SWITCH MATRIX CATALOG

SWITCH SOLUTIONS

ELECTROMECHANICAL MATRIX
SOLID STATE MATRIX
FIBER OPTIC MATRIX
FULLY INTEGRATED SYSTEMS

CMP
Dow-Key® Microwave
CORPORATION
A DOVER COMPANY

OUR EXPERTISE, YOUR SWITCH SOLUTION
SINCE 1945

Our Experience

As the world's largest manufacturer of electromechanical switches, Dow-Key Microwave Corporation is committed to providing unparalleled customer service, competitive pricing, on-time delivery, and products that are distinguished by quality and reliability. Founded in 1945, we are the oldest continuously operating switch manufacturer in the United States. Today, we are 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 electronic components and systems.

Quality Assurance

Dow-Key Microwave is a world-class manufacturer with an unparalleled reputation for product quality. Indeed, our space-qualified switches have contributed to the mission success of nearly 100 satellite and launch vehicle programs since 1972. Our commitment to continuous improvement of our products and processes, along with our extensive series of internal and external assessments, ensures compliance with the AS9100 and ISO-9001:2000 standards requirements.

Advanced Capabilities

Dow-Key Microwave's 36,000-square-foot, state-of-the-art manufacturing facility includes two Class 7 clean rooms in order to support our high-reliability space and military projects. To accomplish the engineering, manufacture, and test of our products and assemblies, we invest heavily in capital equipment. This advanced equipment includes a wide array of vector network analyzers and synthesized sources, noise figure measuring equipment, passive inter-modulation (PIM) test stands, thermal/vacuum chambers, RF power sources, and shock and vibration stations for environmental screening, to name just a few.

Your Switch Solution

The best in the RF switch industry, Dow-Key Microwave's engineering team is dedicated to supporting customers through product selection, custom-designed solutions, and RF system integration. Whether your organization needs electromechanical switches, automated test equipment, or space-qualified switching arrays, our engineering team works with your specific requirements to create the optimum RF switching solution. Backed by decades of industry experience, our highly skilled technical staff is continuously improving the quality and variety of our product offering based upon customer needs as well as advances in technology. We offer customers the best value solution for their applications, on budget and on time. Since 1945, our experience is your switch solution.

Rev. 0912

SWITCH MATRICES

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For our other product lines, see seperate Product Catalog and Space Product Brouchure for more details.

ORDERING INFORMATION

At Dow-Key you are not limited to the products in this catalog, as it is intended to be used as a guide in selecting a switch product or switch matrix for a given application. Requests for modification of standard items and their specifications in order to meet specific needs are always welcome. Inquiries regarding custom integrated components or switch assemblies are also always appreciated.

The catalog is subject to change without notification at any time and new product information is constantly being added in the form of press releases through the corporate website at www.dowkey.com. Please visit our website to request quotes, download product materials, for listing of our manufacturer's representative and factory contact information.

Ordering

The information found in this catalog or on www.dowkey.com should be sufficient for you to select a particular Dow-Key product. In those cases where additional information is required, call Dow-Key directly or our local Dow-Key Sales Representative who will provide you with price and delivery information.

When placing your order, please include the part number, product name, quantity, and shipping instructions. In the case of a non-standard product, a full description of desired features must accompany your order to avoid any errors. Send orders to:

Dow-Key Microwave
4822 McGrath Street
Ventura, CA 93003 U.S.A.

Or send them in care of our Sales Representative in your area. A complete listing of our Representatives can be found at www.dowkey.com.

Orders will be accepted by way of U.S. mail, telephone, fax, or email. Confirmation of orders on your standard Purchase Order is required.

Telephone: 805.650.0260
Fax: 805.650.1734
Email: askdk@dowkey.com

Domestic Terms

Net 30 days, F.O.B. Dow-Key plant, Ventura, California, U.S.A. unless otherwise specified. Shipments made to firms are on a C.O.D. basis unless credit has been established or on receipt of advance payment. American Express, MasterCard and Visa are also accepted.

Export Terms

Unless other terms have been agreed upon in advance, export terms are either payment in advance of shipment or against a confirmed irrevocable letter of credit. All prices are F.O.B Ventura, California, U.S.A.

Shipping

Orders within the United States and Canada will be shipped via United Parcel Service Ground unless other instructions are received. Shipment to all other countries will be by customer direction.

Packaging

All products shipped from Dow-Key Microwave, Ventura, California are packaged in accordance with best commercial practices unless otherwise specified in the contract or purchase order.

Delivery

Most standard products are available from within our typical manufacturing lead-time of 4 to 12 weeks after receipt of order.

Source Inspection

Should Customer Source Inspection of product be required, a charge of $300.00 per day per occurrence will apply.

Application and Technical Assistance

Dow-Key provides a knowledgeable and experienced engineering staff to work closely with customers in product design and application development as well as minor modifications to existing standard products. This service is also available for the design of individual specialized switching components or complex switching systems.

Warranty

Dow-Key Microwave Corporation warrants all switch products to be free of defects in material and workmanship for a period of one year after the date of initial shipment. The limit of liability under this warranty is to repair, replace or refund purchase price on any product or part thereof that is returned by the purchaser and proves to be defective after examination by Dow-Key. This warranty does not extend to any products mishandled, misused or subjected to abuse or neglect in storage, transportation or use. Repairs or alterations made without consent or knowledge of Dow-Key Microwave Corporation will invalidate this warranty. This warranty supercedes all others, either expressed or implied.

Return Material Authorization

Please contact Dow-Key to receive a Return Material Authorization (RMA) number prior to returning any item for service. Items returned to Dow-Key without a RMA number are subject to return without evaluation or any work being done. Dow Key will not accept COD freight charges for returned items.

Dow-Key Terms and Conditions

Dow-Key Microwave Corporation Terms and Conditions apply to all orders unless other provisions have been previously agreed upon. A copy of Dow-Key's Terms and Conditions can be found at www.dowkey.com.

Certificate of Compliance

If requested at order placement, a certificate of compliance is available upon shipment.

Minimum Order Amount

Dow-Key's minimum order amount is $300.00.

Product Changes

Dow-Key Microwave Corporation continuously improves products as new technologies, materials and processes become available. We, therefore, reserve the right to alter, amend, discontinue, or replace any product and or specifications in this catalog at our sole discretion without prior notice.

ELECTROMECHANICAL SWITCH MATRICES

DowKey Microwave
CORPORATION
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CMP

1RU Model

2RU Model

Features

Configuration	Multiple Switches (bidirectional): SPDT[3], DPDT, SP3T, SP4T SP6T, SP8T, SP10T, SP12T
Operating Frequency	DC-18 GHz, DC-26.5 GHz or DC-40 GHz
Manual Control	LCD with Keypad (1RU) Touch Screen LCD (2RU-4RU)
Remote Control	**ENET:** Ethernet, Built-In Website, RS-232 and USB port. **GPIB:** IEEE-488, RS-232 and USB port.
Impedance	50-Ohm

Application

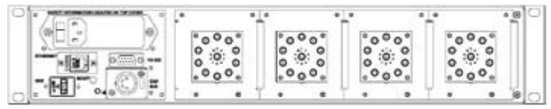
The MS-series is a switch solution populated with individual switches to allow the user to control multiple coaxial switches easily through software.

It gives the user the flexibility to add as many switches as needed (limited to the size of the enclosure) on the rear panel or inside the box starting with a 19" 1RU chassis up to 4RU (and larger enclosures for custom designs).

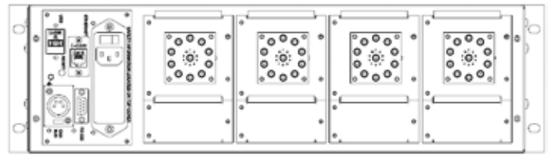
- Switches can be mixed & matched
- Terminated and non-terminated switches
- Normally Open & Latching switches
- Built-in firmware to add, remove and address switches for trouble free switch replacement
- Application configuration available through "configuration file" - transferred via HTTP, USB or COM ports.
- Keeps track of the life of each switch
- Field upgradable firmware via boot loader [1]

Rear View with SP10T Switches

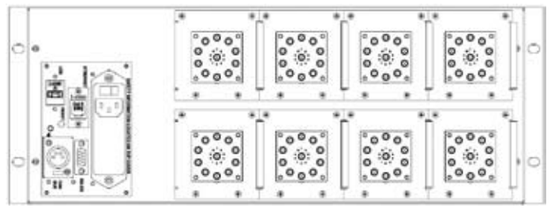
2RU



3RU



4RU



[1] Check Availability

Specifications

Relay Type	Coaxial
I/O Connector Type	SMA Female or N Female
Switching Time	50 ms (incl. control delay)
Operating Life (min)	1,000,000 (cold)
MTBF	30,000-50,000 Hours
Operating Temperature	0 °C to +50 °C
Storage Temperature	-20 °C to +70 °C
Operating Humidity	10-80% non-condensing
Dimensions (max)	19" Wide rack mount 15.25" (1U-2U) & 18.5" (3U-4U) Depth (w/o handles) 1U to 4U Height (1.75" to 7.00")
Weight	Varies per part number
Manual Control	LCD/Keypad or Touch Screen LCD
Remote Control Ethernet or GPIB Option	
ENET Option	Ethernet (TCP/IP), 10/100 BASE-T, built-in website, manual or DHCP IP address assignment
RS-232	DB9 (f), Baud Rate1200 -115200 bps
USB Port	Operates as a virtual RS-232
GPIB Option	GPIB (IEEE-488), RS-232 and USB
Commands/Syntax	Dow-Key SCPI commands
Fuse	Accessible/replaceable on the rear
AC Power Supply	110-240 VAC, 50-60 Hz
Cooling / Venting	Fans as required with 2U-4U models

RF Specifications

(P/N 411L-420832N)

DC-18 GHz, Latching, Non-Terminated				SPDT [3]/ DPDT Switch
Frequency [GHz]	**VSWR Max.**	**Isolation Min. [dB]**	**Insertion Loss Max. [dB]**	**CW Power Max. [W]**
DC-1	**1.10**	**85**	**0.10**	**200**
1-4	**1.20**	**80**	**0.20**	**100**
4-8	**1.30**	**70**	**0.30**	**50**
8-12	**1.40**	**65**	**0.40**	**35**
12-18	**1.50**	**60**	**0.50**	**25**

[3] ADD A TERMINATION TO ONE PORT OF THE DPDT SWITCH TO GET A SPDT SWITCH

(P/N 5x5-5208-3)

DC-18 GHz, Normally Open, Non-Terminated				SP3T - SP6T Switch
Frequency [GHz]	**VSWR Max.**	**Isolation Min. [dB]**	**Insertion Loss Max. [dB]**	**CW Power Max. [W]**
DC-3	1.2	80	0.20	125
3-8	1.3	70	0.30	90
8-12.4	1.4	60	0.40	75
12.4-18	1.5	60	0.50	60

(P/N 4x1KL-420822N, 4x1KL-420823N)

DC-26.5 GHz, Latching, Non-Terminated/Terminated				SP3T - SP6T Switch
Frequency [GHz]	**VSWR Max.**	**Isolation Min. [dB]**	**Insertion Loss Max. [dB]**	**CW Power Max. [W]**
DC-4	1.2	80	0.20	100
4-8	1.3	75	0.30	50
8-12.4	1.4	70	0.40	35
12.4-18	1.5	60	0.50	25
18-26.5	1.8	50	0.80	10

Part Number Selector

MS – 1U 18 S – 4 / 6 – ENET

Chassis Height	Frequency	Connector	Quantity [2]	Switch Type	Terminated	Remote Control
1U = 1.75"	12 = DC-12.5 GHz	N = N female	1 = 1 Switch	2 = SPDT [3]	T = 2W Termination	ENET = Ethernet
2U = 3.50"	18 = DC-18 GHz	S = SMA female	2 = 2 Switches	X = DPDT Transfer	(otherwise leave it	GPIB = GPIB
3U = 5.25"	26 = DC-26.5 GHz [1]	K = 2.9 mm	3 = 3 Switches	3 = SP3T	blank)	
4U = 7.00"	40 = DC-40 GHz [1]		. . .	4 = SP4T		
			8 = 8 Switches	6 = SP6T		
				8 = SP8T		
				10 = SP10T		
				12 = SP12T		

[1] Not available with all switch types.

[2] For 9 and more switches, we can mount inside the chassis. See Appendix A for details.

RF Specifications (cont.)

(P/N 581-520802N)

DC-18 GHz, Normally Open, Non-Terminated				SP8T Switch
Frequency [GHz]	VSWR Max.	Isolation Min. [dB]	Insertion Loss Max. [dB]	CW Power Max. [W]
DC-4	1.25	70	0.20	100
4-8	1.35	65	0.30	70
8-12.4	1.40	60	0.40	60
12.4-16	1.50	60	0.60	50
16-18	1.80	55	0.80	45

(P/N 581-420853N, 581K-420853N)

DC-18 GHz, DC-26.5 GHz, Latching, Terminated				SP8T Switch
Frequency [GHz]	VSWR Max.	Isolation Min. [dB]	Insertion Loss Max. [dB]	CW Power Max. [W]
DC-4	1.20	80	0.20	100
4-8	1.30	75	0.30	90
8-12.4	1.40	70	0.40	75
12.4-18	1.50	60	0.50	60
18-26.5	1.80	55	0.80	45

(P/N 5A1-520802N)

DC-18 GHz, Normally Open, Non-Terminated				SP10T Switch
Frequency [GHz]	VSWR Max.	Isolation Min. [dB]	Insertion Loss Max. [dB]	CW Power Max. [W]
DC-4	1.20	70	0.20	100
4-8	1.30	65	0.30	70
8-12.4	1.40	60	0.40	60
12.4-18	1.60	55	0.60	50

(P/N 5C1-520802N, 5C1-420853N)

DC-18 GHz, Normally Open Non-Term. / Latching Term.				SP12T Switch
Frequency [GHz]	VSWR Max.	Isolation Min. [dB]	Insertion Loss Max. [dB]	CW Power Max. [W]
DC-4	1.20	70	0.20	100
4-8	1.40	65	0.40	50
8-12.4	1.50	60	0.60	35
12.4-18	1.80	60	0.80	25

SEE APPENDIX C FOR SWITCH SCHEMATICS

FOR SWITCHES MOUNTED INSIDE A CHASSIS,
CONTACT DOW-KEY MICROWAVE FOR RF SPECIFICATIONS.

We reserve the right to alter, amend or replace any specifications at our sole discretion and without prior notice.

Front View

Rear View with Ethernet Control Interface

Features

Controller	Allows the user to control Dow-Key RF switches
Configuration	Supports 24 CAN bus switches via RJ11 connectors
Power Supply	110-240 VAC, 100W max.
Manual Control	LCD with Keypad
Remote Controls	**ENET:** Ethernet, Built-In Website, RS-232 and USB port. **GPIB:** IEEE-488, RS-232 and USB port.
Expansion	• Supports > 24 switches • 2nd power supply

Application

The MS-6101 controller offers an ideal switch setup allowing anyone to build their own matrix solution by plugging-in Dow-Key CAN bus controlled switches onto the rear panel. The controller converts CAN interface to either Ethernet or GPIB interface.

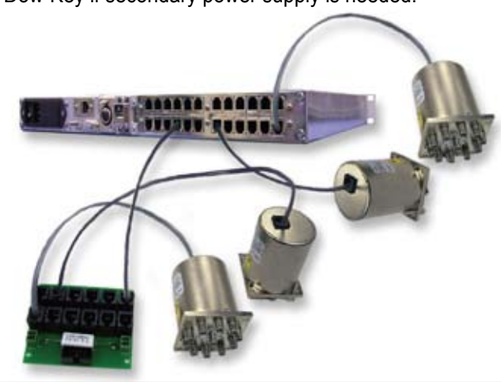
The 1RU controller is outfitted with 24 RJ11 ports on the back to support 24 CAN bus switches and can be expanded to support additional switches as needed by adding patch panels.

CAN bus switches, RJ11-X cables, RJ11 patch panel (for expansion) and secondary power supply are purchased separately.

Input power: The input AC power supply will down convert and distribute DC voltage to all the switches and sub-component (including the patch panel if needed).

What You Need

1. One MS-6101 controller
2. Select any CAN bus controlled switches per Table 1.
3. Get RJ11-6 cable for each switch to plug-in to the controller
4. If more than 24 switches are need, add RJ11 patch panel board for each additional 11 switches and use RJ11-4 cables. Also, check with Dow-Key if secondary power supply is needed.



MS-6101 Specifications

I/O Connector Type	24x RJ11-6
RoHS Compliant	Yes
EMI Shielded Ports	RJ45, USB, RS-232, GPIB, RJ11-6, CAN bus
MTBF	30,000-50,000 Hours
Operating Temperature	0 °C to +50 °C
Storage Temperature	-20 °C to +70 °C
Operating Humidity	10-80% non-condensing
Dimensions (max)	19" Wide rack mount 15.25" Depth 1U Height (1.75")
Weight (approx)	10 lbs

Manual Control	LCD with Keypad
Remote Control Ethernet or GPIB Option	
MS-6101-ENET	Ethernet (TCP/IP), 100/100 BASE-T, HTTP (built-in website,) manual or DHCP IP address assignment
RS-232	DB9 (f), Baud Rate1200 -115200 bps
USB Port	Operates as a virtual RS-232
MS-6101-GPIB	GPIB (IEEE-488), RS-232 and USB
Commands/Syntax	Dow-Key SCPI commands
Switching Time	50 ms (including control delay)
AC Power Supply	110-240 VAC, 50-60 Hz
Fuse	Accessible/replaceable on the rear

TABLE 1

LIST OF CAN BUS SWITCHES

SWITCH TYPE	PART NUMBER	FREQUENCY	ACTUATOR	RF CONNECTOR	TERMINATED
SPDT[3]/ DPDT	411C-420832N	DC-18 GHz	LATCHING	SMA	NO
SPDT[3]/ DPDT	411CY-421132N	DC-40 GHz	LATCHING	2.9 mm (K)	NO
SP3T	535-5208-3	DC-18 GHz	NORMALLY OPEN	SMA	NO
SP3T	431KL-420822N	DC-26.5 GHz	LATCHING	SMA	NO
SP3T	431KL-420823N	DC-26.5 GHz	LATCHING	SMA	YES
SP4T	545-5208-3	DC-18 GHz	NORMALLY OPEN	SMA	NO
SP4T	441KL-420822N	DC-26.5 GHz	LATCHING	SMA	NO
SP4T	441KL-420823N	DC-26.5 GHz	LATCHING	SMA	YES
SP6T	565-5208-3	DC-18 GHz	NORMALLY OPEN	SMA	NO
SP6T	461KL-420822N	DC-26.5 GHz	LATCHING	SMA	NO
SP6T	461KL-420823N	DC-26.5 GHz	LATCHING	SMA	YES
SP8T	581-520802N	DC-18 GHz	NORMALLY OPEN	SMA	NO
SP8T	581K-520802N	DC-26.5 GHz	NORMALLY OPEN	SMA	NO
SP8T	581K-420853N	DC-26.5 GHz	LATCHING	SMA	YES
SP10T	5A1-520802N	DC-18 GHz	NORMALLY OPEN	SMA	NO
SP12T	5C1-520802N	DC-18 GHz	NORMALLY OPEN	SMA	NO
SP12T	5C1-420853N	DC-18 GHz	LATCHING	SMA	YES

[3] ADD A TERMINATION TO ONE PORT OF THE DPDT SWITCH TO GET A SPDT SWITCH

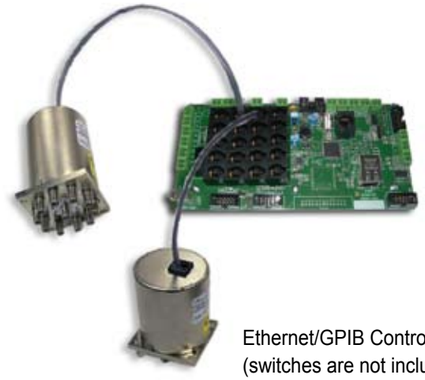
ALL CANBUS SWITCHES USE 12 VDC COILS. IF SWITCH USED WITH MS-6101 CONTROLLER, THE POWER SUPPPLY WILL DOWN CONVERT VAC TO 12 VDC.

CAN Bus Switch Specifications

Relay Type	Coaxial
Impedance	50-Ohm
I/O Connector Type	SMA Female or 2.9 mm Female
Operating Frequency	DC-18 GHz, DC-26.5 GHz or DC-40 GHz
Operating Life (min)	1,000,000 (cold)
Control Interface	CAN Bus control
Coil Voltage	12 Vdc
Program & Control	Through the MS-6101 controller you can add/remove and assign unique CAN ID address to the switch, and track the life of each switch.

List of Part Numbers

Controller	
MS-6101-ENET	Ethernet with LCD/Keypad
MS-6101-GPIB	GPIB with LCD/Keypad
RF Switches	
See Table 1 for part numbers	
Additional Components	
41099-072-X	RJ11-6 cable of X inches length
41099-069-X	RJ11-4 cable of X inches length
41054-028	RJ11 Patch panel board
40090-003	2W, 50-Ohm, Termination



Ethernet/GPIB Controller Board (switches are not included)

Features

MS-ENET	Kit provides software controls via Ethernet, Web-interface, RS-232 and USB port. It includes PCB board and RJ11-4 cables.
MS-GPIB	Kit provides software controls via GPIB (IEEE-488), RS-232 and USB port. It includes PCB board and RJ11-4 cables.
Kit Components Include:	• 1 PCB board for controlling 20 Dow-Key CAN bus switches • 12x RJ11-4 cables
Expansion	Support >20 switches

Application / What you Need

The MS-ENET and MS-GPIB kits are low budget solutions for users who are comfortable to assemble components on their own to build a RF switch solution.

Depending of the type of control, there are two kits available. Either kit consists of an Ethernet/GPIB control board and 12x RJ11-6 cables (to be used with CAN bus switches), where some assembly is required.

RF switches are not included and are purchased separately. Refer to the MS-6101 Controller page for a list of available Dow-Key CAN bus switches (Table 1).

MS-ENET: This kit allows the user to control switches via Ethernet (TCP/IP with manual or DHCP IP address assignment), RS-232, USB and HTTP (built-in website).

MS-GPIB: This kit offers the user GPIB (IEEE-488), RS-232 and USB controls.

MS-Control kits are offered with Dow-Key SCPI commands that gives the user the flexibility to control the switches either directly via GPIB or TCP/IP protocols. These commands can also easily be embedded into customer designed software programs as a “string”.

Application:
Best used for ATE, test-bench and system integrated applications.

What You Need:
1. Select either MS-ENET or MS-GPIB kit
2. Choose any CAN bus controlled switches per Table 1
3. Purchase additional RJ11-6 cable if 13 or more switches are needed.
4. If more than 20 switches are required, purchase RJ11 patch panel board along with RJ11-4 cables. The board support 11 additional switches and can be cascaded to support up to 256 switches.

Specifications / Part Numbers

General	
ENET/GPIB Control Board Dimensions:	3.0” W x 7.0” L
I/O Connector Type	20x RJ11-4
MTBF	30,000-50,000 Hours
Control Board Power	+12 Vdc
Current Draw (max)	300 mA (excl. switches)
Operating Temperature	0 °C to +50 °C
Storage Temperature	-20 °C to +70 °C
Operating Humidity	10-80% non-condensing
Software	
Commands/Syntax	Dow-Key SCPI commands
Switching Time	50 ms (incl. control delay)

Ethernet Kit (Part Number MS-ENET)	
RJ-45 port	Ethernet (TCP/IP), 10/100 BASE-T, HTTP, manual/DHCP IP assignment
RS-232 Port	DB9 (F), Baud Rate1200 -115200 bps
USB Port	Operates as a virtual RS-232
41099-069-36	12x 3 FT RJ11-4 cables (unassembled)
GPIB Kit (Part Number MS-GPIB)	
GPIB Port	IEEE-488, 24-pin female (centronics)
USB Port	Operates as a virtual RS-232
41099-069-36	12x 3 FT RJ11-4 cables (unassembled)
Additional Part Numbers	
41099-069-X	RJ11-4 cable of X inches length
41054-028	RJ11 Patch Panel

3RU Model

Features

Switch Configuration	1xN bidirectional Terminated & Non-Terminated Maximum 1x143
Operating Frequency	DC-18 GHz or DC-26.5 GHz
Manual Control	LCD with Keypad (1RU) Touch Screen LCD (2RU-4RU)
Remote Control	**ENET:** Ethernet, Built-In Website, RS-232 and USB port. **GPIB:** IEEE-488, RS-232 and USB port.
Impedance	50-Ohm

Application

MP-series is a multiplexer with the capability to switch one input to as many as 143 outputs. The input/output ports are bidirectional.

Design starts from 1x13 to 1x143 (1RU-4RU enclosure) and can be customized to support a larger configuration. It is available with maximum frequency at 18 GHz or 26.5 GHz, both terminated and non-terminated options along with SMA or N-type connectors.

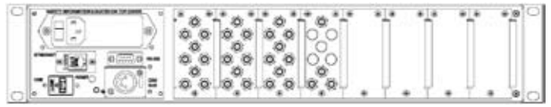
Software Features:

- Built-in firmware to add, remove and address switches for trouble free switch replacement
- Application configuration available through "configuration file" - transferred via HTTP, USB or COM ports.
- Keeps track of the life of each switch
- Field upgradable firmware via boot loader (1)

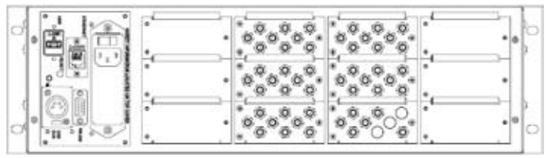
(1) Check Availability

Rear View Samples (2)

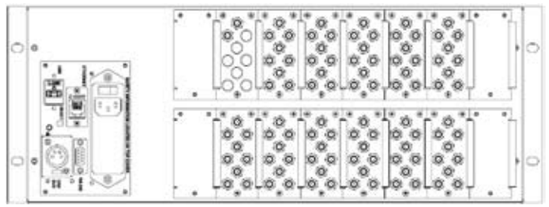
2RU (1x30)



3RU (1x50)



4RU (1x100)



(2) The exact port locations may be different

Specifications

Relay Type	Coaxial
I/O Connector Type	SMA Female or N Female
Switching Time	50 ms (incl. control delay)
Operating Life (min)	1,000,000 (cold)
MTBF	30,000-50,000 Hours
Operating Temperature	0 °C to +50 °C
Storage Temperature	-20 °C to +70 °C
Operating Humidity	10-80% non-condensing
Dimensions (max)	19" Wide rack mount 15.25" (1U-2U) & 18.5" (3U-4U) Depth (w/o handles) 1U to 4U Height (1.75" to 7.00")
Weight	Varies per part number

Manual Control	LCD/Keypad or Touch Screen LCD
Remote Control Ethernet or GPIB Option	
ENET Option	Ethernet (TCP/IP), 10/100 BASE-T, built-in website, manual or DHCP IP address assignment
RS-232	DB9-F, Baud Rate1200 -115200 bps
USB Port	Operates as a virtual RS-232
GPIB Option	GPIB (IEEE-488), RS-232 and USB
Commands/Syntax	Dow-Key SCPI commands
Fuse	Accessible/replaceable on the rear
AC Power Supply	110-240 VAC, 50-60 Hz
Cooling / Venting	Fans as required with 2U-4U models

RF Specifications

THE RF PERFORMANCE FOR ≤1x70 IS SLIGHTLY BETTER.

SP10T AND/OR SP12T SWITCHES MOUNTED ON THE REAR

DC-18 GHz, Non-Terminated, SMA				1x13 to 1x84
Frequency [GHz]	VSWR Max.	Isolation Min. [dB]	Insertion Loss Max. [dB]	CW Power Max. [W]
DC-8	1.4	80	1.0	90
8-12	1.7	80	1.5	60
12-16	1.9	80	2.0	45
16-18	2.4	80	3.0	35

THE RF PERFORMANCE FOR ≤1x100 IS SLIGHTLY BETTER.

SP10T AND/OR SP12T SWITCHES MOUNTED INSIDE THE ENCLOSURE

DC-18 GHz, Non-Terminated, SMA				1X85 to 1X120
Frequency [GHz]	VSWR Max.	Isolation Min. [dB]	Insertion Loss Max. [dB]	CW Power Max. [W]
DC-4	1.4	80	2.5	90
4-8	1.7	80	4.0	60
8-12	1.9	80	5.0	45
12-18	2.4	80	6.5	35

SP12T SWITCHES MOUNTED INSIDE THE ENCLOSURE

DC-18 GHz, Non-Terminated, SMA				1x121 to 1x143
Frequency [GHz]	VSWR Max.	Isolation Min. [dB]	Insertion Loss Max. [dB]	CW Power Max. [W]
DC-4	1.4	80	2.0	90
4-8	1.7	80	3.5	60
8-12	2.0	80	4.5	45
12-18	2.4	80	5.5	35

SEE APPENDIX B FOR MORE RF DATA & APPENDIX C FOR SWITCH SCHEMATICS

We reserve the right to alter, amend or replace any specifications at our sole discretion and without prior notice.

Part Number Selector

MP – 3U 18 S – 100 [ ] – ENET

Chassis Height	Frequency	Connector	Outputs (1)	Terminated	Remote Control
1U = 1.75"	18 = DC-18 GHz	N = N female	1 = 1 Output	T = 2W Termination	ENET = Ethernet
2U = 3.50"	26 = DC-26.5 GHz	S = SMA female	2 = 2 Outputs	(otherwise leave it	GPIB = GPIB
3U = 5.25"			3 = 3 Outputs	blank)	
4U = 7.00"			. . .		
			143 = 143 Outputs		

(1) Maximum outputs vary per following parameters:
For DC-18GHz Switch: Maximum 143 outputs (Non-Terminated & SMA)
Maximum 132 outputs (Terminated & SMA)
Maximum 47 outputs (Non-Terminated or Terminated & N)
For DC-26.5GHz Switch: Maximum 64 outputs (Non-Terminated or Terminated & SMA)

CB-3U18S-6X8-ENET

Features

Switch Configuration	2x2 up to 12x12 Terminated & Non-Terminated
Configuration	Non-Blocking Crossbar
Operating Frequency	DC-18 GHz or DC-26.5 GHz
Manual Control	LCD with Keypad (1RU) Touch Screen LCD (2RU-4RU)
Remote Control	**ENET:** Ethernet, Built-In Website, RS-232 and USB port. **GPIB:** IEEE-488, RS-232 and USB port.
Impedance	50-Ohm

Application

For more complex test setups and signal switching, the CB-series crossbar matrix is an excellent choice. It allows testing of multiple UUT/DUT (units/devices under test) with many input/output signals or high speed communication buses without having to connect and disconnect them from the setup.

A crossbar system can route any input signal to any output port such that the path between the I/O ports is unique at any given time.

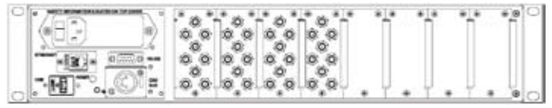
Software Features:

- Built-in firmware to add, remove and address switches for trouble free switch replacement
- Application configuration available through "configuration file" - transferred via HTTP, USB or COM ports.
- Keeps track of the life of each switch
- Field upgradable firmware via boot loader (1)

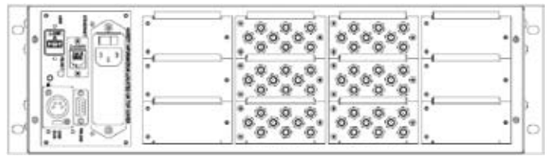
(1) Check Availability

Rear View Samples (2)

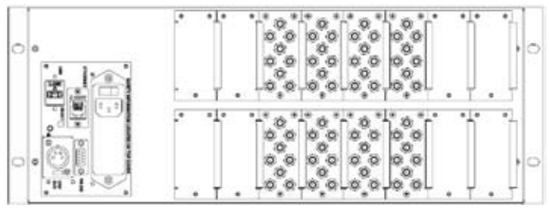
2RU



3RU



4RU



(2) The exact port locations may be different

CAN Bus Specifications

Relay Type	Coaxial, Normally Open
I/O Connector Type	SMA Female or N Female
Switching Time	50 ms (incl. control delay)
Operating Life (min)	1,000,000 (cold)
MTBF	30,000-50,000 Hours
Operating Temperature	0 °C to +50 °C
Storage Temperature	-20 °C to +70 °C
Operating Humidity	10-80% non-condensing
Dimensions (max)	19" Wide rack mount 15.25" (1U-2U) & 18.5" (3U-4U) Depth (w/o handles) 1U to 4U Height (1.75" to 7.00")
Weight	Varies per part number

Manual Control	LCD/Keypad or Touch Screen LCD
Remote Control Ethernet or GPIB Option	
ENET Option	Ethernet (TCP/IP), 10/100 BASE-T, built-in website, manual or DHCP IP address assignment
RS-232	DB9-F, Baud Rate1200 -115200 bps
USB Port	Operates as a virtual RS-232
GPIB Option	GPIB (IEEE-488), RS-232 and USB
Commands/Syntax	Dow-Key SCPI commands
Fuse	Accessible/replaceable on the rear
AC Power Supply	110-240 VAC, 50-60 Hz
Cooling / Venting	Fans as required with 2U-4U models

RF Specifications

SEE APPENDIX C FOR SWITCH SCHEMATICS

SP10T NORMALLY OPEN SWITCHES

DC-18 GHz, Non-Terminated, SMA or N				2x2 to 10x10
Frequency [GHz]	**VSWR**	**Isolation [dB]**	**Insertion Loss [dB]**	**CW Power [W]**
DC-4	1.30	80	2.0	90
4-8	1.35	80	3.0	60
8-12	1.45	80	3.5	45
12-16	1.55	80	4.0	40
16-18	1.80	80	5.0	35

SP12T NORMALLY OPEN SWITCHES

DC-18 GHz, Non-Terminated, SMA or N				11x11 to12x12
Frequency [GHz]	**VSWR**	**Isolation [dB]**	**Insertion Loss [dB]**	**CW Power [W]**
DC-4	1.30	80	2.0	90
4-8	1.45	80	3.5	60
8-12	1.55	80	4.0	45
12-16	1.80	80	4.5	40
16-18	2.00	80	5.5	35

SP10T AND/OR SP12T NORMALLY OPEN/FAILSAFE SWITCHES

DC-18 GHz, Terminated, SMA or N				11Tx12 /12x11T /11Tx11T (MAX)
Frequency [GHz]	**VSWR**	**Isolation [dB]**	**Insertion Loss [dB]**	**CW Power [W]**
DC-4	1.30	80	2.0	90
4-8	1.45	80	3.5	60
8-12	1.65	80	4.0	45
12-16	1.80	80	4.5	40
16-18	2.00	80	5.5	35

We reserve the right to alter, amend or replace any specifications at our sole discretion and without prior notice.

Part Number Selector

CB – 1U 18 S – 4 [ ] x 6 [ ] – ENET

Chassis Height	Frequency	Connector	Number of Inputs (1)	Terminated Inputs	Number of Outputs (1)	Terminated Outputs
1U = 1.75"	18 = DC-18 GHz	N = N female	1 = 1 Input	T = 2W Termination	1 = 1 Output	T = 2W Termination
2U = 3.50"	26 = DC-26.5 GHz	S = SMA female	2 = 2 Inputs	(otherwise leave it	2 = 2 Outputs	(otherwise leave it
3U = 5.25"			3 = 3 Inputs	blank)	3 = 3 Outputs	blank)
4U = 7.00"			. . .		. . .	
			12 = 12 Inputs		12 = 12 Outputs	

Remote Control
ENET = Ethernet
GPIB = GPIB

(1) Maximum Inputs X Outputs per following:
For DC-18GHz Switch: 12 Inputs Non-Terminated X 12 Outputs Non-Terminated
11 Inputs Terminated X 12 Outputs Non-Terminated
12 Inputs Non-Terminated X 12 Outputs Terminated
For DC-26.5GHz Switch: 8 Inputs Terminated X 8 Outputs Terminated

4141 | Crossbar

4141-2/32-GPIB

Features

Maximum I/O ports	2x32 bidirectional Terminated Output ports
Configuration	Non-blocking Crossbar
Operating Frequency	DC-18 GHz
Manual Control	LCD with Keypad
Remote Control	Ethernet/RS-232 or GPIB/RS-232
Impedance	50-Ohm

Part Numbers

4141-2/32-ENET	4141-2/32-GPIB

Application

The 4141 Model is a bidirectional crossbar switch matrix configured with 2 inputs and 32 outputs using cascaded SP8T coaxial switches. The non-connected output ports are terminated to 50-ohm loads.

A crossbar system can route any input signal to any output port such that the path between the I/O ports is unique at any given time.

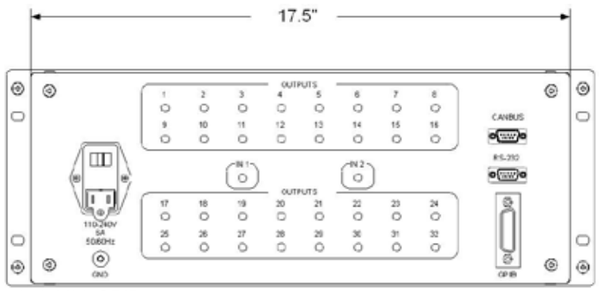
The switches can either be controlled via a LCD with Keypad on the front or remotely via Ethernet or GPIB along with RS-232 serial interface.

The system is best used for RF signal switching among multiple devices. A suggested application is to use it as an expansion port for network analyzers.

SEE APPENDIX C FOR SWITCH SCHEMATIC

RF Specifications & Rear View

2x32				
Frequency [GHz]	**VSWR Max.**	**Isolation Min. [dB]**	**Insert. Loss Max. [dB]**	**CW Power Max. [W]**
DC-8	1.40	70	3.0	10
8-12	1.70	65	4.0	7.5
12-18	1.85	60	5.0	5.0



4141-2/32-GPIB

Specifications

Relay Type	Latching Coaxial
Self-Terminating	2W, 50-Ohm Output Ports
I/O Connector Type	SMA Female
Switching Time (typ)	540 ms (incl. control delay)
Operating Life (min)	1,000,000 (cold)
MTBF	30,000-50,000 Hours
Operating Temperature	0 °C to +50 °C
Storage Temperature	-20 °C to +70 °C
Operating Humidity	10-80% non-condensing
Dimensions (max)	19" Wide rack mount 20" Depth 4U Height (7.00")

Manual Control	4x40 LCD with Keypad
Remote Control Ethernet or GPIB Option	
ENET Option	Ethernet (TCP/IP), 10/100 BASE-T, manual IP address assignment
RS-232	DB9 Female, Baud Rates 9,600 bps
GPIB Option	GPIB (IEEE-488) 24-pin (f) & RS-232
Commands/Syntax	Dow-Key SCPI commands
Switching Time	420 ms approx. (incl. control delay)
Fuse	Accessible/replaceable on the rear
AC Power Supply	85-264 VAC, 47-63 Hz, 150 W
Cooling / Venting	2 Fans / Side-to-Side
Weight (max)	30 lbs

4169 | Crossbar

4169-10/10-ENET

Features

Maximum I/O ports	10x10 bidirectional Normally Open, Phase-Matched Terminated Input & Output ports
Configuration	Non-blocking Crossbar
Operating Frequency	DC-18 GHz
Manual Control	LCD with Keypad
Remote Control	RS-232 with Ethernet or GPIB
Impedance	50-Ohm

Part Numbers

N= # of Inputs / M= # of Outputs

4169-N/M-ENET	4169-N/M-GPIB

Application

Model 4169 is a bidirectional crossbar switch configured with maximum (10) inputs and (10) outputs - all accessible on the front - where unused input and output ports are internally terminated to a 2W/50-ohm load and all paths are phase matched.

A crossbar system can route any input signal to any output port such that the path between the I/O ports is unique at any given time.

This model is equipped with front panel LCD/keypad display for manual and local control, and remotely it can be controlled via RS-232 with the options of Ethernet or GPIB.

It is best used for RF testing where phase matched paths are critical and easy access to connect/ disconnect I/O ports of the UUT is required from the front.

RF Specifications & Rear View

10x10				
Frequency [GHz]	**VSWR Max.**	**Isolation Min. [dB]**	**Insert. Loss Max. [dB]**	**CW Power Max. [W]**
DC-4	1.20	75	2.5	100
4-8	1.35	70	3.0	80
8-12	1.45	65	4.5	60
12-16	1.75	60	6.0	50
16-18	2.00	60	6.7	40

4169

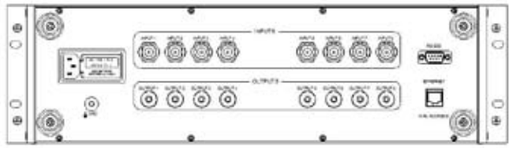
Specifications

Relay Type	Normally Open Coaxial Phased Matched, Terminated
I/O Connector Type	SMA Female
Switching Time (typ)	420 ms (incl. control delay)
Operating Life (min)	1,000,000 (cold)
MTBF	30,000-50,000 Hours
Operating Temperature	0 °C to +50 °C
Storage Temperature	-20 °C to +70 °C
Operating Humidity	10-80% non-condensing
Dimensions (max)	19" Wide rack mount 20" Depth 4U Height (7.00')

Manual Control	4x40 LCD with Keypad
Remote Control Ethernet or GPIB Option	
ENET Option	Ethernet (TCP/IP), 10/100 BASE-T, manual IP address assignment
RS-232	DB9 Female, Baud Rates 9,600 bps
GPIB Option	GPIB (IEEE-488) 24-pin (f) & RS-232
Commands/Syntax	Dow-Key SCPI commands
Switching Time	420 ms approx. (incl. control delay)
Fuse	Accessible/replaceable on the rear
AC Power Supply	85-264 VAC, 47-63 Hz, 150 W
Cooling / Venting	2 Fans / Side-to-Side
Weight (max)	30 lbs

4601 | Fan-Out

4601-8/8-ENET



Features

Input/Output ports	4x4 to 8x8 unidirectional
Configuration	Non-blocking Full Fan-Out
Operating Frequency	1-18 GHz
Manual Control	LCD Touch Screen
Remote Control	Ethernet
Power Supply	Redundant power supplies
Impedance	50-Ohm

Part Numbers

N= # of Inputs / M= # of Output

4601-N/M-ENET	N=M: 4x4, 5x5, 6x6, 7x7, 8x8

Application

The 4601 Model is an unidirectional 50-ohm Fan-Out switch matrix configured with a maximum of 8 inputs and 8 outputs. The RF inputs are first amplified with high linearity amplifiers (to compensate for the insertion loss) and then divided using 4-way power dividers before being routed to SP8T coaxial switches terminated to 2W/50-ohm loads. Hence, the frequency band is limited to 1-18 GHz.

A fan-out matrix divides all the RF inputs such that it can switch any input to one or more (all) outputs simultaneously.

The 4601-series is equipped with MS Windows based PC, removable SATA hard drive, redundant power supplies with LED monitoring on the front panel. Locally it can be controlled via an LCD touch screen and remotely with Ethernet.

RF Specifications

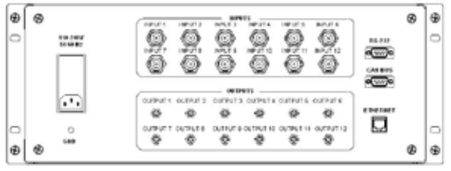
	4x4 to 8x8
VSWR (max)	2.50:1 input & output
Isolation (min)	60 dB input/input
	60 dB input/output
	60 dB output/output (different input)
	18 dB output/output (common input)
Gain	0 dB ± 2.0 dB
Gain Flatness	0.5 dB max over any “rolling” 100 MHz span, 8.0 dB max across 1-18 GHz
Survivable Input Power	+20 dBm (max) no damage
1dB Compression (min)	+5 dBm input
3rd Order Intercept (min)	+10 dBm
2nd Order Intercept (min)	+20 dBm
Noise Figure (max)	11 dB

Specifications

Relay Type	Latching Terminated Coaxial
Other Components	Amplifiers, Power Dividers
I/O Connector Type	N (f) inputs / SMA (f) outputs
Switching Time (min)	300 ms (incl. control delay)
Operating Life (cold)	1,000,000 per position
MTBF	30,000-50,000 Hours
Dimensions (max)	19” wide rack mount 20” Depth 3U Height (5.25”)
Operating Temperature	0 °C to +50 °C
Storage Temperature	-20 °C to +70 °C
Operating Humidity	10-80% non-condensing
Weight (max)	50 lbs

Local Control	6.5” LCD Touch Screen (640x480)
Remote Control	Ethernet TCP/IP, 10/100/1000 BASE-T
Commands/Syntax	Dow-Key SCPI commands
Operating System	Microsoft Windows 7 or later RS-232 gives access to the built-in PC
Hard drive	160 GB (min) SATA HD / removable
CPU/ Memory	Embedded Intel processor / 2G RAM (min)
Power Supply	120-240 VAC, 50-60 Hz, 2A-1A, 250W (max) Power switch with guard on the front and LED indicators for redundancy
Fuse	Accessible/replaceable on the rear
Cooling / Venting	2 Fans / Side-to-Side

4701-12/12-ENET



Features

Input/Output ports	9x9 to 12x12 unidirectional
Configuration	Non-blocking Full Fan-Out
Operating Frequency	1-18 GHz
Manual Control	LCD Touch Screen
Remote Control	Ethernet
Power Supply	Redundant power supplies
Impedance	50-Ohm

Part Numbers

N= # of Inputs / M= # of Output

4701-N/M-ENET	N=M: 9x9, 10x10, 11x11, 12x12

Application

The 4701 Model is an unidirectional 50-ohm Fan-Out switch matrix configured with a maximum of 12 inputs and 12 outputs. The RF inputs are first amplified with high linearity amplifiers (to compensate for the insertion loss) and then divided using 4-way and 3-way power dividers before being routed to terminated SP12T coaxial switches with 2W/50-ohm loads. Hence, the frequency band is limited to 1-18 GHz.

A fan-out matrix divides all the RF inputs such that it can switch any input to one or more (all) outputs simultaneously.

The 4701-series is equipped with MS Windows based PC, removable SATA hard drive, redundant power supplies with LED monitoring on the front panel. Locally it can be controlled via an LCD touch screen and remotely with Ethernet.

RF Specifications

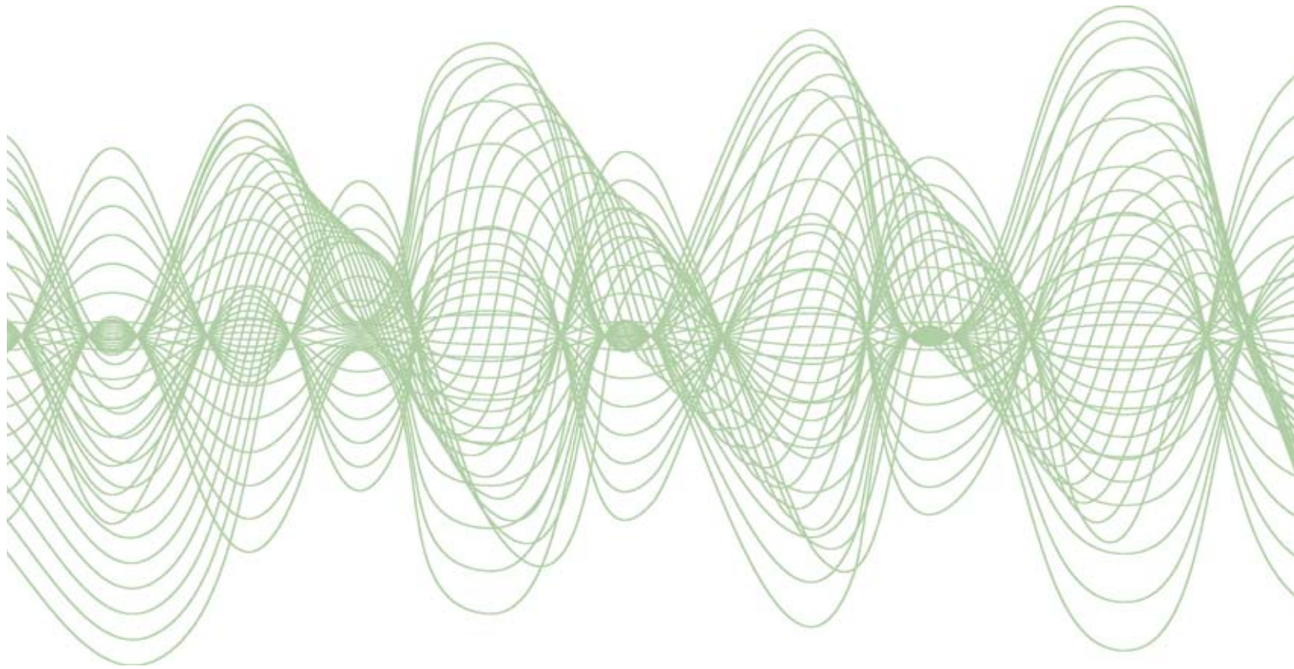
	9x9 to 12x12
VSWR (max)	2.50:1 input & output
Isolation (min)	60 dB input/input
	60 dB input/output
	60 dB output/output (different input)
	18 dB output/output (common input)
Gain	0 dB ± 2.0 dB
Gain Flatness	0.5 dB max over any “rolling” 100 MHz span, 8.0 dB max across 1-18 GHz
Survivable Input Power	+15 dBm (max) do damage
1dB Compression (min)	+5 dBm input
3rd Order Intercept (min)	+10 dBm
2nd Order Intercept (min)	+20 dBm
Noise Figure (max)	11 dB

Specifications

Relay Type	Latching Terminated Coaxial
Other Components	Amplifiers, Power Dividers
I/O Connector Type	N (f) inputs / SMA (f) outputs
Switching Time (min)	300 ms (incl. control delay)
Operating Life (cold)	1,000,000 per position
MTBF	30,000-50,000 Hours
Dimensions (max)	19” wide rack mount 20” Depth 4U Height (7.00)
Operating Temperature	0 °C to +50 °C
Storage Temperature	-20 °C to +70 °C
Operating Humidity	10-80% non-condensing
Weight (max)	50 lbs

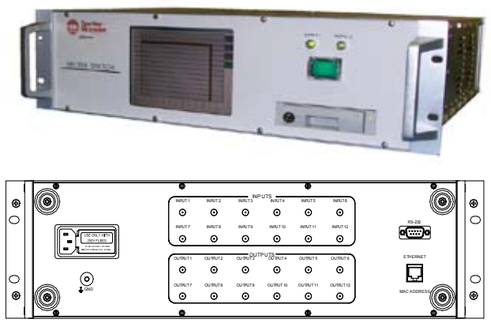
Local Control	6.5” LCD Touch Screen (640x480)
Remote Control	Ethernet TCP/IP, 10/100/1000 BASE-T
Commands/Syntax	Dow-Key SCPI commands
Operating System	Microsoft Windows 7 or later RS-232 gives access to the built-in PC
Hard drive	160 GB (min) SATA HD / removable
CPU/ Memory	Embedded Intel processor / 2G RAM (min)
Power Supply	120-240 VAC, 50-60 Hz, 2A-1A, 250W (max) Power switch with guard on the front and LED indicators for redundancy
Fuse	Accessible/replaceable on the rear
Cooling / Venting	2 Fans / Side-to-Side

SOLID STATE MATRICES



DownKey Microwave
CORPORATION
A DOVER COMPANY
CMP

3202| L-band Fan-Out



3202

Features

Input/Output ports	6x6 to 12x12 unidirectional
Configuration	Non-blocking Full Fan-Out
Operating Frequency	800-2500 MHz
Manual Control	LCD Touch Screen
Remote Control	Ethernet
Power Supply	Redundant power supplies
Impedance	50-Ohm

Part Numbers

N= # of Inputs / M= # of Output

3202	(12x12)	3202-NXM-ENET
3202-8X16-ENET	(8X16)	N=M: 6x6, 8x8,10x10

Application

The 3202 Model is a non-blocking full fan-0ut solid state switch matrix operating from 800 MHz to 2500 MHz (L-band). The system can be configured with maximum 12 inputs and 12 outputs or as 8 by 16.

As a fan-out matrix, the input RF signals are amplified and divided across every output such that each input signal can be switched to all output ports simultaneously.

This model is equipped with a MS Windows based PC, removable SATA hard drive and redundant power supplies with LED monitoring on the front panel. Locally it can be controlled via an LCD touch screen and remotely with Ethernet.

This model is ideal for SATCOM applications where high density RF switching (transmitting and receiving) for narrowband, low frequency and low power applications are required.

RF Characteristics

	6x6 to 12x12, 8x16
VSWR (max)	1.80:1 input & output
Isolation (min)	55 dB input/input
	55 dB input/output
	55 dB output/output (different input)
	40 dB output/output (common input)
Gain	0 dB ± 2.0 dB
Gain Flatness	0.5 dB max over any 50 MHz span 800-950 MHz & 2250-2500 MHz
Survivable Input Power	+20 dBm (max) no damage
1dB Compression (min)	+12 dBm input
3rd Order Intercept (min)	+25 dBm
2nd Order Intercept (min)	+30 dBm
Noise Figure (max)	15 dB

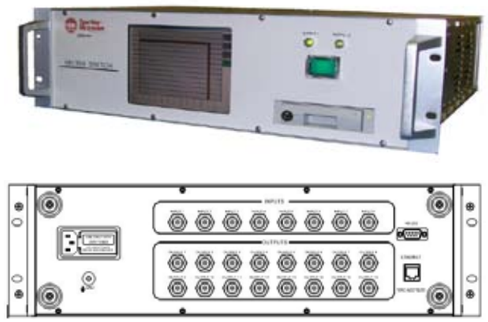
Specifications

Relay Type	Solid State
Other Components	Amplifiers, Power Dividers
I/O Connector Type	SMA female
Switching Time (typ)	100 ms (incl. control delay)
MTBF	25,000-50,000 Hours
Dimensions (max)	19” wide rack mount 21” Depth 3U Height (5.25”)
Operating Temperature	0 °C to +50 °C
Storage Temperature	-20 °C to +70 °C
Operating Humidity	10-80% non-condensing
Weight (max)	40 lbs

Local Control	6.5” LCD Touch Screen (640x480)
Remote Control	Ethernet TCP/IP, 10/100/1000 BASE-T
Commands/Syntax	Dow-Key SCPI commands
Operating System	Microsoft Windows 7 or later RS-232 gives access to the built-in PC
Hard drive	160 GB (min) SATA HD / removable
CPU/ Memory	Embedded Intel processor / 2G RAM (min)
Power Supply	120-240 VAC, 50-60 Hz, 3-6A, 250W (max) Power ON/OFF switch with guard on the front and LED indicators for redundancy
Fuse	Accessible/replaceable on the rear
Cooling / Venting	4 fans / side-to-side

We reserve the right to alter, amend or replace any specifications at our sole discretion and without prior notice.

3203 | VHF-band Fan-Out



3203

Features

Input/Output ports	8x8 or 8x16 unidirectional
Configuration	Non-blocking Full Fan-Out
Operating Frequency	20-1100 MHz
Manual Control	LCD Touch Screen
Remote Control	Ethernet
Power Supply	Redundant power supplies
Impedance	50-Ohm

Part Numbers

3203	(8X16)	3203-8X8-ENET	(8X8)

Application

The 3203 Model is a non-blocking full fan-out solid state switch matrix operating from 10 MHz to 1100 MHz (VHF-band). The system can be configured with a maximum 8 inputs and 16 outputs.

As a fan-out matrix, the input RF signals are amplified and divided across every output such that each input signal can be switched to all output ports simultaneously.

The 3203 series is equipped with a MS Windows based PC, LCD touch screen display with GUI for manual control and redundant power supplies with LED monitoring on the front panel. Remotely, it is controlled using Ethernet.

This model is ideal for SATCOM applications where high density RF switching (transmitting and receiving) for narrowband, low frequency and low power applications are required.

RF Characteristics

	8x8 to 8x16
VSWR (max)	1.80:1 input & output
Isolation (min)	55 dB input/input
	55 dB input/output
	55 dB output/output (different input)
	30 dB output/output (common input)
Gain	0 dB ± 2.0 dB
Survivable Input Power	+25 dBm (max) no damage
1dB Compression (min)	+15 dBm input
3rd Order Intercept (min)	+25 dBm
2nd Order Intercept (min)	+55 dBm
Noise Figure (max)	14 dB

Specifications

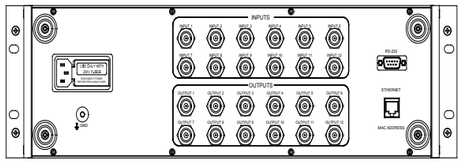
Relay Type	Solid State
Other Components	Amplifiers, 8-way Power Dividers
I/O Connector Type	BNC female
Switching Time (typ)	100 ms (incl. control delay)
MTBF	25,000-50,000 Hours
Dimensions (max)	19” wide rack mount 21” Depth 3U Height (5.25”)
Operating Temperature	0 °C to +50 °C
Storage Temperature	-20 °C to +70 °C
Operating Humidity	10-80% non-condensing
Weight (max)	40 lbs

Local Control	6.5” LCD Touch Screen (640x480)
Remote Control	Ethernet TCP/IP, 10/100/1000 BASE-T
Commands/Syntax	Dow-Key SCPI commands
Operating System	Microsoft Windows 7 or later RS-232 gives access to the built-in PC
Hard drive	160 GB (min) SATA HD / removable
CPU/ Memory	Embedded Intel processor / 2G RAM (min)
Power Supply	120-240 VAC, 50-60 Hz, 3-6A, 250W (max) Power ON/OFF switch with guard on the front and LED indicators for redundancy
Fuse	Accessible/replaceable on the rear
Cooling / Venting	4 fans / side-to-side

We reserve the right to alter, amend or replace any specifications at our sole discretion and without prior notice.

3204| IF-band Fan-Out

3204



Features

Input/Output ports	6x6 to 12x12 unidirectional
Configuration	Non-blocking Full Fan-Out
Operating Frequency	20-200 MHz
Manual Control	LCD Touch Screen
Remote Control	Ethernet
Power Supply	Redundant power supplies
Impedance	50-Ohm

Part Numbers

N= # of Inputs / M= # of Output

3204	(12x12)	3204-NXM-ENET
		N=M: 6x6, 8x8, 10x10

Application

The 3204 Model is a non-blocking full fan-out solid state switching system operating from 20 MHz to 200 MHz (IF-band). The system can be configured to a maximum of 12 inputs and 12 outputs.

As a fan-out matrix, the input RF signals are divided across every output such that each input signal can be switched to all output ports simultaneously.

This model is equipped with a MS Windows based PC, removable SATA hard drive and redundant power supplies with LED monitoring on the front panel. Locally it can be controlled via an LCD touch screen and remotely with Ethernet.

This model is ideal for SATCOM applications where high density RF switching (transmitting and receiving) for narrowband, low frequency and low power applications are required.

RF Characteristics

	6x6 to 12x12
VSWR (max)	1.50:1 input & output
Isolation (min)	55 dB input/input
	55 dB input/output
	55 dB output/output (different input)
	40 dB output/output (common input)
Gain	0 dB ± 1.0 dB
Gain Flatness	0.5 dB max over any 70 MHz span
Survivable Input Power	+15 dBm (max) no damage
1dB Compression (min)	+10 dBm input
3rd Order Intercept (min)	+20 dBm
2nd Order Intercept (min)	+35 dBm
Noise Figure (max)	15 dB

Specifications

Relay Type	Solid State
Other Components	Amplifiers, Power Dividers
I/O Connector Type	SMA female
Switching Time (typ)	100 ms (incl. control delay)
MTBF	25,000-50,000 Hours
Dimensions (max)	19” wide rack mount 21” Depth 3U Height (5.25”)
Operating Temperature	0 °C to +50 °C
Storage Temperature	-20 °C to +70 °C
Operating Humidity	10-80% non-condensing
Weight (max)	40 lbs

Local Control	6.5” LCD Touch Screen (640x480)
Remote Control	Ethernet TCP/IP, 10/100/1000 BASE-T
Commands/Syntax	Dow-Key SCPI commands
Operating System	Microsoft Windows 7 or later RS-232 gives access to the built-in PC
Hard drive	160 GB (min) SATA HD / removable
CPU/ Memory	Embedded Intel processor / 2G RAM (min)
Power Supply	120-240 VAC, 50-60 Hz, 3-6A, 250W (max) Power ON/OFF switch with guard on the front and LED indicators for redundancy
Fuse	Accessible/replaceable on the rear
Cooling / Venting	4 fans / side-to-side

We reserve the right to alter, amend or replace any specifications at our sole discretion and without prior notice.

3205

Features

Input/Output ports	6x6 to 12x12 unidirectional
Configuration	Non-blocking Full Fan-Out
Operating Frequency	2-32 MHz
Manual Control	LCD Touch Screen
Remote Control	Ethernet
Power Supply	Redundant power supplies
Impedance	50-Ohm

Part Numbers

3205	(6X12)	3205-6X6-ENET	(6X6)

Application

The 3205 Model is a non-blocking full fan-out solid state switching system operating from 2 MHz to 32 MHz (HF-band). The system can be configured with a maximum 6 inputs and 12 outputs

As a fan-out matrix, the input RF signals are divided across every output such that each input signal can be switched to all output ports simultaneously.

This model is equipped with a MS Windows based PC, removable SATA hard drive and redundant power supplies with LED monitoring on the front panel. Locally it can be controlled via an LCD touch screen and remotely with Ethernet.

This model is ideal for SATCOM applications where high density RF switching (transmitting and receiving) for narrowband, low frequency and low power applications are required.

RF Characteristics

	6x6 to 6x12
VSWR (max)	1.80:1 input & output
Isolation (min)	50 dB input/input
	50 dB input/output
	50 dB output/output (different input)
	30 dB output/output (common input)
Gain	0 dB ± 2.0 dB
Survivable Input Power	+25 dBm (max) no damage
1dB Compression (min)	+15 dBm input
3rd Order Intercept (min)	+30 dBm
2nd Order Intercept (min)	+60 dBm
Noise Figure (max)	10 dB

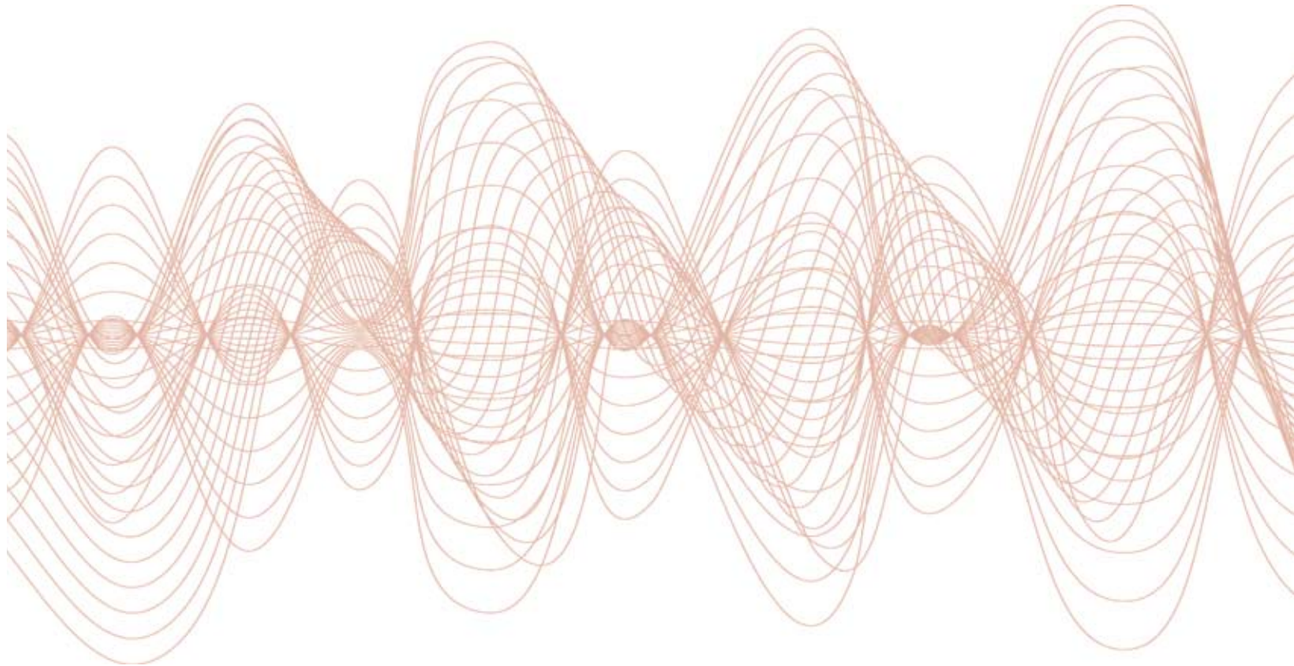
Specifications

Relay Type	Electromechanical Relay
Other Components	Amplifiers, Power Dividers
I/O Connector Type	SMA female
Switching Time (typ)	100 ms (incl. control delay)
MTBF	25,000-50,000 Hours
Dimensions (max)	19” wide rack mount 21” Depth 3U Height (5.25”)
Operating Temperature	0 °C to +50 °C
Storage Temperature	-20 °C to +70 °C
Operating Humidity	10-80% non-condensing
Weight (max)	40 lbs

Local Control	6.5” LCD Touch Screen (640x480)
Remote Control	Ethernet TCP/IP, 10/100/1000 BASE-T
Commands/Syntax	Dow-Key SCPI commands
Operating System	Microsoft Windows 7 or later RS-232 gives access to the built-in PC
Hard drive	160 GB (min) SATA HD / removable
CPU/ Memory	Embedded Intel processor / 2G RAM (min)
Power Supply	120-240 VAC, 50-60 Hz, 3-6A, 250 W (max) Power ON/OFF switch with guard on the front and LED indicators for redundancy
Fuse	Accessible/replaceable on the rear
Cooling / Venting	4 fans / side-to-side

We reserve the right to alter, amend or replace any specifications at our sole discretion and without prior notice.

FIBER OPTIC MATRICES



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7001 | C-band Crossbar/Fan-Out

7001

Features

Input/Output Configurations	16x16 Matrix utilized as 8x14 Crossbar with two 1x4 Fan-Out Segments
Operating Frequency	1530-1565 nm (C-band)
Manual Control	LCD Touch Screen
Remote Control	Ethernet

Part Number

7001

Application

The 7001 models is a non-blocking 16x16 matrix with MEMS optical switches and splitters and it is configured as a 8x14 crossbar with two 1x4 fan-out switch segments. It switches input-to-output paths in pure optical domain with a operating wavelength of 1530-1565 nm in C-band.

The crossbar segment routes any input signal to any output port such that the path between the I/O ports is unique at any given time. Whereas the fan-out configuration re-routes outputs 15 &16 back to inputs 9-to-12 & 13-to-16 respectively to make two 1x4 fan-out segments. See appendix C for more details.

This model is equipped with a MS Windows based PC, removable SATA hard drive and redundant power supplies with LED monitoring and guarded power switch on the front panel. Locally it can be controlled through an LCD touch screen with Graphical User Interface (GUI) and remotely through Ethernet.

RF Characteristics

	Crossbar Segment	Fan-Out Segment
Insertion Loss (1) (max)	2 dB	1.60 dB
Crosstalk (max)	-70 dB	-70 dB
Back Reflection (max)	-50 dB	-50 dB
TDL (2) (max)	0.30 dB	0.30 dB
WDL(3) (max)	0.25 dB	0.25 dB
PDL (4) (max)	0.05 dB	0.05 dB
Repeatability (max)	± 0.02 dB	± 0.02 dB
Stability (max)	± 0.02 dB	± 0.02 dB
Optical Power (max)	500 mW	500 mW

(1) Measured at 1550 nm
(2) Time Dependent Loss
(3) Wavelength Dependent Loss specified in ± 20nm range
(4) Polarization Dependent Loss

SEE APPENDIX C FOR SWITCH SCHEMATIC

Specifications

Relay Type	Non-Latching MEMS
I/O Connector Type	LC
Switching Time (max)	35 ms (excl. software delay)
Fiber Type	9/125 μm single mode
Lifetime (min)	10^9 cycles
Dimensions (max)	19” wide full rack 20” Depth 3U Height (5.25”)
Operating Temperature	0 °C to +50 °C
Storage Temperature	-20 °C to +65 °C
Operating Humidity	10-80% non-condensing
Weight (typ)	30 lbs

Local Control	6.5” (640x480) LCD Touch Screen GUI USB port for keyboard or mouse
Remote Control	Ethernet (TCP/IP)
Fault & Error Reporting	via Ethernet and LCD (visual)
Commands/Syntax	Dow-Key SCPI commands
Operating System	Microsoft Windows
Hard drive (min)	120 GB SATA HD / removable
Power Supply	120-240 VAC, 50-60 Hz, 250 W (max) Power ON/OFF switch with guard on the front and LED indicators for redundancy
Fuse	Accessible/replaceable on the rear
Cooling / Venting	2 fans / side-to-side

7002

Features

Input/Output Configurations	16x16 Matrix utilized as 14x15 crossbar with a 1x2 Fan-Out Segment
Operating Frequency	1530-1560 nm (C-band)
Manual Control	LCD Touch Screen
Remote Control	Ethernet

Part Number

7002

Application

The 7002 models is a non-blocking 16x16 matrix with MEMS optical switches and splitters and it is configured as a 14x15 crossbar with a 1x2 fan-out switch segment. It switches input-to-output paths in pure optical domain with a operating wavelength of 1530-1565 nm in C-band.

The crossbar segment routes any input signal to any output port such that the path between the I/O ports is unique at any given time. Whereas the fan-out segment amplifies output 16 and re-routes it to input 15 & 16 to configure a 1x2 fan-out switch. See appendix C for more details.

This model is equipped with a MS Windows based PC, removable SATA hard drive and redundant power supplies with LED monitoring and guarded power switch on the front panel. Locally it can be controlled through an LCD touch screen with Graphical User Interface (GUI) and remotely through Ethernet.

RF Characteristics

	Crossbar Segment	Fan-Out Segment
Insertion Loss (1) (max)	2 dB	5.4 dB
Crosstalk (max)	-70 dB	-70 dB
Back Reflection (max)	-47 dB	-47 dB
TDL (2) (max)	0.40 dB	0.55 dB
PDL (3) (max)	0.20 dB	0.30 dB
Repeatability (max)	± 0.04 dB	± 0.04 dB
Optical Power (max)	500 mW	500 mW

(1) Measured at 1550 nm
(2) Time Dependent Loss
(3) Polarization Dependent Loss

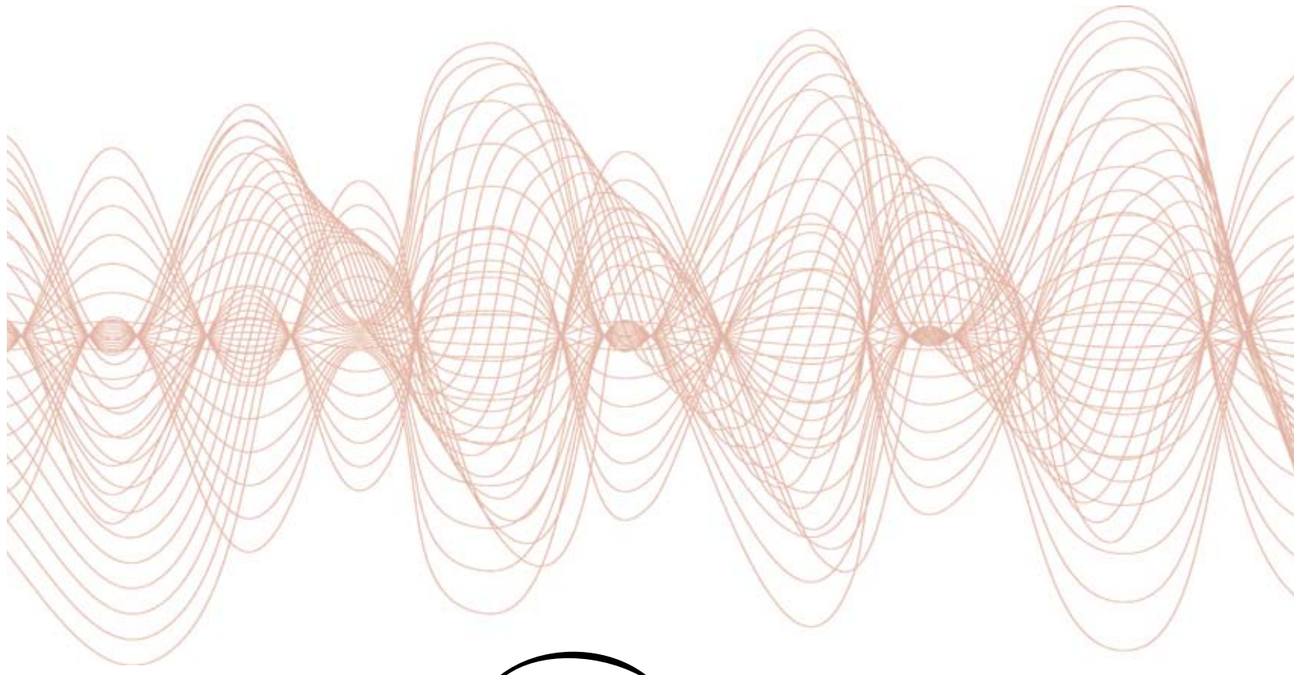
SEE APPENDIX C FOR SWITCH SCHEMATIC

Specifications

Relay Type	Non-Latching MEMS
I/O Connector Type	FC/APC
Switching Time (max)	35 ms (excl. software delay)
Filter Type	9 μm single mode
Lifetime (min)	10^9 cycles
Dimensions (max)	19” wide full rack 20” Depth 3U Height (5.25”)
Operating Temperature	0 °C to +50 °C
Storage Temperature	-20 °C to +65 °C
Operating Humidity	10-80% non-condensing
Weight (typ)	30 lbs

Local Control	6.5” (640x480) LCD Touch Screen GUI USB port for keyboard or mouse
Remote Control	Ethernet (TCP/IP)
Fault & Error Reporting	via Ethernet and LCD (visual)
Commands/Syntax	Dow-Key SCPI commands
Operating System	Microsoft Windows
Hard drive (min)	120 GB SATA HD / removable
Power Supply	120-240 VAC, 50-60 Hz, 250 W (max) Power ON/OFF switch with guard on the front and LED indicators for redundancy
Fuse	Accessible/replaceable on the rear
Cooling / Venting	2 fans / side-to-side

INTEGRATED SWITCH SYSTEM CAPABILITIES



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5096 | C-band Fan-Out

5096

Features

Input/Output ports	16x32 expandable to 32x64 unidirectional
Configuration	Non-blocking Full Fan-Out
Operating Frequency	3.4-4.2 GHz (C-band)
Manual Control	LCD Touch Screen
Remote Control	RS-422
Impedance	50-Ohm

Part Numbers

5096	(32x64)	5263	(16x64)

Application

The C-band non-blocking fan-out solid state switch model is ideal for SATCOM applications with a narrow band operating frequency of 3.4-4.2 GHz. It can be configured to maximum 16 inputs and 64 outputs and is a fully integrated 19" rack 34U modular system using (8) sub-modules (32x64):

1x Controller module (3U)
2x 16x64 Input modules (3U ea.)
4x 32x16 Output modules (6U ea.)
1x Fan Control module (1U)

The system is fully controlled through the Controller module, which is equipped with a MS Windows based PC, removable SATA hard drive and multiple power supplies. Locally it can be controlled via an LCD touch screen and remotely with RS-422.

On the rear panel, the Input and the Output Modules are interconnected using 9-pin CAN bus D-sub connectors to create a full 16x64 or 32x64 matrix.

RF Characteristics (5096 & 5263)

VSWR (max)	1.3:1 input & output
Isolation (min)	60 dB input/input
	60 dB input/output
	60 dB output/output (different input)
	20 dB output/output (common input)
Gain, any path	-14 dB ± 2 dB @ 3.8 GHz, 20°C
Gain, bal. btw. ch. (max)	± 1.5 dB @ 3.8 GHz, 20°C
Gain Stability	± 0.2 dB over ± 5°C
Gain, variation vs. freq.	± 0.5 dB over any 40 MHz segment
	± 0.5 dB over any 80 MHz segment
	± 1.5 dB over 3.4-4.2 GHz segment
1dB Compression (min)	-5 dBm output
3rd Order Intercept (min)	+4 dBm output
Noise Figure (max)	17 dB
Spurious Outputs (max)	-100 dBm signal dependent
	-70 dBc signal related

Specifications

Relay Type	Solid State
Other Components	Amplifiers, Power Dividers
I/O Connector Type	SMA female
Dimensions (max)	19" wide full rack
	21" Depth
	34U Height (59.5")
Operating Temperature	0 °C to +50 °C
Storage Temperature	-40 °C to +50 °C
Operating Humidity	10-80% non-condensing
Weight (typ)	295 lbs (32x64)

Local Control	6.5" LCD Touch Screen
	USB port for keyboard or mouse
Remote Control	RS-422 with DB9 male
Commands/Syntax	Dow-Key SCPI commands
Operating System	Microsoft Windows
Hard drive	160 GB (min) SATA HD / removable
CPU/ Memory	Embedded Intel processor / 2G RAM (min)
Power Supply	120-240 VAC, 50-60 Hz,1200 W (max)
	(multiple power supplies are included)
Fuse	Accessible/replaceable on the rear
Cooling / Venting	1x 1U Fan Module

5190/5191 | L-band Fan-In/Fan-Out

5190

5191

Features

Input/Output ports	12x48 Transmitter &
	48x12 Receiver
Configuration	12x48 Non-blocking Full Fan-Out
	48x12 Non-blocking Full Fan-In
Operating Frequency	950-2050 MHz (L-band)
Manual Control	LCD Touch Screen
Remote Control	RS-422
Impedance	50-Ohm

Part Numbers

5190 (Receiver)	5191 (Transmitter)

Application

The L-band non-blocking fan-out transmitter and fan-in receiver model is ideal for Teleport SATCOM applications with a narrow band operating frequency of 950-2050 MHz. The transmitter 19"rack is configured with 12 inputs and 48 outputs and the second 19" rack is the receiver tower with 48 inputs and 12 outputs.

Each rack is integrated using modular approach consisting for the following sub-modules:

5190/5191: Both Receiver and Transmitter
Power supply module, Signal monitor panel and Fiber optic receiver

5190: Receiver Only (48x12)
4x 12x12 fan-in module, Main controller and L-Band amplifiers

5191: Transmitter Only (12x48)
4x 12x12 fan-out module and Slave controller

RF Characteristics (5190 & 5191)

VSWR (max)	1.8:1 input & output
Isolation (min)	55 dB input/input
	60 dB input/output
	55 dB output/output (different input)
	40 dB output/output (common input)
Gain, any path	0 dB ± 2.5 dB
Power, Operating (max)	+12 dBm routed to 1output (fan-in)
Power, no damage (max)	+15 dBm routed to 1output (fan-in)
1dB Compression (min)	+10 dBm output
3rd Order Intercept (min)	+21 dBm output
Noise Figure (max)	17 dB (12x48)
	21 dB (48x12)

Specifications

Relay Type	Solid State
Other Components	Amplifiers, Power Dividers & Power Combiners
I/O Connector Type	SMA female
Dimensions (max)	19" wide full rack
	21" Depth
	Height: 16U fan-in /16U fan-out segments plus more modules
Operating Temperature	0 °C to +50 °C
Storage Temperature	-40 °C to +50 °C
Operating Humidity	10-80% non-condensing

Local Control	6.5" LCD Touch Screen
	USB port for keyboard or mouse
Remote Control	RS-422 with DB9 male
Commands/Syntax	Dow-Key SCPI commands
Operating System	Microsoft Windows
Hard drive	160 GB (min) SATA HD / removable
CPU/ Memory	Embedded Intel processor / 2G RAM (min)
Power Supply	120-240 VAC, 50-60 Hz, 3-6 A, 350 W / 12V
	& 50 W / 5 V, redundant power supplies
Fuse	Accessible/replaceable on the rear
Cooling / Venting	As needed within each module

5230 | L-band Fan-In/Fan-Out

5230

Features

Input/Output Configuration	4x48 Non-Blocking Full Fan-Out 48x4 Non-Blocking Full Fan-In 8x2 Electromechanical Matrix(1)
Operating Frequency	950-2050 MHz (L-band)
Manual Control	LCD Touch Screen
Remote Control	2x Ethernet ports, SNMP
Impedance	50-Ohm

Part Number

5230

(1) not discussed on this data sheet

Application

The L-band non-blocking fan-out/fan-in solid state switch model is a compact 4x48 and 48x4 switch matrix solution integrated with a modular approach using (7) sub-modules:

3x 16x4 Fan-in modules (1U ea.)
1x Controller module (3U)
3x 4x16 Fan-out modules (1U ea.)

The system is fully controlled through the Controller module, which is equipped with a MS Windows based PC and two removable and replaceable power supplies cartridges. Locally it can be controlled from an LCD touch screen and remotely via Ethernet with SNMP v1 protocol.

On the rear panel, the fan-in and the fan-out modules are interconnected using RJ11 CAN bus connectors to create a full 4x48 and 48x4 matrix. (The 8x2 switch resides inside the control module)

RF Characteristics (4x48 & 48x4)

VSWR (max)	1.8:1 input & output
Isolation (min)	60 dB input/input
	60 dB input/output
	60 dB output/output (different input)
fan-in only	60 dB output/output (common input)
fan-out only	40 dB output/output (common input)
Gain	+2 dB ± 2 dB
Power, Operating (max)	+3 dBm routed to 1 output (fan-in)
	+14 dBm routed to 1 output (fan-out)
1dB Compression (min)	1 dBm (fan-in)
	8 dBm (fan-out)
3rd Order Intercept (min)	+17 dBm (fan-in), -9 dBm input power
	+24 dBm (fan-out), +6 dBm input power
Noise Figure (max)	20 dB (fan-in)
	18 dB (fan-out)

Specifications

Relay Type	Solid State
Other Components	Amplifiers, Power Dividers & Power Combiners
I/O Connector Type	SMA female
Dimensions (max)	19” Wide 21” Depth 9U Height (15.75”)
Operating Temperature	0 °C to +40 °C
Storage Temperature	-40 °C to +40 °C
Operating Humidity	10-80% non-condensing

Local Control	6.5” LCD Touch Screen GUI USB port for keyboard or mouse
Remote Control	Ethernet with SNMP v1 protocol 2x RJ-45 connectors available
Operating System	Microsoft Windows
Hard drive	160 GB (min) SATA HD / removable
CPU/ Memory	Embedded Intel processor / 2G RAM (min)
Power Supply	120-240 VAC, 50-60 Hz, 2x 300 W (max) 2x power module cartridges, Power ON/OFF switch with guard on the front panel
Fuse	Accessible/replaceable on the rear

APPENDIX
RF DATA & SCHEMATICS

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The Tables are to guide on how to determine the enclosure height for the MS-Series.

Depending on switch type, number of input & output ports and connector type, the number of switches that can be mounted on the rear panel or inside an enclosure varies.

SMA, NON-TERMINATED (NT), TERMINATED (T), MOUNTED ON THE REAR PANEL, 1-8 SWITCHES

	SPDT(1)/DPDT	SP3T	SP4T	SP6T	SP8T	SP10T	SP12T
1RU	5NT, 5T(1)	5NT	5NT	5NT	-	-	-
2RU	4NT, 4T(1)	4NT, 4T	4NT, 4T	4NT, 4T	4NT, 4T	4NT	4NT,4T
3RU	4NT, 4T(1)	-	-	-	-	-	-
4RU	8NT, 8T(1)	8NT, 8T	8NT, 8T	8NT, 8T	8NT, 8T	8NT	8NT, 8T

(1) For SPDT one port on the DPDT switch is externally terminated to 2W 50-ohm load.

SMA, NON-TERMINATED (NT), TERMINATED (T), MOUNTED INSIDE THE MATRIX, 9-35 SWITCHES

	DPDT	SP3T	SP4T	SP6T	SP8T	SP10T	SP12T
1RU	-	-	-	-	-	-	-
2RU	15NT	15NT, 15T	14NT, 14T	10NT, 10T	-	-	-
3RU	18NT	27NT, 27T	21NT, 21T	15NT, 15T	12NT,12T	9NT	-
4RU	24NT	35NT, 35T	28NT, 28T	20NT, 20T	16NT,16T	13NT	11NT, 11T

N, NON-TERMINATED (NT), TERMINATED (T), MOUNTED INSIDE THE MATRIX, 2-16 SWITCHES

	DPDT	SP3T	SP4T	SP6T	SP8T	SP10T	SP12T
1RU	-	-	-	-	-	-	-
2RU	8NT	-	-	3NT	2NT,2T	2NT	-
3RU	12NT	-	-	5NT, 5T	4NT, 4T	3NT	2NT, 2T
4RU	16NT	-	-	6NT, 6T	5NT, 5T	4NT	3NT, 3T

For TNC and BNC connectors contact Dow-Key.

DC-18 GHZ TERMINATED SWITCHES WITH SMA-TYPE CONNECTORS

THE RF PERFORMANCE FOR ≤1x56 IS SLIGHTLY BETTER.

VARIOUS SWITCH COMBINATIONS MOUNTED ON THE REAR

DC-18 GHz, Terminated, SMA				1x13 to 1x85
Frequency [GHz]	VSWR Max.	Isolation Min. [dB]	Insertion Loss Max. [dB]	CW Power Max. [W]
DC-4	1.4	80	1.0	90
4-8	1.8	80	1.5	60
8-12	2.0	80	2.0	45
12-18	2.6	80	3.0	35

SP10 & SP12T SWITCHES MOUNTED INSIDE THE ENCLOSURE

DC-18 GHz, Terminated, SMA				1x86 to 1x132
Frequency [GHz]	VSWR Max.	Isolation Min. [dB]	Insertion Loss Max. [dB]	CW Power Max. [W]
DC-4	1.4	80	3.0	90
4-8	1.8	80	4.5	60
8-12	2.0	80	5.5	45
12-18	2.6	80	7.5	35

DC-18 GHZ SWITCHES WITH N-TYPE CONNECTORS

SP10T MOUNTED INSIDE THE ENCLOSURE

DC-18 GHz, Non-Terminated, N				1x13 to 1x47
Frequency [GHz]	VSWR Max.	Isolation Min. [dB]	Insertion Loss Max. [dB]	CW Power Max. [W]
DC-4	1.4	80	2.0	90
4-8	1.6	80	3.0	60
8-12	1.8	80	4.0	45
12-18	2.2	80	5.5	35

SP8T & SP10T SWITCHES MOUNTED INSIDE THE ENCLOSURE

DC-18 GHz, Terminated, N				1x13 to 1x47
Frequency [GHz]	VSWR Max.	Isolation Min. [dB]	Insertion Loss Max. [dB]	CW Power Max. [W]
DC-4	1.4	80	2.5	90
4-8	1.6	80	4.0	60
8-12	1.8	80	5.0	45
12-18	2.1	80	6.5	35

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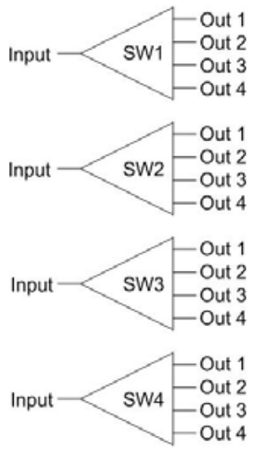
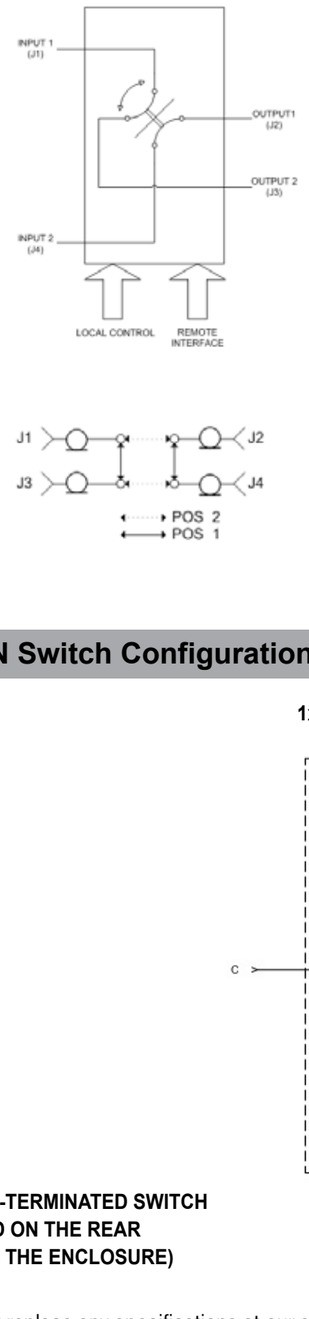
MS-SERIES: Exmaple of Individual Switches

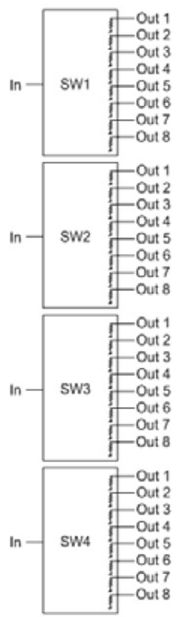
4x SP4T NON-TERMINATED SWITCH



1x DPDT SWITCH

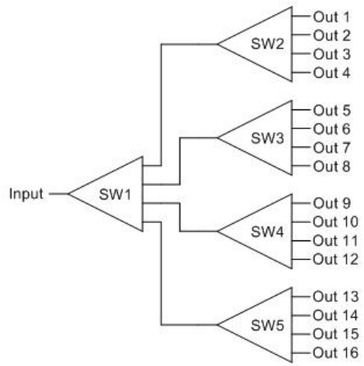


4x SP8T TERMINATED SWITCH

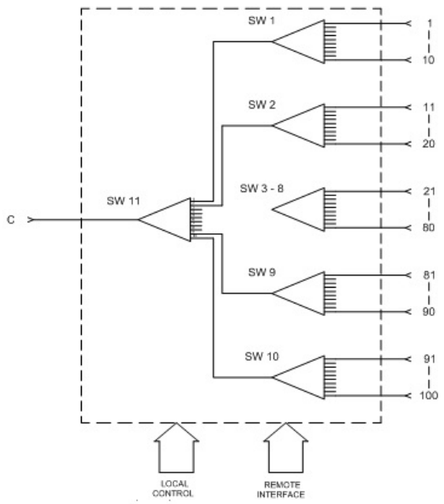


MP-SERIES: Example of 1xN Switch Configurations

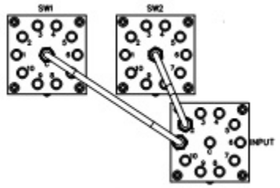
1x16 NON-TERMINATED SWITCH



1x100 NON-TERMINATED SWITCH



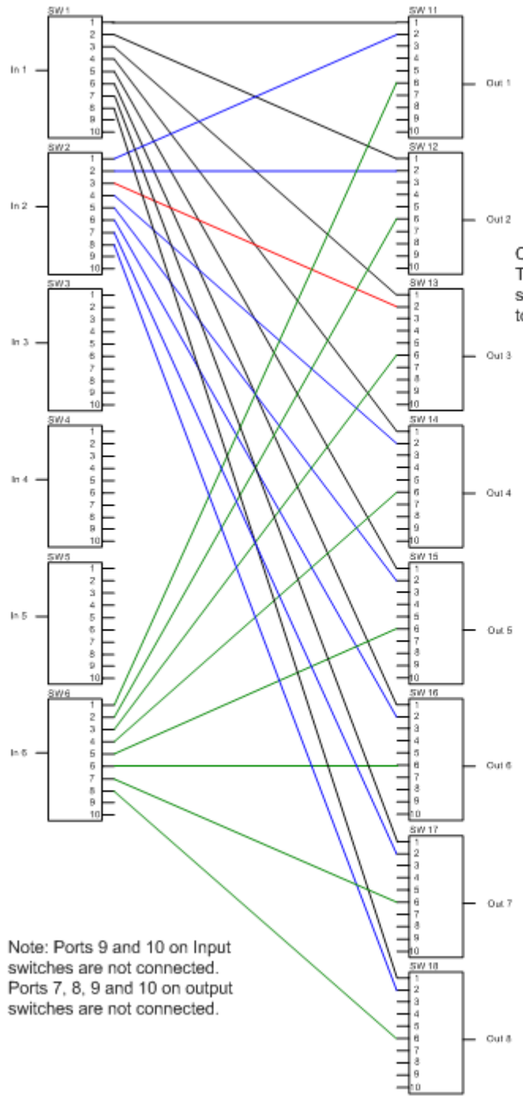
1x20 NON-TERMINATED SWITCH MOUNTED ON THE REAR (OUTSIDE THE ENCLOSURE)



We reserve the right to alter, amend or replace any specifications at our sole discretion and without prior notice.

CB-SERIES: Example of Crossbar Switch Configurations

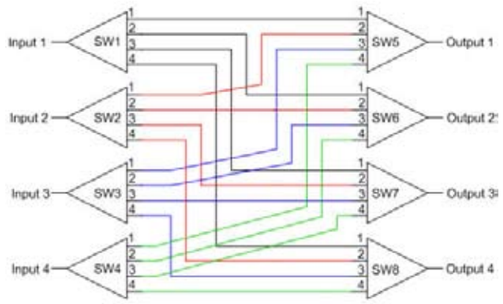
6X8 NON-TERMINATED SWITCH



Connection example:
To connect Input 2 to Output 3 close switch 2 to position 3 and switch 13 to position 2.

Note: Ports 9 and 10 on Input switches are not connected. Ports 7, 8, 9 and 10 on output switches are not connected.

4X4 NON-TERMINATED SWITCH



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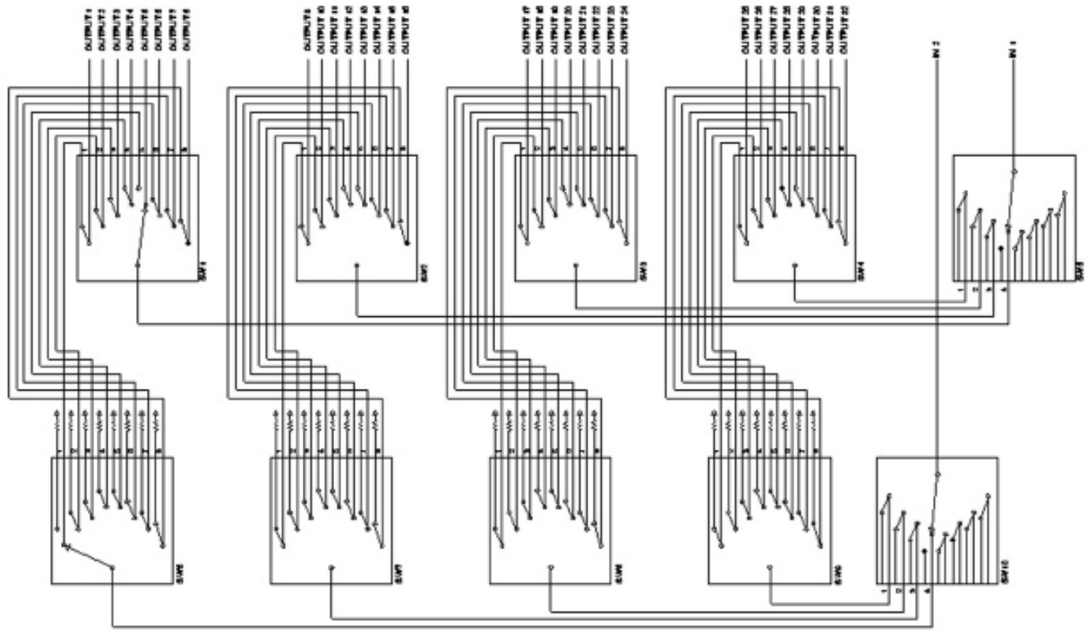
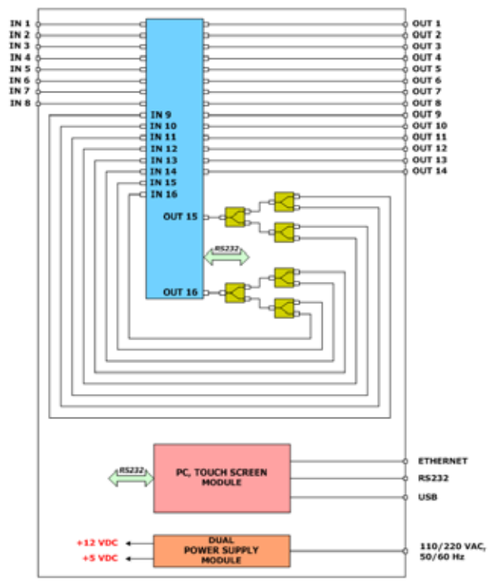
Appendix C — Switch Schematics

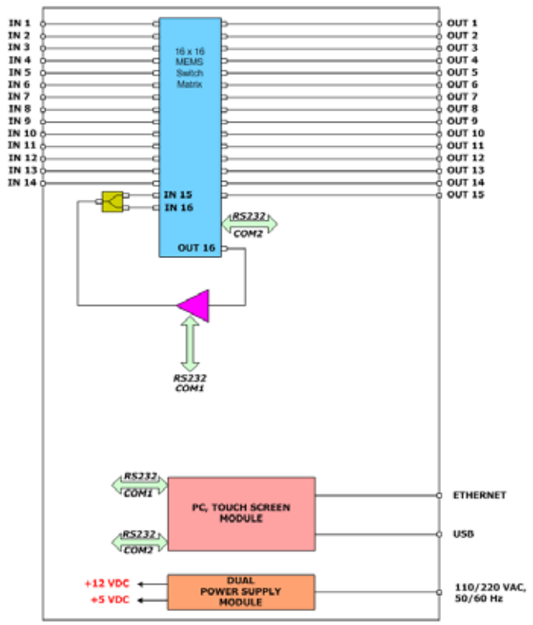
MODEL 4141: 2X32 Switch Configuration



7001 Switch Configuration



7002 Switch Configuration



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