfigure the 4x4 matrix as shown below.

Software Control: 4x4 PXI module

Together with 14F3S-1/4x4 module, a software package is provided. The package includes Graphical User Interfaces for LabVIEW, LabWindows/CVI, and Visual Basics users.

The GUI is developed using VISA respective IVI drivers, and it gives the user access to use the underlying code to develop other applications for controlling the coaxial switch.

Figure 1 shows the internal interconnections of the 4x4 matrix and the table below it, shows the sequence of coils that need to be energized in order to create a closed RF path. Any test setup can be created by controlling the individual coils. Thus, a similar table can be created for the above reconfigured 4x4 module.

Figure 2 shows the LabVIEW GUI and how each coil can be set/reset by controlling each individual coil.

Note: Other possible configurations exist but are not shown.

<table>
<thead>
<tr>
<th>Input 1</th>
<th>Output 1</th>
<th>Output 2</th>
<th>Output 3</th>
<th>Output 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coi1#6</td>
<td>Coi1#3</td>
<td>Coi#2 &amp; Coi1#18</td>
<td>Coi#0 &amp; Coi1#15</td>
<td></td>
</tr>
<tr>
<td>Coi1#10</td>
<td>Coi1#7</td>
<td>Coi1#14</td>
<td>Coi#11 &amp; Coi1#19</td>
<td></td>
</tr>
<tr>
<td>Coi1#13</td>
<td>Coi1#4 &amp; Coi1#20</td>
<td>Coi1#17</td>
<td>Coi1#16</td>
<td></td>
</tr>
<tr>
<td>Coi1#9</td>
<td>Coi1#1 &amp; Coi1#8</td>
<td>Coi1#5 &amp; Coi1#18</td>
<td>Coi1#12</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1: Internal view of 12K3S-1/4x4

Figure 2: Dow-Key LabVIEW GUI
The 14F3S-1/2x5 Model is a bidirectional PXI (PCI eXtensions for Instrumentation) RF switching module. It is configured as a non-blocking crossbar with 2 inputs and 5 outputs. The coaxial switch operates between DC to 18 GHz and the module occupies 4 slots of a 3U PXI chassis. NI PXI-1036 chassis, provided by National Instrument, is recommended; however the module is compatible with any desired PXI chassis. It is design for complex test setups and sophisticated switching requirements.

Software Control:
Graphical User Interfaces (GUIs) are provided in LabVIEW, LabWindows/CVI, and Visual Basic to allow the user to control the switch easily. For advanced programming, VISA and IVI drivers are included such that one can program and control the switch in any way desired using e.g. LabWindows/CVI (NI developed ANSI C-based programming), LabVIEW, Visual Basics, C or any other desired programming language or platform.

Environment
- Relay Type: Electromechanical
- Contact Material: Beryllium copper, gold-plated
- I/O Connector Type: SMA Female
- Dimensions: 4-slots wide
- 3U maximum height (5.25”)
- 7” maximum depth (NI chassis compatible)
- Front Panel Color: Gray
- Weight (max): 1.20 lbs (540 grams)

RF Characteristics
- Impedance: 50 Ohms
- Operating Frequency: DC – 18 GHz
- Switching Speed*: 20 ms (max)
- Operating Life: 1,000,000 cycles (Cold Switching)

* software delays are not taken into account

Power Consumption Backplane Supply

<table>
<thead>
<tr>
<th>Voltage</th>
<th>+12 VDC</th>
<th>+5 VDC</th>
<th>+3.3 VDC</th>
<th>-12 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>1 A</td>
<td>0.15 A</td>
<td>0.1 A</td>
<td>0 A</td>
</tr>
</tbody>
</table>

Shock and Vibration
- Operational Shock: 30 g peak, half-sine, 11 ms pulse
- Random Vibration:
  - Operating: 5 to 500 Hz, 0.3 g rms
  - Non-operating: 5 to 500 Hz, 2.4 g rms

Platforms
- PXI Compliance: All Dow-Key PXI modules support full PXI/cPCI bus interface and complies with both PXI 2.1 specifications and CompactPCI specification (from the PCI Industrial Computer Group - PICMG).

Developed GUIs (Graphical User Interfaces) *:
- LabVIEW GUI
- Visual Basic GUI
- LabWindows GUI

* Refer to 14F3S-1/4x4 data sheet for more details or contact factory.
12K3S Model

Features

DC - 26.5 GHz
Reconfigurable Bidirectional Switches:
- Any (3) switches: SP3T, SP6T, DPDT, or Dual SPDT

Software Control:
- Custom GUI in LabVIEW, LabWindows/CVI and Visual Basic
- VISA/IVI drivers (for advanced programming)

Part Number

12K3S- * / **
E.g. 12K3S-3/X
12K3S-2/6-1/D
12K3S-1/6-1/X-1/3
12K3S-1/X-2/3

* Number of coaxial switches: ranging from (1) to maximum (3)
** Type of switch:
SP3T = 3 ; SP6T = 6 ; Dual SPDT = D ; DPDT (transfer) = X

Note: The order of switches are dictated from left to right with left being the top switch.

Description

Overview:
The 12K3S-Series is a bidirectional PXI (PCI eXtensions for Instrumentation) RF switching module, which can be populated with maximum (3) miniature coaxial switches and with any SP3T, SP6T, Dual SPDT (two SPDT in one switch), and DPDT (Transfer) switch. Thus, it can be reconfigured as one wishes.

Furthermore, the operating frequency for each switch is from DC to 26.5 GHz and the module occupies 2 slots of a 3U PXI chassis. The NI PXI-1036 chassis, provided by National Instrument, is recommended; however the module is compatible with any desired PXI chassis. It is design for advanced and massive test setups, in addition to, sophisticated switching requirements.

Physical

Relay Type: Electromechanical
Contact Material: Beryllium copper, gold-plated
I/O Connector Type: SMA Female
Dimensions: 2-slots wide
3U maximum height (5.25")
7" maximum depth (NI chassis compatible)
Front Panel Color: Gray
Weight (max): 0.92 lbs (420 grams)

RF Characteristics

Impedance: 50 Ohms
Operating Frequency: DC – 18 GHz
Switching Speed*: 25 ms (max)
Operating Life: 1,000,000 cycles (Cold Switching)

* software delays are not taken into account

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-4</th>
<th>4-8</th>
<th>8-12</th>
<th>12-16</th>
<th>16-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSWR (Voltage Standing Wave Ratio)</td>
<td>1.25:1</td>
<td>1.35:1</td>
<td>1.40:1</td>
<td>1.50:1</td>
<td>1.80:1</td>
</tr>
<tr>
<td>Insertion Loss (dB)</td>
<td>0.2</td>
<td>0.3</td>
<td>0.4</td>
<td>0.5</td>
<td>0.8</td>
</tr>
<tr>
<td>Open Channel Isolation (dB)</td>
<td>70</td>
<td>65</td>
<td>60</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>RF CW Power (W)</td>
<td>100 W</td>
<td>70 W</td>
<td>60 W</td>
<td>45 W</td>
<td>30 W</td>
</tr>
</tbody>
</table>

Power Consumption Backplane Supply

<table>
<thead>
<tr>
<th>Voltage</th>
<th>+12 VDC</th>
<th>+5 VDC</th>
<th>+3.3 VDC</th>
<th>-12 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>1 A</td>
<td>0.15 A</td>
<td>0.1 A</td>
<td>0 A</td>
</tr>
</tbody>
</table>

Software Control and Platforms

PXI Compliance:
All Dow-Key PXI modules support full PXI/cPCI bus interface and complies with both PXI 2.1 specifications and CompactPCI specification (from the PCI Industrial Computer Group - PICMG).

Supported Platforms:
- VISA driver
- NI platforms: LabVIEW, LabWindows/CVI
- NI windows: LabVIEW, LabWindows/CVI
- Any programming language using VISA drivers

Developed GUIs (Graphical User Interfaces) *:
- LabVIEW GUI
- Visual Basic GUI
- LabWindows GUI

* Refer to 14F3S-1/4x4 data sheet for more details or contact factory.

Shock and Vibration

Operational Shock: 30 g peak, half-sine, 11 ms pulse
Random Vibration:
- Operating 5 to 500 Hz, 0.3 g rms
- Non-operating 5 to 500 Hz, 2.4 g rms

Environment

Operating Temperature: 0 °C to +55 °C
Storage Temperature: -20 °C to +70 °C
Relative Humidity: 5% to 85% Non-Condensing
Operating Altitude: 5,000 m
Storage Altitude: 15,000 m
5096 System

Full Rack Integrated Switching Solution

Features

- 3.4 - 4.2 GHz (C-band)
- Non-Blocking Full Fan-out:
  - 32 inputs by 64 outputs
- Local Control: Graphical LCD Touch Screen
- Remote Control: RS-422, USB, and CANbus

Part Number

5096

Description

The 5096 Model is a non-blocking full Fan-Out (any input connected to any output simultaneously) solid state switching system, which operates from 3.4 GHz to 4.2 GHz. This C-band system is a 32x64 SMA-type matrix enclosed in a 19" full rack, which consist of the following (8) units:

1. Controller Module with Graphical LCD Touch Screen
2. 16x64 Input Modules
3. 32x16 Output Modules
4. Fan Controller Module

The system is fully controlled through the Controller Module, which is equipped with Windows 2000 operating system (CPU), graphical LCD touch screen display, removable hard disk, and (1) external USB port for plugging in either a mouse or a keypad. On the rear panel, the Input and the Output Modules are interconnected using 9-pin CANbus D-connector such that they create a full 32x64 fan-out switching system. Below top level architecture shows the interconnections between the modules.

Lastly, on each module a +12 VDC DB9 connector is available that goes to the Fan Controller tray to keep the system cooled down.

Control Interfaces

Local Control:
- LCD Touch Screen Display: 6.4" VGA TFT LCD
- Operating System: Microsoft® Windows® 2000 Professional
- Low power CPU (on board): VIA Eden EP6000 (667 MHz) EBGA
- Memory: 128 MB
- Removable Hard Drive: 6 GB
- External USB port: For mouse or keypad control

Remote Control:
- RS-422: DB9 Male connector

Environment

- Line Voltage (max.): 120-240 VAC, 50-630 Hz, 3-6 A, 250 W
- Fuse/Breaker: Externally accessible/replaceable
- Storage Temperature: -40 °C to +50 °C
- Operating Temperature: 0 °C to +50 °C
- Operating Humidity: 10-80% (non-condensing)
**RF Characteristics**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impedance</td>
<td>50 Ohms</td>
</tr>
<tr>
<td>Operating Frequency</td>
<td>3.4 - 4.2 GHz</td>
</tr>
<tr>
<td>VSWR (max)</td>
<td>1.3:1 (Input)</td>
</tr>
<tr>
<td></td>
<td>1.3:1 (Output)</td>
</tr>
<tr>
<td>Isolation (min)</td>
<td>60 dB input / input</td>
</tr>
<tr>
<td></td>
<td>60 dB input / output</td>
</tr>
<tr>
<td></td>
<td>60 dB output / output (Different Input)</td>
</tr>
<tr>
<td></td>
<td>20 dB output / output (Common Input)</td>
</tr>
<tr>
<td>Gain (any path)</td>
<td>-14 +/- 2 dB @ 3.8 GHz @ 20 °C</td>
</tr>
<tr>
<td>Gain (max. balance between channels)</td>
<td>+/- 1 dB @ 3.8 GHz</td>
</tr>
<tr>
<td>Gain Stability</td>
<td>+/- 0.2 dB over +/- 5 °C</td>
</tr>
<tr>
<td>Gain Variation vs. Freq.</td>
<td>+/- 0.2 dB over any 40 MHz segment</td>
</tr>
<tr>
<td></td>
<td>+/- 0.4 dB over any 80 MHz segment</td>
</tr>
<tr>
<td></td>
<td>+/- 1.0 dB over any 3.4-4.2 GHz</td>
</tr>
<tr>
<td>Group Delay Variation</td>
<td>+0.2 ns p-p max. over any 80 MHz segments</td>
</tr>
</tbody>
</table>

**Physical**

- **Relay Type:** Solid State
- **I/O Connector Type:** SMA Female
- **Dimensions:** 19" wide standard rack mount
  - Controller Module: 3U (5.25" H x 21"D)
  - Input Module: 3U (5.25" H x 21"D)
  - Output Module: 6U (10.5" H x 21"D)
  - Fan Tray: 1U (1.75" H x 6.5"D)
- **Front Panel Color:** Gray
- **Weight (max):**
  - Controller Module: 18 lbs
  - Input Module: 25 lbs
  - Output Module: 56 lbs
  - Fan Tray: 3 lbs

**Noise Figure (max):** 17 dB

- **1 dB Compression Point (min):** -5 dBm (Output)
- **3rd Order Intercept Point (IP3) min.:** +3 dBm (Output)
- **Spurious Outputs (max):**
  - -100 dBm (signal independent)
  - -70 dBm (signal related)
**5190/5191 System**  Full Rack Integrated Switching Solution

### Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operating Temperature:</strong></td>
<td>0 °C to +50 °C</td>
</tr>
<tr>
<td><strong>Storage Temperature:</strong></td>
<td>-25 °C to +50 °C</td>
</tr>
<tr>
<td><strong>Operating Humidity:</strong></td>
<td>70% (non-condensing)</td>
</tr>
<tr>
<td><strong>Storage Humidity:</strong></td>
<td>70% (non-condensing)</td>
</tr>
</tbody>
</table>

**Control Interfaces**

<table>
<thead>
<tr>
<th><strong>Local Control:</strong></th>
<th><strong>Remote Control:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>LCD Touch Screen Display</td>
<td>RS-485 9-pin 'D' sub-miniature female connector</td>
</tr>
<tr>
<td>Operating System</td>
<td></td>
</tr>
<tr>
<td>Microsoft® Windows® 2000 Professional</td>
<td></td>
</tr>
<tr>
<td>Low power CPU (on board)</td>
<td></td>
</tr>
<tr>
<td>VIA Eden EP6000 (667 MHz) EBGA</td>
<td></td>
</tr>
<tr>
<td>Memory</td>
<td></td>
</tr>
<tr>
<td>128 MB</td>
<td></td>
</tr>
<tr>
<td>External USB port</td>
<td></td>
</tr>
<tr>
<td>For mouse or keypad control</td>
<td></td>
</tr>
</tbody>
</table>

**Environment**

| **Operating Temperature:**               | 0 °C to +50 °C                                                          |
| **Storage Temperature:**                 | -25 °C to +50 °C                                                        |
| **Operating Humidity:**                  | 70% (non-condensing)                                                   |
| **Storage Humidity:**                    | 70% (non-condensing)                                                   |

### Description

The 5190/5191 Model is composed of two Full Duplex Transmitter (Tx) and Receiver (Rx) racks; operating from 900 to 2050 MHz. This L-band Teleport is unique such that the system has a single main controller module Model 5162-4 (located on the Rx rack), while the Tx rack is controlled via a slave module Model 5162-3. Thus, when closing a path on the receiver side, a matching path will also be closed on the transmitter end.

This sophisticated switching system is built by cascading (4) 12x12 Fan-Out (Model 5162-2) and (4) 12x12 Fan-In (Model 5162-1) modules to create 12x48 configuration on the Rx rack respective 48x12 configuration on the Tx rack. On the Rx rack, all (4) 12x12 modules are routed to a Main Control Module and integrated to a 12x48 system, while on the Tx rack it goes to the Slave Control Module.

The system is fully controlled through Main Controller Module (from Rx rack), which is equipped with Windows 2000 Professional operating system (CPU), graphical LCD touch screen display and a removable hard disk. On the rear panel, 12x12 Modules Fan-out modules are interconnected using 9-pin CANbus D-connector.

Model 5190/5191 is also loaded with (4) FOXCOM Fiber Optic modules; two for transmitting and two for receiving signals. In addition, each rack is equipped with a Power Supply module, a Signal Monitor panel, and a Signal Attenuation Control module. Furthermore, the Rx rack is populated with (6) MITEQ L-band amplifiers.

### Part Number

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5190/5191</td>
<td>Transmitter/Receiver Racks</td>
</tr>
</tbody>
</table>

### Subsystem Part Numbers

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>41203-007</td>
<td>Power Supply Module</td>
</tr>
<tr>
<td>5162-1</td>
<td>12x12 Fan-In Module</td>
</tr>
<tr>
<td>5162-2</td>
<td>12X12 Fan-Out Module</td>
</tr>
<tr>
<td>5162-3</td>
<td>Slave Control Module</td>
</tr>
<tr>
<td>5162-4</td>
<td>Master Control Module</td>
</tr>
<tr>
<td>5191-10</td>
<td>Signal Attenuation Control Module</td>
</tr>
</tbody>
</table>

**Photo:** 5191/5191 Full Rack System
# 5190/5191 System  Full Rack Integrated Switching Solution

## RF Characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impedance</td>
<td>50 Ohms</td>
</tr>
<tr>
<td>Operating Frequency</td>
<td>900 - 2050 MHz</td>
</tr>
<tr>
<td>VSWR (max)</td>
<td>1.8:1 (Input)</td>
</tr>
<tr>
<td></td>
<td>1.8:1 (Output)</td>
</tr>
<tr>
<td>Isolation (min)</td>
<td>55 dB input / input</td>
</tr>
<tr>
<td></td>
<td>60 dB input / output</td>
</tr>
<tr>
<td></td>
<td>55 dB output / output (Different Input)</td>
</tr>
<tr>
<td></td>
<td>40 dB output / output (Common Input)</td>
</tr>
<tr>
<td>Gain (any path)</td>
<td>0 +/- 2.5 dB</td>
</tr>
<tr>
<td>Noise Figure 12x48 modules (max)</td>
<td>17 dB</td>
</tr>
<tr>
<td>Noise Figure 48x12 modules (max)</td>
<td>21 dB</td>
</tr>
<tr>
<td>1 dB Compression Point (min)</td>
<td>+10 dBm (Output)</td>
</tr>
<tr>
<td>3rd Order Intercept Point (IP3) min.</td>
<td>+21 dBm (Output)</td>
</tr>
</tbody>
</table>

## Physical

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relay Type</td>
<td>Solid State</td>
</tr>
<tr>
<td>I/O Connector Type</td>
<td>SMA Female</td>
</tr>
<tr>
<td>Dimensions</td>
<td>19&quot; wide standard rack mount</td>
</tr>
<tr>
<td>Controller Module</td>
<td>4U (7&quot; H x 21&quot;D)</td>
</tr>
<tr>
<td>12x12 Fan-In Module</td>
<td>3U (5.25&quot; H x 21&quot;D)</td>
</tr>
<tr>
<td>12x12 Fan-Out Module</td>
<td>3U (5.25&quot; H x 21&quot;D)</td>
</tr>
<tr>
<td>Fan-In Output Module</td>
<td>4U (7&quot; H x 6.5&quot;D)</td>
</tr>
</tbody>
</table>

## Receiver Rack:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>&quot;EMCOR&quot; RACK</td>
</tr>
<tr>
<td>A2</td>
<td>Signal entrance panel (Top Surface)</td>
</tr>
<tr>
<td>A3-1</td>
<td>DKM 5162 - Power Supply Module</td>
</tr>
<tr>
<td>A3-2</td>
<td>DKM 5162 Matrix switch – 12 x 12 Switch Module</td>
</tr>
<tr>
<td>A3-3</td>
<td>DKM 5162 Matrix switch – 12 x 12 Switch Module</td>
</tr>
<tr>
<td>A3-4</td>
<td>DKM 5162 Matrix switch – Main Control (Input) Module</td>
</tr>
<tr>
<td>A3-5</td>
<td>DKM 5162 Matrix switch – 12 x 12 Switch Module</td>
</tr>
<tr>
<td>A3-6</td>
<td>DKM 5162 Matrix switch – 12 x 12 Switch Module</td>
</tr>
<tr>
<td>A4</td>
<td>Signal Monitor Panel</td>
</tr>
<tr>
<td>A5</td>
<td>DKM 5191-10 Signal Attenuation Control Module</td>
</tr>
<tr>
<td>A6</td>
<td>Fiber Optic Receiver</td>
</tr>
<tr>
<td>A7</td>
<td>Blank</td>
</tr>
<tr>
<td>A8</td>
<td>L-Band Amplifier</td>
</tr>
<tr>
<td>A9</td>
<td>Blank</td>
</tr>
<tr>
<td>A10</td>
<td>L-Band Amplifier</td>
</tr>
<tr>
<td>A11</td>
<td>Blank</td>
</tr>
<tr>
<td>A12</td>
<td>L-Band Amplifier</td>
</tr>
<tr>
<td>A13</td>
<td>Blank</td>
</tr>
<tr>
<td>A14</td>
<td>Convenience Outlet Panel</td>
</tr>
</tbody>
</table>

## Transmitter Rack:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>&quot;EMCOR&quot; RACK</td>
</tr>
<tr>
<td>A2</td>
<td>Signal entrance panel (Top Surface)</td>
</tr>
<tr>
<td>A3-1</td>
<td>DKM 5162 – Power Supply Module</td>
</tr>
<tr>
<td>A3-2</td>
<td>DKM 5162 Matrix switch – 12 x 12 Switch Module</td>
</tr>
<tr>
<td>A3-3</td>
<td>DKM 5162 Matrix switch – 12 x 12 Switch Module</td>
</tr>
<tr>
<td>A3-4</td>
<td>DKM 5162 Matrix switch – Slave Control (Output) Module</td>
</tr>
<tr>
<td>A3-5</td>
<td>DKM 5162 Matrix switch – 12 x 12 Switch Module</td>
</tr>
<tr>
<td>A3-6</td>
<td>DKM 5162 Matrix switch – 12 x 12 Switch Module</td>
</tr>
<tr>
<td>A4</td>
<td>Signal Monitor Panel</td>
</tr>
<tr>
<td>A5</td>
<td>DKM 5191-10 Signal Attenuation Control Module</td>
</tr>
<tr>
<td>A6</td>
<td>Fiber Optic Receiver</td>
</tr>
<tr>
<td>A7</td>
<td>Blank</td>
</tr>
<tr>
<td>A8</td>
<td>Blank</td>
</tr>
<tr>
<td>A9</td>
<td>Blank</td>
</tr>
<tr>
<td>A10</td>
<td>Blank</td>
</tr>
<tr>
<td>A11</td>
<td>Blank</td>
</tr>
<tr>
<td>A12</td>
<td>Blank</td>
</tr>
<tr>
<td>A13</td>
<td>Blank</td>
</tr>
<tr>
<td>A14</td>
<td>Convenience Outlet Panel</td>
</tr>
</tbody>
</table>
**4012 Model**

**Electromechanical - RF Switching System**

### Features

**DC - 18 GHz**
- Bidirectional Terminated Non-Blocking Crossbar Matrix:
  - 2 Inputs by 8 Outputs

**Local Control:** LCD with Keypad Control

**Remote Control:** ENET or GPIB

### Description

The 4012 Model is a bidirectional crossbar (any input connected to any output at the time) coaxial switching system which operates between DC to 18 GHz. The system is configured with (2) SMA-type inputs and (8) SMA-type outputs using two custom made 50 Ω (2W) terminated latching switches. To achieve lowest loss possible, the switches are located next to each other such that the length of the RF cables are kept to a minimum.

The unit is equipped with Ethernet (ENET) connection on the rear panel, in addition to, LCD display and 16 button keypad for manual override on the front panel. It is enclosed in a 4U chassis with only 5” depth and is powered up via a 110/220 VAC power supply.

### Control Interfaces

**Local control (on the front panel):** All systems are equipped with manual control via a 4-line LCD (4x40) display and keypad control.

**Remote Control (on the rear panel) using SCPI commands:**
- **ENET Version:**
  - >> TCP/IP control via 802.3 protocol (Ethernet)
  - >> Supports 10BASE-T/100BASE-T via RJ-45 connector.

- **GPIB Version:**
  - >> IEEE-488 with 26 pin female connector

### Environment

- **85-264 VAC, 47-63 Hz, 3-6 A, 275 W (max)**
- **Standard AC grounded power cable (removable, IEC 320 C19 to NEMA 5-15P)**
- **Fuse/Breaker:** Externally accessible/replaceable
- **Storage Temperature:** -20 °C to +70 °C
- **Operating Temperature:** 0 °C to +50 °C
- **Operating Humidity:** 10-80% (non-condensing)

### Physical

- **Relay Type:** Terminated Latching Multiposition
- **Contact Material:** Beryllium copper, gold-plated
- **I/O Connector Type:** SMA Female
- **Dimensions:** 19" wide standard rack mount
  - 4U maximum height (7")
  - 5" maximum depth
- **Front Panel Color:** Gray

### Part Numbers

| 4012 - 2/8 - ENET | 4012 - 2/8 - GPIB |

### RF Characteristics

#### Voltage Standing Wave Ratio (VSWR)

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-4</th>
<th>4-8</th>
<th>8-12</th>
<th>12-18</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.3:1</td>
<td>1.4:1</td>
<td>1.6:1</td>
<td>1.8:1</td>
</tr>
</tbody>
</table>

#### Insertion Loss (dB)

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-4</th>
<th>4-8</th>
<th>8-12</th>
<th>12-18</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.0</td>
<td>2.0</td>
<td>2.5</td>
<td>3.0</td>
</tr>
</tbody>
</table>

#### Open Channel Isolation (dB)

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-4</th>
<th>4-8</th>
<th>8-12</th>
<th>12-18</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>70</td>
<td>70</td>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>

#### RF CW Power (W)*

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-4</th>
<th>4-8</th>
<th>8-12</th>
<th>12-18</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50 W</td>
<td>40 W</td>
<td>30 W</td>
<td>20 W</td>
</tr>
</tbody>
</table>

* Combined input power on all inputs (at the same time)
4013 Model
Electromechanical - RF Switching System

Features

DC - 18 GHz
Bidirectional Non-Blocking Crossbar Matrix:
  2 Inputs by 6 Outputs
Local Control: LCD with Keypad Control
Remote Control: ENET or GPIB

Part Numbers

4013 - 2/6 - ENET  4013 - 2/6 - GPIB

Description

The 4013 Model is a bidirectional crossbar (any input connected to any output at the time) coaxial switching system which operates between DC to 18 GHz. The system is configured with (2) SMA-type inputs and (6) SMA-type outputs using two custom made 50 \( \Omega \) (2W) terminated latching switches. The maximum insertion loss is only 0.9 dB, such that the switches are located next to each other in a manner that the length of the RF cables are kept to a minimum and yet the customer can engage directly with the switches.

The unit is equipped with Ethernet (ENET) connection on the rear panel, in addition to, LCD display and 16 button keypad for manual override on the front panel. It is enclosed in a 4U chassis with only 5" depth and is powered up via a 110/220 VAC power supply.

Control Interfaces

Local control (on the front panel): All systems are equipped with manual control via a 4-line LCD (4x40) display and keypad control.

Remote Control (on the rear panel) using SCPI commands:
- ENET Version:
  - >> TCP/IP control via 802.3 protocol (Ethernet)
  - >> Supports 10BASE-T/100BASE-T via RJ-45 connector.
- GPIB Version:
  - >> IEEE-488 with 26 pin female connector

Environment

Power Supply: 85-264 VAC, 47-63 Hz, 3-6 A, 275 W (max)
Standard AC grounded power cable (removable, IEC 320 C19 to NEMA 5-15P)
Fuse/Breaker: Externally accessible/replaceable
Storage Temperature: -20 °C to +70 °C
Operating Temperature: 0 °C to +50 °C
Operating Humidity: 10-80% (non-condensing)

Physical

Relay Type: Latching Multiposition
Contact Material: Beryllium copper, gold-plated
I/O Connector Type: SMA Female
Dimensions: 19" wide standard rack mount
  4U maximum height (7"
  5" maximum depth
Front Panel Color: Gray

RF Characteristics

Impedance: 50 Ohms
Operating Frequency: DC-18 GHz
Switching Speed: 50-100 ms (max)
Operating Life: 1,000,000 cycles (Cold Switching)

Voltage Standing Wave Ratio (VSWR)

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-4</th>
<th>4-8</th>
<th>8-12</th>
<th>12-18</th>
<th>1.3:1</th>
<th>1.4:1</th>
<th>1.6:1</th>
<th>1.8:1</th>
</tr>
</thead>
</table>

Insertion Loss (dB)

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-4</th>
<th>4-8</th>
<th>8-12</th>
<th>12-18</th>
<th>0.4</th>
<th>0.5</th>
<th>0.7</th>
<th>0.9</th>
</tr>
</thead>
</table>

Open Channel Isolation (dB)

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-4</th>
<th>4-8</th>
<th>8-12</th>
<th>12-18</th>
<th>70</th>
<th>70</th>
<th>60</th>
<th>60</th>
</tr>
</thead>
</table>

RF CW Power (W)*

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-4</th>
<th>4-8</th>
<th>8-12</th>
<th>12-18</th>
<th>5 W</th>
<th>4 W</th>
<th>3 W</th>
<th>1 W</th>
</tr>
</thead>
</table>

* Combined input power on all inputs (at the same time)
### Features

- **20 - 300 MHz**
- **Crossbar / Fan-Out Matrix:**
  - 4 single Inputs by 4 dual Outputs (4x8)
- **Local Control:** LCD with Keypad Control
- **Remote Control:** RS-232 and ENET with LabView Graphical Interface

### Description

The 4028 Model is a crossbar (any input connected to any output at the time) coaxial switching system which operates between 20 - 300 MHz. The system is configured with (4) N-type inputs and (4) dual BNC-type outputs with 2-way power dividers on each output housed in a 3U chassis. The uniqueness of this system lies in its dual RF channel outputs, which is best used in applications that requires signal splitting or duplex signal testing.

The unit is equipped with front panel LCD/keypad display control. In addition to RS-232 and ENET remote controls, special LabView software is provided to be used via the Ethernet connection for Graphical control, as shown below.

### Control Interfaces

**Local control (on the front panel):**
- System is equipped with manual control via a 4-line LCD (4x40) display and 16 button keypad control.

**Remote control (on the rear panel):**
- RS-232 (D9 female) connector with Baud Rate 9600 bps
- CANBus (D9 male) used for programming the unit
- ENET
- TCP/IP control via 802.3 protocol (Ethernet)
- Supports 10BASE-T/100BASE-T via RJ-45 connector
- Communicates via SCPI commands
- LabView Graphical Interface accessed via Ethernet for easy control.

### Physical

- **Relay Type:** Normally Open Multiposition / SPDT
- **I/O Connector Type:**
  - N Female / BNC Female
- **Dimensions:**
  - 19" wide standard rack mount
  - 3U maximum height (5.25"
  - 20" maximum depth
- **Front Panel Color:** Gray

### RF Characteristics

- **Switching Speed (max):** 100 ms
- **Operating Life:** 1,000,000 cycles (Cold Switching)
- **Impedance:** 50 Ohms
- **Operating Frequency:** 20-300 MHz
- **VSWR (max):** 1.5:1
- **Isolation (min):**
  - 90 dB input / input
  - 90 dB input / output (Different Input)
  - 90 dB output / output (Common Input)
- **Gain (min):**
  - 9 dB (input to output @ 25 °C)
  - 7 dB (IP2 - 2nd Order Output Intercept Point (min))
  - 35 dBm
- **Input Power (max):** 9 dBm (with no damage)
- **Ripple (max):** 1 dB
- **Noise Figure (max):** 7 dB
- **IP2 - 2nd Order Output Intercept Point (min):** 70 dBm
- **IP3 - 3rd Order Output Intercept Point (min):** 35 dBm

### Environment

- **90-246 VAC, 47-63 Hz, 3A**
- **Fuse/Breaker:** Externally accessible/replaceable
- **Storage Temperature:** -20 °C to +70 °C
- **Operating Temperature:** 0 °C to +65 °C
- **Operating Humidity:** 10-80% (non-condensing)
4038 Model
Electromechanical - RF Switching System

**Features**

- **DC - 14 GHz**
- **Bidirectional Blocking Matrix:** 40 Inputs by 1 Output
- **Local Control:** LCD with Keypad Control
- **Remote Control:** RS-232 / ENET (LNET) or RS-232 / GPIB

**Part Number**

**4038 - 40/1 - * **
* ENET or GPIB (LNET is available upon request)

**Description**

The 4038 Model is a bidirectional blocking (one path connected at a time) matrix coaxial switching system which operates from DC to 14 GHz. The system is provided with (40) SMA-type inputs and (1) SMA-type output, which allows a single device to be connected to one of the forty inputs. Therefore, this unit is best used in testing where user can switch between many devices or in a telecommunication system where various input signals (e.g. antenna transmitters) need to be switch to one single device (e.g. antenna receivers).

The unit is equipped with front panel LCD/keypad display for manual control, and remotely it can be controlled by Ethernet (ENET), or GPIB. The LNET version uses LXI protocol which allows the user to remotely control the unit via a web-browser. Hence, it is not equipped with local control.

**Control Interfaces**

- **Local control (on the front panel):**
  - The system is equipped with manual control via a 4-line LCD (4x40) display and keypad control (except for the LNET version).
- **Remote Control (on the rear panel):** All versions are equipped with
  - RS-232 (DP9 female) connector with Baud Rate 9600 bps
  - CANBus (DP9 male) used for programming the unit
  - SCPI commands
- **ENET or LNET (Options):**
  - TCP/IP control via 802.3 protocol (Ethernet)
  - Supports 10BASE-T/100BASE-T via RJ-45 connector.
  - LXI style remote access via any web browser (only LNET version)
- **GPIB (Option):**
  - IEEE-488 with 26 pin female connector

**RF Characteristics**

- **Switching Speed* (typical):** 50-100 ms
- **Operating Life:** 1,000,000 cycles (Cold Switching)
- **Impedance:** 50 Ohms
- **Operating Frequency:** DC - 14 GHz
- **VSWR (max):** 1.7:1
- **Isolation (min):** 60 dB (input/input)
- **Insertion Loss (max):** 3.0 dB
- **Power Handling (CW):** 10 W

**Environmental**

- **Line Voltage:** 110-240 VAC, 50-60 Hz, 3-6 A, ? W (max)
- **Standard AC grounded power cable (removable, IEC 320 C19 to NEMA 5-15P)**
- **Fuse/Breaker:** Externally accessible/replaceable
- **Storage Temperature:** -20 °C to +70 °C
- **Operating Temperature:** 0 °C to +50 °C
- **Operating Humidity:** 10-80% (non-condensing)

* Excluding any software delays
**4039 Model**

**Electromechanical - RF Switching System**

### Features

**DC - 1 GHz**  
**Bidirectional 75 Ω Blocking Matrix:**  
32 Inputs by 1 Output  
Local Control: *LCD with Keypad Control*  
Remote Control: RS-232 / ENET (LNET) or RS-232 / GPIB

### Description

The 4039 model is a bidirectional 75 ohm blocking (one path connected at a time) coaxial switching system which operates between DC to 1 GHz. The system is configured with (32) BNC type inputs and (1) BNC type output.

The system is equipped with both local and remote control. Locally, the unit can be controlled manually via a 4-line 4x40 LCD and 16 button keypad. Remotely, the options of communicating via RS-232/ ENET. RS-232/LNET, or RS-422/GPIB are offered using SCPI commands.

The 75 Ω 4039 model is best used in ATE or in broadcasting industry, where multiple channels are controlled by one input, or where multiple incoming signals need to be routed to one output.

### Control Interfaces

Local control (on the front panel): The system is equipped with manual control via a 4-line LCD (4x40) display and keypad control.

Remote Control (on the rear panel): All versions are equipped with  
- > RS-232 (DP9 female) connector with Baud Rate 9600 bps  
- > CANBus (DP9 male) used for cascading units  
- > SCPI commands  

ENET or LNET (Options):  
- > TCP/IP control via 802.3 protocol (Ethernet)  
- > Supports 10BASE-T/100BASE-T via RJ-45 connector.  
- > LXI style remote access via any web browser (only LNET version)

GPIB (Option):  
- > IEEE-488 with 26 pin female connector

### Physical

- **Relay Type:** Normally Open Multipositions  
- **Contact Material:** Beryllium copper, gold-plated  
- **I/O Connector Type:** BNC Female  
- **Dimensions:**  
  19" wide standard rack mount  
  4U maximum height (7")  
  20" maximum depth  
- **Front Panel Color:** Gray  
- **Weight (max):** 30 lbs

### RF Characteristics

**Switching Speed**: 50-100 ms (max)  
**Operating Life:** 1,000,000 cycles (Cold Switching)  
* Excluding any software delays

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impedance</td>
<td>75 Ohms</td>
</tr>
<tr>
<td>Operating Frequency</td>
<td>DC - 1 GHz</td>
</tr>
<tr>
<td>Isolation (min)</td>
<td>50dB input / input</td>
</tr>
<tr>
<td>Insertion Loss (max.)</td>
<td>3.0 dB</td>
</tr>
<tr>
<td>Input Power (max.)</td>
<td>30 dBm (with no damage)</td>
</tr>
<tr>
<td>VSWR (max)</td>
<td>1.5:1</td>
</tr>
</tbody>
</table>

### Environment

85-264 VAC, 47-63 Hz, 3-6 A  
Standard AC grounded power cable (removable, IEC 320 C19 to NEMA 5-15P)  
Fuse/Breaker: Externally accessible/replaceable

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v2.0  03/09  www.dowkey.com  dkm@dowkey.com
4047 Model  Electromechanical - RF Switching System

Features

DC - 26.5 GHz
Bidirectional Terminated Switches:  
1 Input by n Outputs (max. 48 outputs)
Local Control: LCD with Keypad Control
Remote Control: RS-232 / ENET (LNET) or RS-232 / GPIB

Part Numbers

4047 - 1/n -*  54xx - LNET
n : number of outputs (8, 16, 24, 36, or 48)
* : ENET or GPIB
xx: Contact factory

Description

The 4047 Model is a bidirectional switching system populated with up to 7 coaxial switches, operating between DC to 26.5 GHz, on the rear panel. It is configured with (1) SMA-type input to maximum (48) SMA-type outputs using terminated SP8T switches and can be populated as 1x8, 1x16, 1x24, 1x36, and 1x48 matrix. It is powered up through a power connector using 13.6-14 VDC on the rear panel and is equipped with a 2A line fuse. The insertion loss is 0.2 dB with repeatability through complete path. Moreover, the system can be controlled via both local and remote control.

Model 4047 is ideal to be used in environments with some vibration and that requires a robust system with reliable power connection; such on the field, military, space, or airborne related applications.

Control Interfaces

Local control (on the front panel): All systems (except LNET) are equipped with manual control via a 4-line LCD (4x40) display and keypad control.

Remote Control (on the rear panel): All versions are equipped with
- >> RS-232 (DP9 female) connector with Baud Rate 9600 bps
- >> CANBus (DP9 male) connector
- >> SCPI commands

ENET or LNET (Options):
- >> TCP/IP control via 802.3 protocol (Ethernet)
- >> Supports 10BASE-T/100BASE-T via RJ-45 connector.
- >> LXI style remote access via any web browser (only LNET version)

GPIB (Option):
- >> IEEE-488 with 26 pin female connector

RF Characteristics

Voltage Standing Wave Ratio (VSWR)

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-4</th>
<th>4-8</th>
<th>8-12</th>
<th>12-18</th>
<th>18-26.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.3:1</td>
<td>1.4:1</td>
<td>1.6:1</td>
<td>1.8:1</td>
<td>2.0:1</td>
<td></td>
</tr>
</tbody>
</table>

Insertion Loss (dB)

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-4</th>
<th>4-8</th>
<th>8-12</th>
<th>12-18</th>
<th>18-26.5</th>
</tr>
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<tbody>
<tr>
<td>1.0</td>
<td>1.5</td>
<td>2.0</td>
<td>2.5</td>
<td>3.0</td>
<td></td>
</tr>
</tbody>
</table>

Open Channel Isolation (dB)

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-4</th>
<th>4-8</th>
<th>8-12</th>
<th>12-18</th>
<th>18-26.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

RF CW Power (W)*

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-4</th>
<th>4-8</th>
<th>8-12</th>
<th>12-18</th>
<th>18-26.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 W</td>
<td>50 W</td>
<td>50 W</td>
<td>50 W</td>
<td>30 W</td>
<td>20 W</td>
</tr>
</tbody>
</table>

* Combined input power on all inputs (at the same time)

Physical

Relay Type: Latching Multiposition
Contact Material: Beryllium copper, gold-plated
I/O Connector Type: SMA Female
Dimensions: 19" wide standard rack mount
        4U maximum height (7")
        22" maximum depth
Front Panel Color: Gray

Impedance: 50 Ohms
Switching Speed: 50-100 ms (max)
Operating Life: 1,000,000 cycles (Cold Switching)

Environment

Power Connector: 13.8-14.0 VDC, no polarity, 2A
Fuse/Breaker: Externally accessible/replaceable
Storage Temperature: -20 °C to +70 °C
Operating Temperature: 0 °C to +50 °C
Operating Humidity: 10-80% (non-condensing)

Part Number Options:

4047-1/48 - GPIB rear panel
4047-1/36 - RS-232 rear panel
4047-1/24 - CANBus rear panel
4047-1/16 - ENET rear panel
4047-1/8 - RS-232 rear panel
4061 Model
Electromechanical - RF Switching System

Features

**3 - 18 GHz**
Bidirectional Terminated Non-Blocking Crossbar:
- n Inputs by 4 Outputs (max. 10 inputs)
- Local Control: LCD with Keypad Control
- Remote Control: RS-232 / ENET (LNET) or RS-232 / GPIB

**Part Number**

<table>
<thead>
<tr>
<th>4061 - n/4 - N - *</th>
<th>54xx - LNET</th>
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</thead>
<tbody>
<tr>
<td>n : number of inputs (max. 10)</td>
<td>xx: Contact factory</td>
</tr>
<tr>
<td>* : ENET or GPIB</td>
<td></td>
</tr>
</tbody>
</table>

Description

The 4061 Model is a bidirectional crossbar matrix (any input connected to any output at the time) coaxial switching system which operates between 3 - 18 GHz. The system is configured with (10) N-type inputs and (4) N-type outputs using terminated transfer and SP6T switches. This is an excellent system for those who seek a unit with 50 W load at each I/O and is populated with N-type connectors.

The unit is equipped with front panel LCD/keypad display for manual control, and remotely it can be controlled via Ethernet (ENET), or GPIB. The LNET version uses LXI protocol that allows the user to control the unit only via web-browser and remotely. As a result, it is not equipped with local control.

Control Interfaces

Local control (on the front panel):
- The system is equipped with manual control via a 4-line LCD (4x40) display and keypad control (except for the LNET version).

Remote Control (on the rear panel): All versions are equipped with
- RS-232 (DP9 female) connector with Baud Rate 9600 bps
- CANBus (DP9 male) used for programming the unit
- SCPI commands

ENET or LNET Version (Options):
- TCP/IP control via 802.3 protocol (Ethernet)
- Supports 10BASE-T/100BASE-T via RJ-45 connector.
- LXI style remote access via any web browser (only LNET version)

GPIB Version (Option):
- IEEE-488 with 26 pin female connector

RF Characteristics

- **Switching Speed (max)**: 50-100 ms
- **Operating Life**: 1,000,000 cycles (Cold Switching)
- **Impedance**: 50 Ohms
- **Operating Frequency**: 3 - 18 GHz
- **VSWR (max)**: 1.9:1
- **Isolation (min)**:
  - 60 dB input / input
  - 60 dB input / output
  - 60 dB output / output (Different Input)
  - 15 dB output / output (Common Input)
- **Insertion Loss (max)**: 8.5 dB
- **Power Handling (CW)**: 65 W

Environment

- **Line Voltage**: 110-240 VAC, 50-60 Hz, 3-6 A, 375 W (max)
- **Standard AC grounded power cable** (removable, IEC 320 C19 to NEMA 5-15P)
- **Fuse/Breaker**: Externally accessible/replaceable
- **Storage Temperature**: -20 °C to +70 °C
- **Operating Temperature**: 0 °C to +60 °C
- **Operating Humidity**: 10-80% (non-condensing)
4101 Model

Electromechanical - RF Switching System

Features

DC - 18 GHz
Bidirectional Non-Blocking Crossbar Matrix:
   n Inputs by m Outputs (max. 10x10)
Local Control: LCD with Keypad Control
Remote Control: RS-232 / ENET (LNET) or GPIB / RS-232
Other Available Options (contact factory):
   High Isolation, Phase Matching, and Terminated RF Paths

Part Number

4101 - n/m - * - **  Ex. 4101-4/10-N-ENET

n : Number of inputs (max. 10)
m : Number of outputs (max. 10)
* : Connector type: N, BNC, TNC, or leave it blank for SMA
** : ENET or GPIB

Note: For LNET option contact factory for part number.

Description

The 4101 Model is a bidirectional crossbar (any input connected to any output at the time) coaxial switching system; operating from DC to 18 GHz. The system is configured with maximum 10 inputs and 10 outputs, but can be configured with an number of inputs and outputs (not exceeding the maximum). This system uses normally open multi-throw switches, meaning that by default or at power lost all switches are in open state.

Model 4101 is equipped with front panel LCD/keypad display for manual and local control, and remotely it can be controlled via Ethernet (ENET) or GPIB. The LNET version uses a LXI based protocol, which allows the user only to control the unit remotely and via a web-browser.

The system is best used for any complex requirement of RF signal switching between multiple devices; whether it is a test bench setup, rack mountable chassis (ask for telescopic slides), or out on the field - it can do it all.

Control Interfaces

Local control (on the front panel):
   >> The system is equipped with manual control via a 4-line LCD (4x40) display and keypad control (except for the LNET version).

Remote Control (on the rear panel): All versions are equipped with
   >> RS-232 (9P9 female) connector with Baud Rate 9600 bps
   >> CANBus (OP9 male) used for programming the unit
   >> SCPI commands

Remote Control Interfaces (Options):
   >> TCP/IP control via 802.3 protocol (Ethernet)
   >> Supports 10BASE-T/100BASE-T via RJ-45 connector
   >> LXI style remote access via any web browser (only LNET version)

GPIB (Option):
   >> IEEE-488 with 26 pin female connector

Environment

85-264 VAC, 47-63 Hz, 3-6 A, 375 W (max)
Fuse/Breaker: Externally accessible/replaceable
Storage Temperature: -20 °C to +70 °C
Operating Temperature: 0 °C to +60 °C
Operating Humidity: 10-80% (non-condensing)

Physical

Relay Type: Normally Open Multiposition
Contact Material: Beryllium copper, gold-plated
I/O Connector Type:
   SMA, N, BNC, TNC (Female)
Dimensions:
   19" wide standard rack mount
   4U maximum height (7”)
   24” maximum depth
Front Panel Color: Gray
Weight (max): 42 lbs

RF Characteristics

Impedance: 50 Ohms
Operating Frequency: DC-18 GHz
Switching Speed: 50-100 ms (max)
Operating Life: 1,000,000 cycles (Cold Switching)
* Combined input power on all inputs (at the same time)

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>DC - 4</td>
<td>1.1:1</td>
<td>75</td>
<td>2.0</td>
<td>100</td>
</tr>
<tr>
<td>4 - 8</td>
<td>1.3:1</td>
<td>70</td>
<td>2.5</td>
<td>80</td>
</tr>
<tr>
<td>8 - 12</td>
<td>1.4:1</td>
<td>65</td>
<td>3.0</td>
<td>60</td>
</tr>
<tr>
<td>12 - 16</td>
<td>1.7:1</td>
<td>60</td>
<td>4.5</td>
<td>50</td>
</tr>
<tr>
<td>16 - 18</td>
<td>2.0:1</td>
<td>60</td>
<td>5.0</td>
<td>40</td>
</tr>
</tbody>
</table>

Part Number

4101-10/10-ENET
4104 Model

**Features**

**DC - 18 GHz (or DC - 40 GHz)**
Bidirectional Switches:
- \( n \) Number of SP6T Switches
- \( n \) Number of SP10T Switches
- \( n \) Number of DPDT (transfer) Switches

Local Control: *LCD with Keypad Control*
Remote Control: *RS-232 / ENET (LNET) or GPIB/ RS-232*

Expansion Capability: Master-Slave (upon request)

**System Expendability**

Model 4101 can be expanded through a 9-pin CANBus interface via a slave unit (supporting up to 8 additional switches) using a single Master Controller. For more information contact Dow-Key's technical sales staff.

**Physical**

- Relay Type: Normally Open Multiposition or Latching Transfer
- Contact Material: Beryllium copper, gold-plated
- I/O Connector Type: SMA Female
- Dimensions: 19" wide standard rack mount
- Front Panel Color: Gray
- Weight (nominal): 14 lbs
- *Unit with SP10T switches is 2U in height partially (as shown in above photo)*

**Environment**

- 85-264 VAC, 47-63 Hz, 3-6 A, 275 W (max)
- Standard AC grounded power cable (removable, IEC 320 C19 to NEMA 5-15P)
- Fuse/Breaker: Externally accessible/replaceable
- Storage Temperature: -20 °C to +70 °C
- Operating Temperature: 0 °C to +60 °C

**Control Interfaces**

Local control (on the front panel):
- >> The system is equipped with manual control via a 4-line LCD (4x40) display and keypad control (except for the LNET version).

Remote control (on the rear panel):
- All versions are equipped with
  - >> RS-232 (DP9 female) connector with Baud Rate 9600 bps
  - >> CANBus (DP9 male) used for programming the unit
  - >> SCPI commands

ENET or LNET (Options):
- >> TCP/IP control via 802.3 protocol (Ethernet)
- >> Supports 10BASE-T/100BASE-T via RJ-45 connector
- >> LXI style remote access via any web browser (only LNET version)

GPIB (Option):
- >> IEEE-488 with 26 pin female connector

---

Model 4104 is a bidirectional coaxial switching system with switches mounted independently on the rear panel in 1U chassis and are controlled separately; hence it is known as a blocking configuration.

**Part Numbers**

- **4104* - n/6 - **
- ** 4104 - n/X - **
- ** 4104 - n/10 - **

  *: 'Y' for only 40 GHz switches, or else 'leave it blank'
  \( n \): \( n \) number of switches (max. 4 switches)
  \( \text{SP6T} = 6 \quad \text{SP10T} = 10 \quad \text{DPDT} (\text{transfer}) = X \)

  **: ENET or GPIB

Note 1: For LNET option contact factory for part number.
Note 2: For redundant power supplies, ask for 5148-Series

---

Model 4104 is offered with switches that either operate between DC -18 GHz or between DC-40 GHz (refer to RF data page). The system can support up to (4) switches at the maximum and is available with three different types of switches: DPDT (transfer switch), SP6T, and SP10T.

If a more flexible capability is needed and different type of switches are required, refer to Dow-Key's "Build You Own Matrix" data sheet, where two additional solutions are offered: the Silver Package and the Gold Package.
### 4104 Model

**Electromechanical - RF Switching System**

#### RF Characteristics

- Impedance: 50 Ohms
- Operating Frequency: DC-18 GHz or DC-40 GHz
- Switching Speed: 20 ms
- Operating Life: 1,000,000 cycles (Cold Switching)

Depending on the type of system, different coaxial switches are used. Below charts show the RF data distribution over specific applicable frequencies.

#### RF DATA: 4104 - 4/10 - ***

<table>
<thead>
<tr>
<th></th>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>DC - 8</td>
<td>1.40:1</td>
<td>70</td>
<td>0.40</td>
<td>80</td>
</tr>
<tr>
<td>8 - 12</td>
<td>1.60:1</td>
<td>60</td>
<td>0.50</td>
<td>60</td>
</tr>
<tr>
<td>12 - 18</td>
<td>1.80:1</td>
<td>50</td>
<td>0.80</td>
<td>40</td>
</tr>
</tbody>
</table>

#### RF DATA: 4104 - 4/6 - ***

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DC - 3</td>
<td>1.2:1</td>
<td>80</td>
<td>0.20</td>
<td>80</td>
</tr>
<tr>
<td>3 - 8</td>
<td>1.3:1</td>
<td>70</td>
<td>0.30</td>
<td>60</td>
</tr>
<tr>
<td>8 - 12.4</td>
<td>1.4:1</td>
<td>60</td>
<td>0.40</td>
<td>40</td>
</tr>
<tr>
<td>12.4 - 18</td>
<td>1.5:1</td>
<td>60</td>
<td>0.50</td>
<td>40</td>
</tr>
</tbody>
</table>

#### RF DATA: 4104Y - 4/6 - ***

<table>
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<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>DC - 6</td>
<td>1.30:1</td>
<td>70</td>
<td>0.30</td>
<td>100</td>
</tr>
<tr>
<td>6 - 12</td>
<td>1.40:1</td>
<td>60</td>
<td>0.40</td>
<td>70</td>
</tr>
<tr>
<td>12 - 18</td>
<td>1.50:1</td>
<td>60</td>
<td>0.50</td>
<td>60</td>
</tr>
<tr>
<td>18 - 26.5</td>
<td>1.70:1</td>
<td>55</td>
<td>0.70</td>
<td>45</td>
</tr>
<tr>
<td>26.5 - 40</td>
<td>1.95:1</td>
<td>50</td>
<td>0.95</td>
<td>30</td>
</tr>
</tbody>
</table>

#### RF DATA: 4104 - 4/X - ***

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DC - 1</td>
<td>1:1:1</td>
<td>85</td>
<td>0.10</td>
<td>200</td>
</tr>
<tr>
<td>1 - 8</td>
<td>1.2:1</td>
<td>80</td>
<td>0.20</td>
<td>100</td>
</tr>
<tr>
<td>4 - 8</td>
<td>1.3:1</td>
<td>70</td>
<td>0.30</td>
<td>50</td>
</tr>
<tr>
<td>8 - 12</td>
<td>1.4:1</td>
<td>65</td>
<td>0.40</td>
<td>35</td>
</tr>
</tbody>
</table>

Photo: 4104 - 4/X - *** rear panel view
4118 Model

Electromechanical - RF Switching System

Features

- DC - 200 MHz
- Switching System: 6 Inputs by 1 Output
- Local Control: *Push button control*
- Remote Control: 9-pin D-sub miniature connector, and ENET or GPIB

Part Number

**4118 - 6/1 - BNC - *\(^\text{ENET or GPIB}\)**

Description

The 4118 Model is an electromechanical switching system with an operating frequency ranging from DC to 200 MHz. The system is configured with (6) BNC type inputs and (10) BNC type output.

The uniqueness of this model lies in the front panel which has a local control that allows the user to toggle through each 6 inputs via a push button, where a corresponding LED shows the exact position of the matrix. Furthermore, the front panel has two dedicated LEDs indicating the status of two redundant power supplies and a power switch.

The matrix is designed to be operating remotely either via Ethernet (ENET) or GPIB interface from the rear panel. Also, a 9-pin D-sub miniature connector is available to be used for firmware upgrades.

Control Interfaces

The front panel is equipped with:

- > (6) switch position LED indicators
- > (1) switch position select push button
- > (2) power supply LED indicators
- > (1) power switch

All versions are equipped with:

- > 9-pin D-sub miniature female connector for programming purposes
- > SCPI commands for both ENET and GPIB connections

Remote Control (on the rear panel):

- ENET (option):
  - > TCP/IP control via 802.3 protocol (Ethernet)
  - > Supports 10BASE-T/100BASE-T via RJ-45 connector

GPIB (option):

- > IEEE-488 with 26 pin female connector

Impedance 50 Ohms

Operating Frequency DC - 200 MHz

Isolation (min) 55 dB input / input

55 dB input / output

Insertion Loss -1 dB +/- 2 dB

(defines minimum and maximum gain across the specified frequency band)

Input Power (max) 30 dBm (with no damage)

VSWR (max) 1.5:1 (input)

1.5:1 (output)

Flatness 0.5 dB max. over any 70 MHz span

Environment

- 85-240 VAC, 47-63 Hz, 3-6 A, 375 W (max)
- Fuse/Breaker: Externally accessible/replaceable
- Storage Temperature: -20 °C to +70 °C
- Operating Temperature: 0 °C to +55 °C
- Operating Humidity: 8-80% (non-condensing)

Physical

- Relay Type: Electromechanical
- I/O Connector Type: BNC Female
- Dimensions: 19" wide standard rack mount
- 1U maximum height (1.75")
- 10" maximum depth
- Front Panel Color: Gray
- Weight (max): 20 lbs

Front View:

Rear View:

Photo: 4118 - 6/1- BNC - ENET
4141 Model

Electromechanical - RF Switching System

**Features**

- **DC - 18 GHz**
- Bidirectional Non-Blocking Crossbar: 2 Inputs by 32 Outputs
- Local Control: *LCD with Keypad Control*
- Remote Control: RS-232 / ENET (LNET) or RS-232 / GPIB

**Part Number**

- **4141-2/32-** *
  - *ENET or GPIB*

  *Note: For LNET option contact the factory for part number.*

**Description**

The 4141 Model is a bidirectional crossbar (any input connected to any output at the time) coaxial switching system with an operating frequency from DC to 18 GHz. The system is configured with 2 inputs and 32 outputs using a number of cascading SP10T coaxial switches.

The system is equipped with both local and remote control. Locally, the unit can be controlled manually via a 4-line 4x40 LCD and 16 button keypad. Remotely, the option of communicating via RS-232/ENET or LNET, or RS-232/GPIB is offered using SCPI commands.

The system is used for RF signal switching among multiple devices. A suggested application is to insert a duplex signal and propagate it to various outputs to test, verify, and measure devices.

**Control Interfaces**

Local control (on the front panel): The system is equipped with manual control via a 4-line LCD (4x40) display and keypad control.

Remote control (on the rear panel): All versions are equipped with:
  - >> RS-232 (DP9 female) connector with Baud Rate 9600 bps
  - >> CANbus (DP9 male) used for cascading units
  - >> SCPI commands
  - ENET or LNET (options):
    - >> TCP/IP control via 802.3 protocol (Ethernet)
    - >> Supports 10BASE-T/100BASE-T via RJ-45 connector.
    - >> LXI style remote access via any web browser (only LNET version)
  - GPIB (option):
    - >> IEEE-488 with 26 pin female connector

**Physical**

- Relay Type: Normally Open Multiposition
- Contact Material: Beryllium copper, gold-plated
- I/O Connector Type: SMA Female
- Dimensions: 19” wide standard rack mount
  - 4U maximum height (7”)
  - 24” maximum depth
- Front Panel Color: Gray
- Weight (max): 30 lbs

**RF Characteristics**

**Voltage Standing Wave Ratio (VSWR)**

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-8</th>
<th>8-12</th>
<th>12-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.40:1</td>
<td>1.70:1</td>
<td>1.85:1</td>
<td></td>
</tr>
</tbody>
</table>

**Insertion Loss (dB)**

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-8</th>
<th>8-12</th>
<th>12-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0</td>
<td>4.0</td>
<td>5.0</td>
<td></td>
</tr>
</tbody>
</table>

**Open Channel Isolation (dB)**

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-8</th>
<th>8-12</th>
<th>12-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>65</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>

**RF Carry Power (W)***

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-8</th>
<th>8-12</th>
<th>12-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 W</td>
<td>7.5 W</td>
<td>5 W</td>
<td></td>
</tr>
</tbody>
</table>

**Relay Type:**

* Normally Open Multiposition

**Contact Material:**

* Beryllium copper, gold-plated

**I/O Connector Type:**

* SMA Female

**Dimensions:**

- 19” wide standard rack mount
  - 4U maximum height (7”)
  - 24” maximum depth

**Front Panel Color:**

* Gray

**Weight (max):**

* 30 lbs

---

**Note:**

* For ENET option contact the factory for part number.

* For GPIB option consult with the factory.

**Related Features:**

- 4141-2/32 - *
  - *ENET or GPIB*

---

**Impedance:**

* 50 Ohms

**Operating Frequency:**

* DC-18 GHz

**Switching Speed:**

* 50-100 ms (max)

**Operating Life:**

* 1,000,000 cycles (Cold Switching)

---

**Part Number:**

* 4141-2/32- *
  - *ENET or GPIB*

**Note:**

* For LNET option contact the factory for part number.
The 4159 Model is a 10x8 crossbar matrix (any input connected to any output at the time) coaxial switching system which operates from DC to 18 GHz. The system is provided with (10) SMA-type inputs and (8) SMA-type outputs, with each input having (2) additional outputs (as shown below). Using the additional outputs together with Model 4101-10/10- *, one can expand Model 4159 to 10x18 system (using one additional output) or to 10x28 system (using both additional outputs).

### Description

The unit is equipped with front panel LCD/keypad display for manual control, and remotely it can be controlled via Ethernet (ENET), or GPIB. The LNET version uses LXI protocol, which allows the user to only control the unit via a web-browser and remotely. Thus, it is not equipped with a local control.

### Environment

- **Line Voltage:** 110-240 VAC, 50-60 Hz, 3-6 A, 375 W (max)
- **Fuse/Breaker:** Externally accessible/replaceable
- **Storage Temperature:** -20 °C to +70 °C
- **Operating Temperature:** 0 °C to +50 °C
- **Operating Humidity:** 10-80% (non-condensing)

### Physical

- **Relay Type:** Normally Open Multiposition
- **Contact Material:** Beryllium copper, gold-plated
- **I/O Connector Type:** SMA Female
- **Dimensions:** 19" wide standard rack mount
- **Front Panel Color:** Gray
- **Weight (typical):** 40 lbs

### Control Interfaces

**Local control (on the front panel):**

- The system is equipped with manual control via a 4-line LCD (4x40) display and keypad control (except for the LNET version).

**Remote Control (on the rear panel):** All versions are equipped with

- RS-232 (DP9 female) connector with Baud Rate 9600 bps
- CANBus (DP9 male) used for programming the unit
- SCPI commands

### ENET or LNET Version (Options):

- TCP/IP control via 802.3 protocol (Ethernet)
- Supports 10BASE-T/100BASE-T via RJ-45 connector.
- LXI style remote access via any web browser (only LNET version)

### GPIB Version (Option):

- IEEE-488 with 26 pin female connector

*Note: RF data is shown at 18 GHz. For RF break down refer to 4101 Series.
4166 Model
Electromechanical - RF Switching System

Features

DC - 18 GHz
Bidirectional Non-Blocking Crossbar:
Terminated \( n \) Inputs by \( m \) Outputs (max. 6x12)
Local Control: LCD with Keypad Control
Remote Control: RS-232 / ENET (LNET) or RS-232 / GPIB

Part Numbers

<table>
<thead>
<tr>
<th>4166 - n/m - N - *</th>
<th>54xx - LNET</th>
</tr>
</thead>
<tbody>
<tr>
<td>( n ): number of inputs (max. 6)</td>
<td>xx: Contact factory</td>
</tr>
<tr>
<td>( m ): number of outputs (max. 12)</td>
<td></td>
</tr>
<tr>
<td>* : ENET or GPIB</td>
<td></td>
</tr>
</tbody>
</table>

Description

The 4166 Model is a bidirectional crossbar (any input connected to any output at the time) coaxial switching system with an operating frequency of DC to 18 GHz. The system is configured with maximum (6) N-type inputs and (12) N-type outputs, but it can be configured to any number of inputs and outputs (not exceeding the maximum). Model 4166 offers flexibility in terms of desired configuration, but also a system with terminated coaxial switches that latches. Latching switches have the benefit of stopping current after a path has been selected and stays in its last position if a power loss occurs.

The unit is equipped with front panel LCD/keypad display for manual control, and remotely it can be controlled via Ethernet (ENET), or GPIB using SCPI commands. The LNET version uses LXI protocol which allows the user to only control the unit remotely and offers web-browser control capability. Thus, the switches are mounted on the front panel and the unit is not equipped with local control.

Control Interfaces

Local control (on the front panel):

- \( >> \) The system is equipped with manual control via a 4-line LCD (4x40) display and keypad control (except for the LNET version).

Remote control (on the rear panel): All versions are equipped with

- \( >> \) RS-232 (DP9 female) connector with Baud Rate 9600 bps
- \( >> \) CANBus (DP9 male) used for programming the unit
- \( >> \) SCPI commands

ENET or LNET Version (Options):

- \( >> \) TCP/IP control via 802.3 protocol (Ethernet)
- \( >> \) Supports 10BASE-T/100BASE-T via RJ-45 connector.
- \( >> \) LXI style remote access via any web browser (only LNET version)

GPIB Version (Option):

- \( >> \) IEEE-488 with 26 pin female connector

Environment

| Line Voltage: | 20-240 VAC, 50-60 Hz, 3-6 A |
| Fuse/Breaker: | Externally accessible/replaceable |
| Storage Temperature: | -20 °C to +70 °C |
| Operating Temperature: | 0 °C to +50 °C |
| Operating Humidity: | 10-80% (non-condensing) |

Physical

| Relay Type: | Terminated Latching Multiposition |
| Contact Material: | Beryllium copper, gold-plated |
| I/O Connector Type: | N Female |
| Dimensions: | 19" wide standard rack mount |
| | 4U maximum height (7") |
| | 20" maximum depth |
| Front Panel Color: | Gray |
| Weight (max): | 42 lbs |

RF Characteristics

| Impedance: | 50 Ohms |
| Operating Frequency: | DC-4 GHz |
| Switching Speed: | 50-100 ms (max) |
| Operating Life: | 1,000,000 cycles (Cold Switching) |

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>DC-50</th>
<th>50-4000</th>
<th>4000-18000</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSWR</td>
<td>1.1:1</td>
<td>1.2:1</td>
<td>2.0:1</td>
</tr>
<tr>
<td>Insertion Loss (dB)</td>
<td>0.2</td>
<td>1.8</td>
<td>7.0</td>
</tr>
<tr>
<td>Isolation - Open Channel (dB)</td>
<td>85</td>
<td>75</td>
<td>60</td>
</tr>
<tr>
<td>RF CW Power (W)*</td>
<td>50</td>
<td>50</td>
<td>10</td>
</tr>
</tbody>
</table>

* Combined input power on all inputs (at the same time)
4169 Model

Electromechanical - RF Switching System

Features

**DC - 18 GHz**
Bidirectional Non-Blocking Crossbar (front panel)
Terminated \( n \) Inputs and \( m \) Outputs (max. 10x10)
Local Control : LCD with Keypad Control
Remote Control: RS-232 / ENET (LNET) or RS-232 / GPIB

Part Numbers

4169- n/m - * 54xx - LNET
\( n \) : number of inputs (max. 10)
\( m \) : number of outputs (max. 10)
* : ENET or GPIB
xx : Contact factory

Description

The 4169 Model is a bidirectional crossbar (any input connected to any output at the time) coaxial switching system; operating between DC to 18 GHz. The system is configured with maximum (10) inputs and (10) outputs, but can be configured to a smaller crossbar matrix as required. The unit is unique in the sense that both inputs and outputs are terminated with a 50 \( \Omega \) load and it uses latching coaxial switches. These type of switches have the benefit of stop drawing current after a path has been selected and stays in its last position if a power loss occurs. Furthermore, the unit is ideal to be used for testing, since one can easily access the I/O ports (as they are mounted on the front panel) to connect and disconnect UUTs.

The unit is equipped with front panel LCD/keypad display for manual and local control, and remotely it can be controlled via Ethernet (ENET) or GPIB. The LNET version uses a LXI based protocol, which allows the user only to control the unit remotely and via a web-browser.

Control Interfaces

Local control (on the front panel):

- The system is equipped with manual control via a 4-line LCD (4x40) display and keypad control (except for the LNET version).

Remote Control (on the rear panel): All versions are equipped with

- RS-232 (DP9 female) connector with Baud Rate 9600 bps
- CANBus (DP9 male) used for programming the unit
- SCPI commands

ENET or LNET Version (Options):

- TCP/IP control via 802.3 protocol (Ethernet)
- Supports 10BASE-T/100BASE-T via RJ-45 connector.
- LXI style remote access via any web browser (only LNET version)

GPIB Version (Option):

- IEEE-488 with 26 pin female connector

Environment

- Line Voltage: 120-240 VAC, 50-60 Hz, 3-6 A
- Fuse/Breaker: Externally accessible/replaceable
- Storage Temperature: -20 °C to +70 °C
- Operating Temperature: 0 °C to +50 °C
- Operating Humidity: 10-80% (non-condensing)

Physical

- Relay Type: Normally Open Multiposition
- Contact Material: Beryllium copper, gold-plated
- I/O Connector Type: SMA Female
- Dimensions: 19” wide standard rack mount
- 4U maximum height (7”)
- 20” maximum depth
- Front Panel Color: Gray
- Weight (max): 42 lbs

RF Characteristics

- Impedance: 50 Ohms
- Operating Frequency: DC-18 GHz
- Switching Speed: 50-100 ms (max)
- Operating Life: 1,000,000 cycles (Cold Switching)

Voltage Standing Wave Ratio (VSWR)

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-4</th>
<th>4-8</th>
<th>8-12</th>
<th>12-16</th>
<th>16-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.20:1</td>
<td>1.35:1</td>
<td>1.45:1</td>
<td>1.75:1</td>
<td>2.0:1</td>
<td></td>
</tr>
</tbody>
</table>

Insertion Loss (dB)

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-4</th>
<th>4-8</th>
<th>8-12</th>
<th>12-16</th>
<th>16-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5</td>
<td>3.0</td>
<td>4.5</td>
<td>6.0</td>
<td>6.7</td>
<td></td>
</tr>
</tbody>
</table>

Open Channel Isolation (dB)

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-4</th>
<th>4-8</th>
<th>8-12</th>
<th>12-16</th>
<th>16-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td>70</td>
<td>65</td>
<td>60</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>

RF CW Power (W)*

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-4</th>
<th>4-8</th>
<th>8-12</th>
<th>12-16</th>
<th>16-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 W</td>
<td>80 W</td>
<td>60 W</td>
<td>50 W</td>
<td>40 W</td>
<td></td>
</tr>
</tbody>
</table>

* Combined input power on all inputs (at the same time)
4201 Model
Electromechanical - RF Switching System

**Features**

**DC - 18 GHz**

Bidirectional Switches:
- 1 Input by \( n \) Number of Outputs (max. 100)
- Local Control: LCD with Keypad Control
- Remote Control: RS-232 / ENET (LNET) or GPIB / RS-232

**Part Number**

<table>
<thead>
<tr>
<th>4201 - ( n ) - *</th>
<th>Ex. 4201-100-GPIB</th>
</tr>
</thead>
<tbody>
<tr>
<td>( n ) : number of outputs 10, 20, 30, 40, 50, ..., 100</td>
<td></td>
</tr>
<tr>
<td>* : ENET or GPIB</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** For LNET option contact factory for part number

**Description**

The 4201 Model is a bidirectional switching system which operates between DC to 18 GHz. The system houses up to (11) coaxial SP10T switches at the maximum, which are mounted individually (blocking) on the rear panel. The unit is configured as a multiplexer starting with 1x10 and going up to 1x100 with increments of 10 outputs in a 4U chassis. The switches are externally connected in a "spider" fashion as shown in the sample photo.

The unit can be controlled manually (locally) via a 4-line (4x40) LCD and a keypad. Remotely, the system is offered with the choice of three control interfaces: Ethernet, GPIB, or LXI protocol. Using specific SCPI commands, one can switch between the input and multiple outputs. For detailed information, contact Dow-Key's technical sales staff.

**Physical**

- Relay Type: Normally Open Multiposition
- Contact Material: Beryllium copper, gold-plated
- I/O Connector Type: SMA Female
- Dimensions: 19" wide standard rack mount
  - 4U maximum height (7")
  - 24" maximum depth
- Front Panel Color: Gray
- Weight (max): 30 lbs

**RF Characteristics**

- Impedance: 50 Ohms
- Operating Frequency: DC-18 GHz
- Switching Speed: 50-100 ms (max)
- Operating Life: 1,000,000 cycles (Cold Switching)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DC - 8</td>
<td>1.40:1</td>
<td>70</td>
<td>1.0</td>
<td>80</td>
</tr>
<tr>
<td>8 - 12</td>
<td>1.60:1</td>
<td>60</td>
<td>1.5</td>
<td>60</td>
</tr>
<tr>
<td>12 - 16</td>
<td>1.80:1</td>
<td>55</td>
<td>2.0</td>
<td>40</td>
</tr>
<tr>
<td>16 - 18</td>
<td>2.2:1</td>
<td>50</td>
<td>2.5</td>
<td>40</td>
</tr>
</tbody>
</table>
The 4203 Model is a switching system mounted with one single bidirectional SP12T coaxial switch on the rear panel and has an operating frequency ranging from DC to 18 GHz. The switch is a CANbus controlled coaxial with terminated 2W 50 ohm loads, and is provided with SMA-type connectors.

The unit is equipped with front panel LCD/keypad display for manual control, and remotely it can be controlled via Ethernet (ENET), or GPIB. The LNET version uses LXI protocol, which allows the user to only control the unit via a web-browser and remotely. Thus, it is not equipped with a local control.

The unit is ideal for those who are considering Model 6101 with a SP12T CANbus switch, but like to have the coaxial switch mounted internally in a chassis (and not externally). The tradeoff lies in that Model 5203 is restricted to a 4U chassis (and cannot fit in 1U) due to the switch size.

**Features**

- **DC - 18 GHz**
- **Terminated Bidirectional Switch:** 1 Input by 12 Outputs
- **Local Control:** LCD with Keypad Control
- **Remote Control:** RS-232 / ENET (LNET) or RS-232 / GPIB

**Part Number**

- 4203 - 1/12 - * 54xx - LNET
  - *ENET or GPIB
  - xx: Contact factory

**Description**

The 4203 Model is a switching system mounted with one single bidirectional SP12T coaxial switch on the rear panel and has an operating frequency ranging from DC to 18 GHz. The switch is a CANbus controlled coaxial with terminated 2W 50 ohm loads, and is provided with SMA-type connectors.

The unit is equipped with front panel LCD/keypad display for manual control, and remotely it can be controlled via Ethernet (ENET), or GPIB. The LNET version uses LXI protocol, which allows the user to only control the unit via a web-browser and remotely. Thus, it is not equipped with a local control.

The unit is ideal for those who are considering Model 6101 with a SP12T CANbus switch, but like to have the coaxial switch mounted internally in a chassis (and not externally). The tradeoff lies in that Model 5203 is restricted to a 4U chassis (and cannot fit in 1U) due to the switch size.

**Physical**

- **Relay Type:** Latching Multiposition
- **Contact Material:** Beryllium copper, gold-plated
- **I/O Connector Type:** SMA Female
- **Dimensions:** 19" wide standard rack mount 4U maximum height (7") 20" maximum depth
- **Front Panel Color:** Gray
- **Weight (max):** 25 lbs

**RF Characteristics**

- **Switching Speed (max):** 50-100 ms
- **Operating Life (Cold Switching):** 1,000,000 cycles
- **Impedance:** 50 Ohms

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DC-4</td>
<td>1.2:1</td>
<td>70</td>
<td>0.2</td>
<td>100</td>
</tr>
<tr>
<td>4-8</td>
<td>1.4:1</td>
<td>65</td>
<td>0.4</td>
<td>50</td>
</tr>
<tr>
<td>8-12</td>
<td>1.5:1</td>
<td>60</td>
<td>0.6</td>
<td>35</td>
</tr>
<tr>
<td>12-18</td>
<td>1.8:1</td>
<td>60</td>
<td>0.8</td>
<td>25</td>
</tr>
</tbody>
</table>
4301 Model
Electromechanical - RF Switching System

Features

**DC - 18 GHz**

Bidirectional Switches:
- Number of SP10T Switches
- Local Control: LCD with Keypad Control
- Remote Control: RS-232 / ENET (LNET) or GPIB / RS-232

Part Number

4301 - n/10 - *  

Ex. 4301-11/10-GPIB

- n : number of SP10T Switches (max. 16)
- * : ENET or GPIB

Note 1: For LNET option contact factory for part number
Note 2: (13-16) SP10T only available in a 6U chassis

Description

The 4301 Model is a bidirectional switching system which operates between DC to 18 GHz. The system can support up to (12) coaxial SP10T switches at the maximum in a 4U chassis and (16) coaxial SP10T switches in a 6U chassis. The switches are mounted independently on the rear panel and are controlled separately; hence in a blocking configuration.

The unit can be controlled manually (locally) via a 4-line (4x40) LCD and a keypad. Remotely, the system is offered with the choice of three control interfaces: Ethernet, GPIB, or LXI protocol. Using specific SCPI commands, one can control each individual SP10T switch. For detailed information, contact Dow-Key's technical sales staff.

Physical

- Relay Type: Normally Open Multiposition
- Contact Material: Beryllium copper, gold-plated
- I/O Connector Type: SMA Female
- Dimensions:  
  - 19" wide standard rack mount
  - 4U maximum height (7") *
  - 24" maximum depth
- Front Panel Color: Gray
- Weight (max): 25 lbs *

* 4301-series with (13-16) SP10T is available in 6U chassis (30 lbs)

RF Characteristics

- Impedance: 50 Ohms
- Operating Frequency: DC-18 GHz
- Switching Speed: 50-100 ms (max)
- Operating Life: 1,000,000 cycles (Cold Switching)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DC - 8</td>
<td>1.40:1</td>
<td>70</td>
<td>0.4</td>
<td>70</td>
</tr>
<tr>
<td>8 - 12</td>
<td>1.60:1</td>
<td>60</td>
<td>0.5</td>
<td>60</td>
</tr>
<tr>
<td>12 - 18</td>
<td>1.80:1</td>
<td>50</td>
<td>0.8</td>
<td>40</td>
</tr>
</tbody>
</table>
4501 Model

Electromechanical - RF Switching System

**Features**

**DC - 18 GHz**

Bidirectional Switches:

- **n** Number of SP6T Switches on the Front Panel

Local Control: LCD with Keypad Control

Remote Control: RS-232 / ENET (LNET) or GPIB / RS-232

**Part Number**

4501 - n/6 - *  
Ex. 4501-4/6 - GPIB

- **n**: number of SP6T Terminated Coaxial Switches (max. 4)
- *****: ENET, or GPIB

**Note**: For LNET option contact factory for part number

**Description**

The 4501 Model is a bidirectional switching system that operates between DC to 18 GHz. The system supports up to (4) coaxial SP6T terminated switches, which are mounted on the front panel in a 3U chassis with no interconnections; hence in blocking fashion. A 2-line (2x40) LCD, with 16 button keypad, on the front panel allows the user to manually controlled the switches. An on/off power switch is located on the front panel as well.

Remotely, the system is offered with the choices of three control interfaces: Ethernet, GPIB, or LXI protocol. Using specific SCPI commands, one can switch individual coaxial switches.

Best used for RF signal switching among exchangeable devices in test bench setup that requires easy access to RF I/Os.

**Physical**

- Relay Type: Latching Terminated Multiposition
- Contact Material: Beryllium copper, gold-plated
- I/O Connector Type: SMA Female
- Dimensions: 19" wide standard rack mount  
  3U maximum height (5.25")  
  22" maximum depth
- Front Panel Color: Gray
- Weight (max): 22 lbs

**RF Characteristics**

- Impedance: 50 Ohms
- Operating Frequency: DC-18 GHz
- Switching Speed: 50-100 ms (max)
- Operating Life: 1,000,000 cycles (Cold Switching)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DC - 4</td>
<td>1.20:1</td>
<td>80</td>
<td>0.20</td>
<td>100</td>
</tr>
<tr>
<td>4 - 8</td>
<td>1.30:1</td>
<td>75</td>
<td>0.30</td>
<td>50</td>
</tr>
<tr>
<td>8 - 12.4</td>
<td>1.40:1</td>
<td>70</td>
<td>0.40</td>
<td>35</td>
</tr>
<tr>
<td>12.4 - 18</td>
<td>1.50:1</td>
<td>60</td>
<td>0.50</td>
<td>25</td>
</tr>
</tbody>
</table>

**Environment**

85-264 VAC, 47-63 Hz, 3-6 A, 250 W (max)

Standard AC grounded power cable (removable, IEC 320 C19 to NEMA 5-15P)

Fuse/Breaker: Externally accessible/replaceable

Storage Temperature: -20 °C to +70 °C

Operating Temperature: 0 °C to +60 °C

Operating Humidity: 10-80% (non-condensing)

**Control Interfaces**

Local control (on the front panel):

- The system is equipped with manual control via a 4-line LCD (4x40) display and keypad control.

Remote Control (on the rear panel):

- All versions are equipped with:
  - RS-232 (DP9 female) connector with Baud Rate 9600 bps
  - CANBus (DP9 male) used for programming the unit
  - SCPI commands

ENET or LNET (Options):

- TCP/IP control via 802.3 protocol (Ethernet)
- Supports 10BASE-T/100BASE-T via RJ-45 connector.
- LXI style remote access via any web browser (only LNET version)

GPIB (Option):

- IEEE-488 with 26 pin female connector
4601 Model

Electromechanical - RF Switching System

Features

1 - 18 GHz
Bidirectional Non-Blocking Full Fan-Out Matrix:
- Inputs by Outputs (4x4, 5x5, 6x6, 7x7, or 8x8)
- Local Control: LCD Touch Screen Display
- Remote Control: RS-232 / ENET or GPIB / RS-232

Part Numbers

<table>
<thead>
<tr>
<th>Part Numbers</th>
<th>4601-4/4-*</th>
<th>4601-6/6-*</th>
<th>4601-5/5-*</th>
<th>4601-7/7-*</th>
<th>4601-8/8-*</th>
</tr>
</thead>
<tbody>
<tr>
<td>* ENET or GPIB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Description

The 4601 Model is a Non-blocking Full Fan-Out (any input connected to any output simultaneously) coaxial switching system which operates from 1 GHz up to 18 GHz. The system is configured with maximum (8) N-type inputs and (8) SMA-type outputs. Furthermore, all inputs are outfitted with high linearity amplifiers in order to compensate for system insertion loss.

The 4601-series is equipped with Windows XP operating system (CPU), LCD touch screen display for local control, and redundant power supplies with LED monitoring on the front panel. Remotely, in addition to RS-232 it is either offered with Ethernet or GPIB control.

Features and Control

Local control (on the front panel): All systems are equipped with
- > 6" LCD Touch Screen Display
- > Microsoft® Windows® XP Professional Operating System
- > Removable Hard Drive
- > Front Panel LED indicators for redundant power supplies

Remote Control (on the rear panel): All versions are equipped with
- > RS-232 (DP9 female) connector with Baud Rate 9600 bps
- > CANBus (DP9 male) connector
- > SCPI commands

ENET (option):
- > TCP/IP control via 802.3 protocol (Ethernet)
- > Supports 10BASE-T/100BASE-T via RJ-45 connector.

GPIB (option):
- > IEEE-488 with 26 pin female connector

Environment

85-264 VAC, 47-63 Hz, 3-6 A, 250 W (max)
Standard AC grounded power cable (removable, IEC 320 C19 to NEMA 5-15P)
Fuse/Breaker: Externally accessible/replaceable
Storage Temperature: -20 °C to +70 °C
Operating Temperature: 0 °C to +60 °C
Operating Humidity: 10-80% (non-condensing)

Photo: 4601-8/8-ENET

Physical

- Relay Type: Latching Multiposition
- Contact Material: Beryllium copper, gold-plated
- I/O Connector Type: N Female / SMA Female
- Dimensions:
  - 19" wide standard rack mount
  - 3U maximum height (5.25")
  - 21" maximum depth
- Front Panel Color: Gray
- Weight (max): 50 lbs

RF Characteristics

Voltage Standing Wave Ratio (VSWR)

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-4</th>
<th>4-8</th>
<th>8-16</th>
<th>16-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>2.15:1</td>
<td>2.20:1</td>
<td>2.50:1</td>
<td>2.25:1</td>
</tr>
<tr>
<td>Output</td>
<td>1.60:1</td>
<td>1.80:1</td>
<td>2.15:1</td>
<td>2.11:1</td>
</tr>
</tbody>
</table>

Switching Speed: 50-100 ms (max)
Operating Life: 1,000,000 cycles (Cold Switching)

Impedance: 50 Ohms
Operating Frequency: 1-18 GHz
Isolation (min): 60 dB input / input
- 65 dB input / output (Different Output)
- 18 dB output / output (Common Input)

Gain
<table>
<thead>
<tr>
<th>Gain</th>
<th>0 dB +/- 2 dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Power (max)</td>
<td>+20 dBm</td>
</tr>
<tr>
<td>1 dB Compression Point (min)</td>
<td>+5 dBm</td>
</tr>
<tr>
<td>2nd Order Output Intercept Point (IP2) min</td>
<td>+20 dBm</td>
</tr>
<tr>
<td>3rd Order Output Intercept Point (IP3) min</td>
<td>+10 dBm</td>
</tr>
</tbody>
</table>

Noise (max): 11 dB
4701 Model  
Electromechanical - RF Switching System

**Features**

1 - 18 GHz
Bidirectional Non-Blocking Full Fan-Out Matrix:
- n inputs by n outputs:
  - 9x9, 10x10, 11x11, or 12x12
Local Control: LCD Touch Screen Display
Remote Control: RS-232 / ENET or GPIB / RS-232

**Description**

The 4701 Model is a Non-blocking Full Fan-Out (any input connected to any output simultaneously) coaxial switching system which operates from 1 GHz up to 18 GHz. The system is configured with maximum (12) N-type inputs and (12) SMA-type outputs. Furthermore, all inputs are outfitted with high linearity amplifiers in order to compensate for system insertion loss.

The 4701-series is equipped with Windows XP operating system (CPU), LCD touch screen display for local control, and redundant power supplies with LED monitoring on the front panel. Remotely, in addition to RS-232 it is either offered with Ethernet or GPIB control.

**Features and Control**

Local control (on the front panel): All systems are equipped with
- > 6" LCD Touch Screen Display
- >> Microsoft® Windows® XP Professional Operating System
- >> Removable Hard Drive
- >> Front Panel LED indicators for redundant power supplies

Remote control (on the rear panel): All versions are equipped with
- > RS-232 (DP9 female) connector with Baud Rate 9600 bps
- >> CANBus (DP9 male) connector
- >> SCPI commands

ENET (option):
- >> TCP/IP control via 802.3 protocol (Ethernet)
- >> Supports 10BASE-T/100BASE-T via RJ-45 connector.

GPIB (option):
- >> IEEE-488 with 26 pin female connector

**Environmental**

85-264 VAC, 47-63 Hz, 3-6 A, 250 W (max)
Standard AC grounded power cable (removable, IEC 320 C19 to NEMA 5-15P)
Fuse/Breaker: Externally accessible/replaceable
Storage Temperature: -20 °C to +70 °C
Operating Temperature: 0 °C to +60 °C
Operating Humidity: 10-80% (non-condensing)

**Part Numbers**

| 4701-9/9-* | 4701-11/11-* |
| 4701-10/10-* | 4701-12/12-* |

* ENET or GPIB

**Physical**

- Relay Type: Latching Multiposition
- Contact Material: Beryllium copper, gold-plated
- I/O Connector Type: N Female / SMA Female
- Dimensions: 19" wide standard rack mount
- 4U maximum height (7"
- 25" maximum depth
- Front Panel Color: Gray
- Weight (max): 85 lbs

**RF Characteristics**

**Voltage Standing Wave Ratio (VSWR)**

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>DC-4</th>
<th>4-8</th>
<th>8-16</th>
<th>16-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>2.15:1</td>
<td>2.20:1</td>
<td>2.50:1</td>
<td>2.25:1</td>
</tr>
<tr>
<td>Output</td>
<td>1.60:1</td>
<td>1.80:1</td>
<td>2.15:1</td>
<td>2.11:1</td>
</tr>
</tbody>
</table>

Switching Speed: 50-100 ms (max)
Operating Life: 1,000,000 cycles (Cold Switching)

- Impedance: 50 Ohms
- Operating Frequency: 1-18 GHz
- Isolation (min): 60 dB input / input
- 65 dB input / output
- 50 dB output / output (Different Output)
- 18 dB output / output (Common Input)

Gain

| 0 dB +/- 2 dB (defines minimum and maximum gain across the specified frequency band) |

Input Power (max): +15 dBm
1 dB Compression Point (min): +5 dBm
2nd Order Output Intercept Point (IP2) min: +20 dBm
3rd Order Output Intercept Point (IP3) min: +10 dBm

Noise (max): 11 dB
### Solid State - RF Switching System

**3095**

#### Features

100 MHz - 1250 MHz  
Non-Blocking Full Fan-out:  
16 Inputs by 16 Outputs  
Local Control: Not Available  
Remote Control: RS-232 / ENET (or LNET) or RS-232 / GPIB

#### Control Interfaces

- Power switch with guard  
- No local control is available

Remote Control (on the rear panel): All versions are equipped with  
- RS-232 (DB9 female) connector with Baud Rate 9600 bps  
- ENET  
- GPIB Version: IEEE-488 with 26 pin female connector

#### Environment

85-264 VAC, 47-63 Hz, 3-6 A, 250 W (max)  
Standard AC grounded power cable (removable, IEC 320 C19 to NEMA 5-15P)  
Fuse/Breaker: Externally accessible/replaceable  
Storage Temperature: -20 °C to +70 °C  
Operating Temperature: 0 °C to +50 °C  
Operating Humidity: 10-80% (non-condensing)

#### Part Number

3095 - 16X16 - *  
* ENET or GPIB (LNET available upon request)

#### Description

The 3095 Model is a Non-blocking Full Fan-Out (any input connected to any output simultaneously) coaxial switching system with a wide operating frequency ranging from 100 MHz up to 1250 MHz. The system is configured with 16 SMA-type inputs and 16 SMA-type outputs.

The uniqueness of this model lies in that it lacks local LCD type control, whereas it is designed to be operating only remotely either via RS-232, Ethernet (ENET), LXI (LNET), or GPIB interface. A power switch with a guard is equipped on the front panel, while all I/Os and interfaces are populate on the rear panel.

#### RF Characteristics

- **Impedance**: 50 Ohms
- **Operating Frequency**: 100-1250 MHz
- **Isolation (min)**: 50 dB input / input  
  50 dB input / output  
  50 dB output / output (Different Input)  
  50 dB output / output (Common Input)
- **Gain**: 0 dB +/- 2.0 dB (defines min. and max. gain across the specified frequency band)
- **Input Power (max)**: 20 dBm with no damage  
  1 dB Input Compression Point: +15 dBm
- **VSWR (max)**: 1.9:1 (input)  
  1.3:1 (output)
- **IP3 - 3rd Order Output Intercept Point (typical)**: 20 dBm
- **IP2 - 2nd Order Output Intercept Point (typical)**: 30 dBm
- **Noise Figure (typical)**: 15 dB
3202 Series
Solid State - RF Switching System

Features

800 MHz - 2500 MHz (L-band)
Non-Blocking Full Fan-out:
  n Inputs by m Outputs (6x6 to 12x12)
Local Control : LCD Touch Screen
Remote Control: RS-232 / ENET or RS-232 / GPIB

Part Number

3202- nXm - * - **  Ex. 3202-6X6-N-ENET
n : Any number of inputs from (6) up to (12)
m : Any number of outputs from (6) up to (12)
* : 'N' for N-type connector, or else leave it blank
** : ENET or GPIB

Description

The 3202 Model is a Non-blocking Full Fan-Out (any input connected to any output simultaneously) solid state switching system which operates from 800 MHz to 2500 MHz (L-band). The system can be configured with maximum (12) SMA type inputs and (12) SMA type outputs and with a starting configuration of 6 inputs by 6 outputs.

The 3202-series is equipped with Windows XP operating system (CPU), LCD touch screen display for local control, and redundant power supplies with LED monitoring on the front panel. Remotely, in addition to RS-232 it is either offered with Ethernet or GPIB control.

Control Interfaces

Local control (on the front panel): All systems are equipped with
  >> 6” LCD Touch Screen Display
  >> Microsoft® Windows® XP Professional Operating System
  >> Removable Hard Drive
  >> Front Panel LED indicators for redundant power supplies

Remote Control (on the rear panel): All versions are equipped with
  >> SCPI commands

  ENET
    >> TCP/IP control via 802.3 protocol (Ethernet)
    >> Supports 10BASE-T/100BASE-T via RJ-45 connector.
    >> RS-232 (DP9 female) connector with Baud Rate 9600 bps

  GPIB Version:
    >> IEEE-488 with 26 pin female connector

Environment

85-264 VAC, 47-63 Hz, 3-6 A, 250 W (max)
Standard AC grounded power cable (removable, IEC 320 C19 to NEMA 5-15P)
Fuse/Breaker: Externally accessible/replaceable
Storage Temperature: -20 °C to +70 °C
Operating Temperature: 0 °C to +60 °C
Operating Humidity: 10-80% (non-condensing)

Diagram:

Relay Type: Solid State
I/O Connector Type: SMA Female
Dimensions: 19” wide standard rack mount
            3U maximum height (5.25”)
            25” maximum depth
Front Panel Color: Gray
Weight (max): 40 lbs

RF Characteristics

Impedance 50 Ohms
Operating Frequency 800 – 2500 MHz
Isolation (min) 60 dB input / input
                65 dB input / output
                50 dB output / output
                (Different Input)
                40 dB output / output
                (Common Input)
Gain 0 dB +/- 2.0 dB
      (defines minimum and maximum gain across the specified frequency band)
Input Power (max) +20 dBm with no damage
1 dB Compression Point +11 dBm
VSWR (max)
Input 1.8:1
Output 1.8:1
3rd Order Output Intercept Point (IP3) min +25 dBm
2nd Order Output Intercept Point (IP2) min +30 dBm
Noise Figure (max) 17 dB
3203 Series

Solid State - RF Switching System

Features

20 MHz - 1100 MHz (VHF-band)
Non-Blocking Full Fan-out:
8 Inputs by \( n \) Outputs
Local Control: LCD Touch Screen
Remote Control: RS-232 / ENET or RS-232 /GPIB

Description

The 3203 Model is a Non-blocking Full Fan-Out (any input connected to any output simultaneously) solid state switching system which operates in VHF-band: from 20 MHz to 1100 MHz. The system can be configured either with (6) SMA type inputs and (16) SMA type outputs and as 8x8 matrix.

The 3203-series is equipped with Windows XP operating system (CPU), LCD touch screen display for local control, and redundant power supplies with LED monitoring on the front panel. Remotely, in addition to RS-232 it is either offered with Ethernet or GPIB control.

Control Interfaces

Local control (on the front panel): All systems are equipped with
- 6” LCD Touch Screen Display
- Microsoft® Windows® XP Professional Operating System
- Removable Hard Drive
- Front Panel LED indicators for redundant power supplies

Remote Control (on the rear panel): All versions are equipped with
- RS-232 (DB9 female) connector with Baud Rate 9600 bps
- SCPI commands
- ENET
  - TCP/IP control via 802.3 protocol (Ethernet)
  - Supports 10BASE-T/100BASE-T via RJ-45 connector.
- GPIB Version:
  - IEEE-488 with 26 pin female connector

Environment

85-264 VAC, 47-63 Hz, 3-6 A, 250 W (max)
Standard AC grounded power cable (removable, IEC 320 C19 to NEMA 5-15P)
Fuse/Breaker: Externally accessible/replaceable
Storage Temperature: -20 °C to +70 °C
Operating Temperature: 0 °C to +60 °C
Operating Humidity: 10-80% (non-condensing)

Part Number

3203 - 8Xn - * - ** Ex. 3203-8X16-N-ENET

- \( n \) : Any number of outputs from (8) up to (16)
- *: ‘N’ for N-type connector, or else leave it blank
- **: ENET or GPIB

RF Characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impedance</td>
<td>50 Ohms</td>
</tr>
<tr>
<td>Operating Frequency</td>
<td>20 – 1100 MHz</td>
</tr>
<tr>
<td>Isolation (min)</td>
<td>55 dB input / input</td>
</tr>
<tr>
<td></td>
<td>70 dB input / output</td>
</tr>
<tr>
<td></td>
<td>50 dB output / output (Different Input)</td>
</tr>
<tr>
<td></td>
<td>30 dB output / output (Common Input)</td>
</tr>
<tr>
<td>Gain</td>
<td>0 dB +/- 2.0 dB (defines minimum and maximum gain across the specified frequency band)</td>
</tr>
<tr>
<td>Input Power (max)</td>
<td>+20 dBm with no damage</td>
</tr>
<tr>
<td>1 dB Compression Point</td>
<td>+15 dBm</td>
</tr>
<tr>
<td>VSWR (max)</td>
<td>Input 1.8:1</td>
</tr>
<tr>
<td></td>
<td>Output 2.0:1</td>
</tr>
<tr>
<td>3rd Order Output Intercept Point (IP3) min</td>
<td>+26 dBm</td>
</tr>
<tr>
<td>2nd Order Output Intercept Point (IP2) min</td>
<td>+55 dBm</td>
</tr>
<tr>
<td>Noise Figure (max)</td>
<td>20 - 100 MHz 18 dB</td>
</tr>
<tr>
<td></td>
<td>100 - 1100 MHz 17 dB</td>
</tr>
</tbody>
</table>

Part Numbers:

- 3203-8Xn: Any number of outputs from 8 to 16
- *: ‘N’ for N-type connector, or else leave it blank
- **: ENET or GPIB

Photo:

Ex. 3203-8X16-N-ENET

Physical

- Relay Type: Solid State
- I/O Connector Type: SMA Female
- Dimensions: 19” wide standard rack mount
- 3U maximum height (5.25”)
- 25” maximum depth
- Front Panel Color: Gray
- Weight (max): 40 lbs
3204 Series

Features

20 MHz - 200 MHz (IF-band)
Non-Blocking Full Fan-out:
  \( n \) Inputs by \( m \) Outputs (6x6 to 12x12)
Local Control: LCD Touch Screen
Remote Control: RS-232 / ENET or RS-232 / GPIB

Part Number

3204 - nXm - *  Ex. 3204 - 12X12 - ENET

\( n \): Any number of inputs from (6) up to (12)
\( m \): Any number of outputs from (6) up to (12)
* : ENET or GPIB

Description

The 3204 Model is a Non-blocking Full Fan-Out (any input connected to any output simultaneously) solid state switching system which operates from 20 MHz to 200 MHz (IF-band). The system can be configured with maximum (12) SMA type inputs and (12) BNC type outputs; with a starting configuration of 6 inputs by 6 outputs.

The 3204-series is equipped with Windows XP operating system (CPU), LCD touch screen display for local control, and redundant power supplies with LED monitoring on the front panel. Remotely, in addition to RS-232 it is either offered with Ethernet or GPIB control.

Control Interfaces

Local control (on the front panel): All systems are equipped with
  >> 6" LCD Touch Screen Display
  >> Microsoft® Windows® XP Professional Operating System
  >> Removable Hard Drive
  >> Front Panel LED indicators for redundant power supplies

Remote Control (on the rear panel): All versions are equipped with
  >> RS-232 (DP9 female) connector with Baud Rate 9600 bps
  >> SCPI commands

ENET
  >> TCP/IP control via 802.3 protocol (Ethernet)
  >> Supports 10BASE-T/100BASE-T via RJ-45 connector.

GPIB Version:
  >> IEEE-488 with 26 pin female connector

Environment

85-264 VAC, 47-63 Hz, 3-6 A, 250 W (max)
Standard AC grounded power cable (removable, IEC 320 C19 to NEMA 5-15P)
Fuse/Breaker: Externally accessible/replaceable
Storage Temperature: -20 °C to +70 °C
Operating Temperature: 0 °C to +60 °C
Operating Humidity: 10-80% (non-condensing)

Physical

- Relay Type: Solid State
- I/O Connector Type: BNC Female
- Dimensions: 19" wide standard rack mount
  3U maximum height (5.25")
  25" maximum depth
- Front Panel Color: Gray
- Weight (max): 40 lbs

RF Characteristics

- Impedance: 50 Ohms
- Operating Frequency: 20 – 200 MHz
- Isolation (min):
  - 55 dB input / input
  - 65 dB input / output
  - 65 dB output / output (Different Input)
  - 45 dB output / output (Common Input)
- Gain:
  - 0 dB +/- 1.0 dB (defines minimum and maximum gain across the specified frequency band)
- Input Power(max): +15 dBm with no damage
- 1 dB Compression Point: +10 dBm
- VSWR (max):
  - Input: 1.5:1
  - Output: 1.5:1
- 3rd Order Output Intercept Point (IP3) min: +20 dBm
- 2nd Order Output Intercept Point (IP2) min: +35 dBm
- Noise Figure (max): 15 dB
## Features

2 MHz - 32 MHz (HF-band)
Non-Blocking Full Fan-out:
6 Inputs by n Outputs (6x6 to 6x12)
Local Control: LCD Touch Screen
Remote Control: RS-232 / ENET or RS-232 / GPIB

### Description

The 3205 Model is a Non-blocking Full Fan-Out (any input connected to any output simultaneously) solid state switching system which operates from 2 MHz to 32 MHz (HF-band). The system can be configured with maximum (6) SMA type inputs and (12) SMA type outputs; with a starting configuration of 6 inputs by 6 outputs.

The 3205-series is equipped with Windows XP operating system (CPU), LCD touch screen display for local control, and redundant power supplies with LED monitoring on the front panel. Remotely, in addition to it is either offered with Ethernet or GPIB control.

### Control Interfaces

Local control (on the front panel): All systems are equipped with
- > 6” LCD Touch Screen Display
- >> Microsoft® Windows® XP Professional Operating System
- >> Removable Hard Drive
- >> Front Panel LED indicators for redundant power supplies

Remote Control (on the rear panel): All versions are equipped with
- >> RS-232 (DP9 female) connector with Baud Rate 9600 bps
- >> SCPI commands

ENET
- >> TCP/IP control via 802.3 protocol (Ethernet)
- >> Supports 10BASE-T/100BASE-T via RJ-45 connector.

GPIB Version:
- >> IEEE-488 with 26 pin female connector
- >> RS-422 (DP9 female) connector

### Environment

85-264 VAC, 47-63 Hz, 3-6 A, 200 W (max)
Standard AC grounded power cable (removable, IEC 320 C19 to NEMA 5-15P)
Fuse/Breaker:
- Externally accessible/replaceable
Storage Temperature: -20 °C to +70 °C
Operating Temperature: 0 °C to +60 °C
Operating Humidity: 10-80% (non-condensing)

### Part Number

<table>
<thead>
<tr>
<th>3205 - 6Xn - *</th>
<th>Ex. 3205-6X8-GPIB</th>
</tr>
</thead>
<tbody>
<tr>
<td>n : Any number of outputs from (6) up to (12)</td>
<td>* : ENET or GPIB</td>
</tr>
</tbody>
</table>

### Physical

Relay Type: Solid State
I/O Connector Type: BNC Female
Dimensions:
- 19” wide standard rack mount
- 3U maximum height (5.25”)
- 25” maximum depth
Front Panel Color: Gray
Weight (max): 40 lbs

### RF Characteristics

<table>
<thead>
<tr>
<th>Impedance</th>
<th>50 Ohms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Frequency</td>
<td>2.0 – 32 MHz</td>
</tr>
<tr>
<td>Isolation (min)</td>
<td>70 dB input / input</td>
</tr>
<tr>
<td></td>
<td>65 dB input / output</td>
</tr>
<tr>
<td></td>
<td>65 dB output / output (Different Input)</td>
</tr>
<tr>
<td></td>
<td>30 dB output / output (Common Input)</td>
</tr>
<tr>
<td>Gain</td>
<td>0 dB +/– 2.0 dB (defines minimum and maximum gain across the specified frequency band)</td>
</tr>
<tr>
<td>Input Power(max)</td>
<td>+20 dBm with no damage</td>
</tr>
<tr>
<td>1 dB Compression Point</td>
<td>+15 dBm</td>
</tr>
<tr>
<td>VSWR (max)</td>
<td>1.4:1</td>
</tr>
<tr>
<td>Input</td>
<td>1.4:1</td>
</tr>
<tr>
<td>Output</td>
<td>1.4:1</td>
</tr>
<tr>
<td>3rd Order Output Intercept Point (IP3) min</td>
<td>+32 dBm</td>
</tr>
<tr>
<td>2nd Order Output Intercept Point (IP2) min</td>
<td>+60 dBm</td>
</tr>
<tr>
<td>Noise Figure (max)</td>
<td>10 dB</td>
</tr>
</tbody>
</table>
Build Your Own Matrix

Electromechanical RF Switching

Features

Plug and Go switching solution that allows the user to design a RF system using any CANbus coaxial switches together with a kit or a plug-and-go unit.


Description

The Build Your Own Matrix solution offers an ideal setup for engineers who are looking for a low-cost switching solution. It allows the user to design a switching matrix in any way desired by choosing CANbus switches per Table 1 together with a package: Silver or Gold Package. Either package provides both hardware and software that allows the user to interact and control each individual switch using SCPI commands. Refer to applications notes on software control.

The Silver Package consists of a kit with either ENET or GPIB board, patch panel, and RJ-11 harness for the CANbus switches. The user needs to assemble the blocks together to create a communication interface between CANbus switches (purchased seperately - see Table 1) and Ethernet (ENET) or GPIB protocols. Kit Model 5188 allows the user to communicate with the RF switches through TCP/IP protocol over LAN, thus referred to as ENET solution, where on the contrary the Kit Model 5189 offers a GPIB interface instead. Note that a +12VDC power supply is required to drive this switch solution and it is not included.

The draw back with the silver package is that it requires some tedious time of putting together the pieces and it lacks an enclosed ESD proofed system. However, it is very beneficial to be used as a partial solution to a bigger switching design and is ideal to be used within another design.

The Gold Package offers a more sophisticated and cleaner solution enclosed in 1U chassis that is ready to be used by plugging in coaxial switches on the rear panel. Model 6101 is fully equipped with dual power supply, local and remote control interfaces. A 2-line LCD display and a push-button keypad on the front panel allows the user to control the switching system locally. The rear panel of the chassis is populated with (24) CANbus interfaces and with either a RJ-45 (Ethernet interface) or a DP9 male connector (GPIB interface) for remote control. This ultimate solution requires no assembly time and is hassle free. All that is needed - plug in selected CANbus switches (purchased separately) on the rear and autoconfig the unit from the local LCD control - the system is up and running at no time.

In order for the system to distinguish between each CANbus switch, each switch needs to have its own address. Model 5060 is a unit that allows the user to program the switches easily with different addresses. Just plug in the CANbus switch, set a unique binary address via a 8-pin dip-switch, power up the unit, and flip a mechanical switch. A solid green LED will indicate when the CANbus switch has been programmed.

It is strongly advised to include Model 5060 in either choice of package. It gives the user total control over how to interface with each switch at software level, in addition to, providing the user a safety net to re-program switches as needed.

Note: CANbus switches are programmed to a default address by manufactures and needs to be reprogrammed to unique addresses before used with any package.

Silver Package Part Numbers

| 5188  | ENET Kit |
| 5189  | GPIB Kit |
| 5060  | CANbus Address Box |

Gold Package Part Numbers

| 6101 - * | * ENET or GPIB Controller |
| 5060    | CANbus Address Box |

Table 1: Available CANbus Coaxial Switches

<table>
<thead>
<tr>
<th>Normally Open</th>
<th>DPDT</th>
<th>SP3T</th>
<th>SP4T</th>
<th>SP6T</th>
<th>SP8T</th>
<th>SP10T</th>
<th>SP12T</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Latching Self Cut-off</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>N/A</td>
<td>✓</td>
</tr>
<tr>
<td>DC - 18 GHz</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>N/A</td>
<td>✓</td>
</tr>
<tr>
<td>DC - 26.5 GHz</td>
<td>✓</td>
<td>N/A</td>
<td>✓</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>DC - 40 GHz</td>
<td>✓</td>
<td>N/A</td>
<td>✓</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>50 ohm Termination</td>
<td>N/A</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Indicator</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>N/A</td>
<td>✓</td>
</tr>
<tr>
<td>Mounting Bracket</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

* Consult with manufacture on exact part numbers
Build Your Own Matrix

Silver Package

ENET Kit: 5188

(1) Ethernet Translator Board (firmware included)
(1) Patch Panel (can interface up to 12 CANBus switches)
(12) RJ-11 cables with connectors (unassembled)
(2) Feet of a 'straight-through' RJ-45 cable with connector (unassembled)
(1) Phoenix connector plug (for connecting patch panel to Ethernet board)

GPIB Kit: 5189

(1) GPIB Translator Board (firmware included)
(1) Patch Panel (can interface up to 12 CANBus switches)
(12) RJ-11 cable with connectors (unassembled)
(1) Feet of a GPIB ribbon cable with connectors (unassembled)
(1) Phoenix connector plug (for connecting patch panel to GPIB board)

CANBus Address Box: 5060

Since each CANbus needs its own unique address, the CANbus Address Box allows the user to program each switch easily in four step (takes less than 5 minutes):
1. Plug in the CANbus switch via RJ-11 cable to the address box.
2. Power up the box (+12VDC) using any power supplier.
3. Use a 8-bit dip switch to set the address.
4. Flip the programming switch on the box and wait for the blinking green light to turn solid green.

The photo on the right shows the patch panel that comes with Kit 5188 and Kit 5189, and how the CANbus switches are connected. The patch panel in turn will go to a +12 VDC power source, and either to the GPIB or the ENET translator board (provided in respective kit) via the Phoenix connectors. For more information on how to build your own matrix, refer to the following publications on our website at www.dowkey.com:

>> "Creating Your Own RF Switching System": AN2008-08-CYOM
>> "GPIB Software Configuration": AN2008-08-GPIB
>> "ENET Software Configuration": AN2008-08-ENET

Gold Package

Model 6101:

Model 6101 is composed either with an ENET or a GPIB solution in 1U chassis, in addition to built in dual power supplies, (24) CANBus interfaces, and LCD display with keypad control. This series is the ultimate kit for creating your own matrix solution.

Note: A CANBus address box is strongly advised to be used.
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