

**System 40**  
**Custom Coaxial RF**  
**Signal Routing Systems**  
Instruction Manual

Contains Operating and Servicing Information

**KEITHLEY**

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# System 40 Custom Coaxial RF Signal Routing Systems Instruction Manual

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# Manual Print History

The print history shown below lists the printing dates of all Revisions and Addenda created for this manual. The Revision Level letter increases alphabetically as the manual undergoes subsequent updates. Addenda, which are released between Revisions, contain important change information that the user should incorporate immediately into the manual. Addenda are numbered sequentially. When a new Revision is created, all Addenda associated with the previous Revision of the manual are incorporated into the new Revision of the manual. Each new Revision includes a revised copy of this print history page.

Revision A (Document Number 40MWS-901-01) .....	January 1999
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# Safety Precautions

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The following safety precautions should be observed before using this product and any associated instrumentation. Although some instruments and accessories would normally be used with non-hazardous voltages, there are situations where hazardous conditions may be present.

This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury. Read the operating information carefully before using the product.

The types of product users are:

**Responsible body** is the individual or group responsible for the use and maintenance of equipment, for ensuring that the equipment is operated within its specifications and operating limits, and for ensuring that operators are adequately trained.

**Operators** use the product for its intended function. They must be trained in electrical safety procedures and proper use of the instrument. They must be protected from electric shock and contact with hazardous live circuits.

**Maintenance personnel** perform routine procedures on the product to keep it operating, for example, setting the line voltage or replacing consumable materials. Maintenance procedures are described in the manual. The procedures explicitly state if the operator may perform them. Otherwise, they should be performed only by service personnel.

**Service personnel** are trained to work on live circuits, and perform safe installations and repairs of products. Only properly trained service personnel may perform installation and service procedures.

Exercise extreme caution when a shock hazard is present. Lethal voltage may be present on cable connector jacks or test fixtures. The American National Standards Institute (ANSI) states that a shock hazard exists when voltage levels greater than 30V RMS, 42.4V peak, or 60VDC are present. **A good safety practice is to expect that hazardous voltage is present in any unknown circuit before measuring.**

Users of this product must be protected from electric shock at all times. The responsible body must ensure that users are prevented access and/or insulated from every connection point. In some cases, connections must be exposed to potential human contact. Product users in these circumstances must be trained to protect themselves from the risk of electric shock. If the circuit is capable of operating at or above 1000 volts, **no conductive part of the circuit may be exposed.**

As described in the International Electrotechnical Commission (IEC) Standard IEC 664, digital multimeter measuring circuits (e.g., Keithley Models 175A, 199, 2000, 2001, 2002, and 2010) are Installation Category II. All other instruments' signal terminals are Installation Category I and must not be connected to mains.

Do not connect switching cards directly to unlimited power circuits. They are intended to be used with impedance limited sources. NEVER connect switching cards directly to AC mains. When connecting sources to switching cards, install protective devices to limit fault current and voltage to the card.

Before operating an instrument, make sure the line cord is connected to a properly grounded power receptacle. Inspect the connecting cables, test leads, and jumpers for possible wear, cracks, or breaks before each use.

For maximum safety, do not touch the product, test cables, or any other instruments while power is applied to the circuit under test. ALWAYS remove power from the entire test system and discharge any capacitors before: connecting or disconnecting cables or jumpers, installing or removing switching cards, or making internal changes, such as installing or removing jumpers.

Do not touch any object that could provide a current path to the common side of the circuit under test or power line (earth) ground. Always make measurements with dry hands while standing on a dry, insulated surface capable of withstanding the voltage being measured.


The instrument and accessories must be used in accordance with its specifications and operating instructions or the safety of the equipment may be impaired.


Do not exceed the maximum signal levels of the instruments and accessories, as defined in the specifications and operating information, and as shown on the instrument or test fixture panels, or switching card.


When fuses are used in a product, replace with same type and rating for continued protection against fire hazard.

Chassis connections must only be used as shield connections for measuring circuits, NOT as safety earth ground connections.

If you are using a test fixture, keep the lid closed while power is applied to the device under test. Safe operation requires the use of a lid interlock.

If a  screw is present, connect it to safety earth ground using the wire recommended in the user documentation.

The  symbol on an instrument indicates that the user should refer to the operating instructions located in the manual.

The  symbol on an instrument shows that it can source or measure 1000 volts or more, including the combined effect of normal and common mode voltages. Use standard safety precautions to avoid personal contact with these voltages.

The **WARNING** heading in a manual explains dangers that might result in personal injury or death. Always read the associated information very carefully before performing the indicated procedure.

The **CAUTION** heading in a manual explains hazards that could damage the instrument. Such damage may invalidate the warranty.

Instrumentation and accessories shall not be connected to humans.

Before performing any maintenance, disconnect the line cord and all test cables.

To maintain protection from electric shock and fire, replacement components in mains circuits, including the power transformer, test leads, and input jacks, must be purchased from Keithley Instruments. Standard fuses, with applicable national safety approvals, may be used if the rating and type are the same. Other components that are not safety related may be purchased from other suppliers as long as they are equivalent to the original component. (Note that selected parts should be purchased only through Keithley Instruments to maintain accuracy and functionality of the product.) If you are unsure about the applicability of a replacement component, call a Keithley Instruments office for information.

To clean an instrument, use a damp cloth or mild, water based cleaner. Clean the exterior of the instrument only. Do not apply cleaner directly to the instrument or allow liquids to enter or spill on the instrument. Products that consist of a circuit board with no case or chassis (e.g., data acquisition board for installation into a computer) should never require cleaning if handled according to instructions. If the board becomes contaminated and operation is affected, the board should be returned to the factory for proper cleaning/servicing.

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# 1

# Installation

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## Introduction

System 40 Custom Coaxial RF Signal Routing Systems provide an integrated signal routing solution designed and built to customer specifications. The System 40 typically includes a Keithley Model 7001 or 7002 switch control unit, microwave coaxial switches, a power supply, and a 19-inch rack mount assembly. The IEEE-488 compatible switch controller operates the coaxial switches and provides an easy to read display of switch status. Switch control algorithms are pre-programmed and stored in the switch control unit's non-volatile memory at the factory. If desired, the switch system can be reconfigured by reprogramming the controller for new applications.

Due to the custom nature of the System 40, this Instruction Manual contains general system instructions. Specific information for your system is provided in the as-built documentation package.

System 40 documentation consists of:

- System 40 Custom Coaxial RF Signal Routing Systems Instruction Manual
- Model 7001 or 7002 Switch System Manual
- Additional Keithley standard product manuals per system configuration
- As-built documentation package including:
  - Component list
  - Wiring list
  - Programming list

## Warranty

Warranty information is located at the front of this manual. Note that coaxial switches are warranted for a period of one year or their specified lifetime.

## System 40 installation guidelines

- WARNING**     **The information on the following pages is intended for qualified service personnel only. Do not attempt these procedures unless you are qualified to do so.**
- CAUTION**     **To prevent flexing of the connections and possible damage, ensure that the Model 7020-MWS card is secured with its thumbscrew to the Model 7001/2 rear panel, and that the cable assembly is secured with its two screws to the 7020-MWS card.**

## Fixed rack installation

System 40 systems are either shelf mounted or mounted directly in a rack.

### Rack mount

**Table 1-1**

*System 40 rack assembly parts*

Quantity	Description	Keithley part number	Function
2	Bracket, rear support	BR-21B	Attaches chassis rear to rear rack rails.
4	10-32 × 3/8 Phillips pan head screw	10-32x3/8 PPH	Attaches rear support brackets to chassis.
8	Fastener, captive nut	FA-148	Attaches rear support brackets and front panel to rails.
8	10-32 × 5/8 Phillips pan head screw	10-32x5/8 PPH	

### Parts list

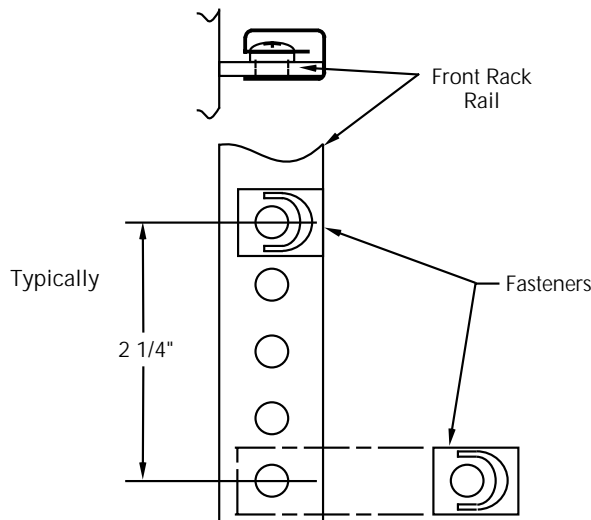
Table 1-1 lists the supplied parts required to rack mount a typical System 40 chassis.

### Rack preparation

1. Select a location in the rack.
2. Hold up the system at the selected location in the rack. The four slotted mounting holes in the front panel dictate the location of the captive nut fasteners on the front rack rails. Mark where the fasteners are to be installed.
3. Referring to Figure 1-1, install four fasteners so the captive nuts are located behind the appropriate holes on the front rack rails.

**Figure 1-1**

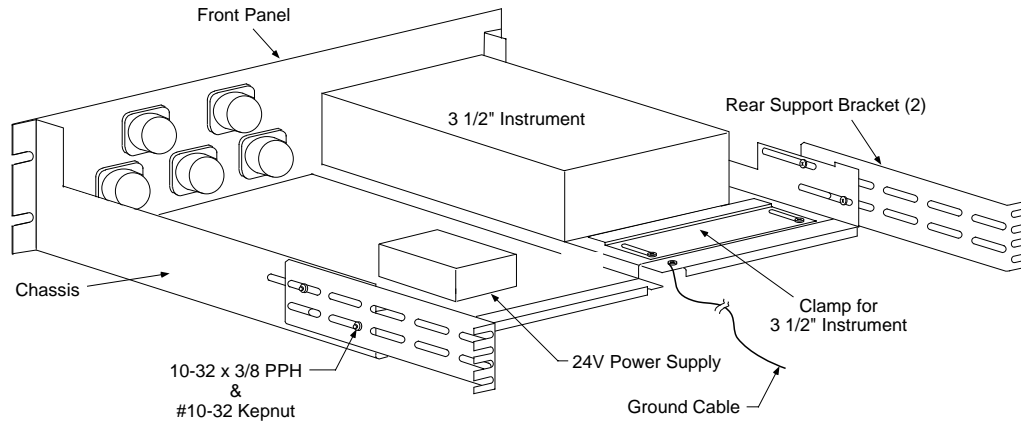
*Fastener installation*



## System installation

Refer to Figure 1-2 to install the chassis and support brackets in the rack.

**Figure 1-2**  
Mounting kit installation



1. Loosely attach the rear support brackets to the chassis with kepnuts and 10-32  $\times$   $\frac{3}{8}$  screws.
2. Position the chassis assembly in the rack to adjust the support brackets, and note the location for the captive nut fasteners on the rear rack rails.
3. Install four fasteners so the captive nuts are located behind the appropriate holes on the rear rack rails.
4. Loosely attach the chassis assembly to the front and rear rack rails with 10-32  $\times$   $\frac{5}{8}$  screws. Secure the rear support brackets to the chassis.
5. Tighten all screws.

**WARNING**      **The System 40 must be separately connected to a safety earth ground to maintain protection against possible shock hazard. Failure to connect the unit to a safety earth ground may result in personal injury or death due to an electric shock.**

## Shelf mount

### Rack preparation

1. Select a position in the rack. In most cases, the weight of the System 40 dictates a position in the lower half of the rack. The System 40 typically takes up 10.5" of vertical space.

**NOTE**      *The chassis must be mounted at a height that is an increment of 1 3/4" from the top or bottom of the rack. Attempting to mount the mainframe at a non-incremental height will lead to difficulties with hole alignment.*

2. Install chassis support assemblies in the rack and secure them.
3. Lift the System 40 onto the chassis supports and slide it into the rack.
4. The chassis can be secured to the front rack flanges with binder head screws.

### System earth ground installation

1. Remove all power from the system.
2. Connect the loose end of the six foot green/yellow ground cable to a quality ground located within your facility using the #10 screw provided.

## Power and control connections

Line power, switch control signals and computer control signals must be connected prior to system operation. RF switch control signals are connected from the 7020-MWS\QCC switch card, installed in the 7001/2 mainframe, to the System 40 chassis mounted RF switch terminals using a ribbon cable terminated with a 96-pin DIN connector. One piece System 40's may be shipped from the factory with this cable connected, two piece systems must be connected after rack installation. The ribbon cable 96-pin DIN connector label identifies the mating 7020-MWS connector. Secure the connectors by tightening the two captive mounting screws located on the ribbon cable connector.

**WARNING** Before beginning any wiring procedures, make sure all power is off.

**CAUTION** 96-pin DIN connectors must be securely fastened to the 7020-MWS card or damage to the card may occur.

5. Connect Model 7001 or 7002 line power and IEEE-488 interface cable as described in the Switch System Manual.
6. Connect the RF switch power supply line cord to the same AC power source circuit as the switch mainframe.

## Coaxial cable installation

System 40 is configured with RF and microwave connectors suitable for the specified operating frequency range. Mating connectors must be clean, must meet connector type interface specifications, and must be tightened to the appropriate torque specification.

**WARNING** Contact with exposed conductors carrying RF power may cause burns. Place protective caps on all unused switch inputs. All cables and connectors should be properly mated and shielded.

**CAUTION** Mating connectors with out of tolerance pin depths may destroy the connector. Verify pin depth before mating connectors.

## Coaxial connector cleaning

Connector interfaces must be free of foreign material to prevent performance degradation. Visually inspect the connector using a 4X to 10X magnifying lens. Try to blow foreign material off the connector using canned air. (Canned air is recommended due to the presence of moisture and oils in air supplied by standard industrial compressors.) Use a lint free miniature cleaning swab moistened with clean isopropyl alcohol to wipe off any remaining foreign material.

## Coaxial connector mating

1. Remove all power to the system before installing cables.
2. Connect cables to System 40 connectors and tighten using a  $\frac{5}{16}$  inch torque wrench, to 7-10 in.-lb for SMA type connectors. Type-N connectors may be connected finger tight. Refer to as-built documentation for other connector types.

**CAUTION** Application of excessive torque may damage connector.

# 2

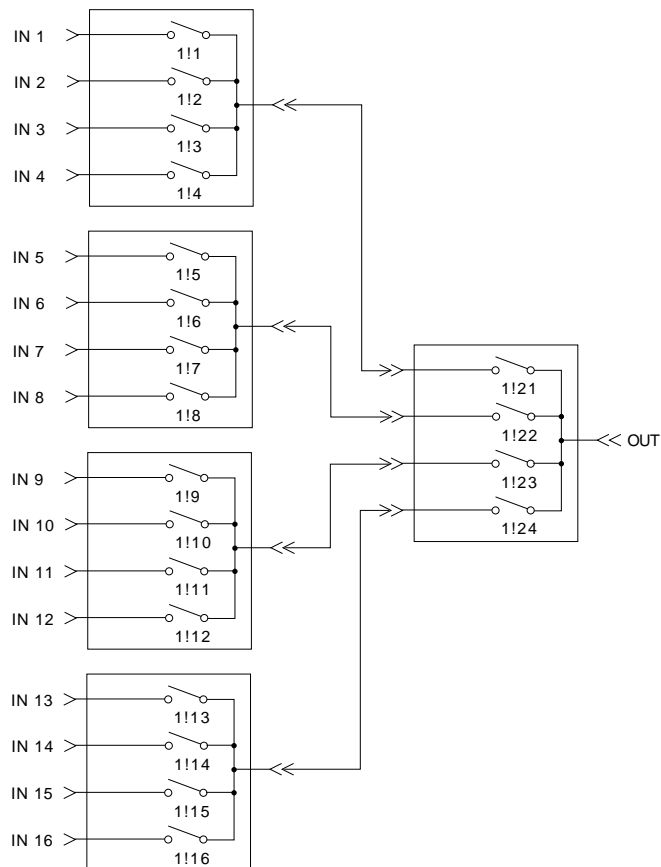
# Operation

## Introduction

System 40 Custom Microwave Switch Systems are derived from the Keithley Model 7116-MWS. Because each System 40 is unique, the 7116-MWS will be used to represent a typical configuration for switch system operating principles and troubleshooting procedures.

The Model 7116-MWS system is a 16-input microwave multiplexer. Sixteen inputs are achieved by connecting five single-pole, four-throw switches together forming a tree switching network as shown in Figure 2-1.

**Figure 2-1**  
*Tree switching network*



## Operating instructions

To select an input channel, the Model 7001 must close two switches at the same time. Table 2-1 lists which Model 7020-MWS digital outputs must be activated to select each respective RF input. The table also shows 7001 channels used to select the inputs.

**Table 2-1**

*Model 7001 channels and memory locations for 1x16 multiplexer*

7116-MWS Input	7020-MWS Digital Outputs				7001 Channels	7001 Memory Location	7116-MWS Relays
	Bank A	Bank B	Bank C	Bank D			
Ch. 1	OUT 1		OUT 21		1!1,1!21	M1	K1, K5
Ch. 2	OUT 2		OUT 21		1!2,1!21	M2	
Ch. 3	OUT 3		OUT 21		1!3,1!21	M3	
Ch. 4	OUT 4		OUT 21		1!4,1!21	M4	
Ch. 5	OUT 5		OUT 22		1!5,1!22	M5	K2, K5
Ch. 6	OUT 6		OUT 22		1!6,1!22	M6	
Ch. 7	OUT 7		OUT 22		1!7,1!22	M7	
Ch. 8	OUT 8		OUT 22		1!8,1!22	M8	
Ch. 9		OUT 9	OUT 23		1!9,1!23	M9	K3, K5
Ch. 10		OUT 10	OUT 23		1!10,1!23	M10	
Ch. 11		OUT 11	OUT 23		1!11,1!23	M11	
Ch. 12		OUT 12	OUT 23		1!12,1!23	M12	
Ch. 13		OUT 13	OUT 24		1!13,1!24	M13	K4, K5
Ch. 14		OUT 14	OUT 24		1!14,1!24	M14	
Ch. 15		OUT 15	OUT 24		1!15,1!24	M15	
Ch. 16		OUT 16	OUT 24		1!16,1!24	M16	

Output patterns for each input are stored in the Model 7001 memory at the factory. The user can call up memory locations to select each input. For example, calling up memory location 1 selects input 1. Some programming examples are listed below.

```
PRINT #1,"output 7; :close (@ 1!1,1!21)"           'Channels select input 1
PRINT #1,"output 7; :close (@ M1)"               'Memory location 1 selects input 1
```

**NOTE**

*Information stored in non-volatile memory will be lost if power is applied to the switch mainframe when switch cards, such as the 7020-MWS, have been removed. To assure memory remains as factory programmed, never power up the mainframe with a switch card removed.*

*In either configuration of the Model 7116-MWS, as one 1 × 16 multiplexer or, with the semi-rigid jumper cables removed, as five 1 × 4 multiplexers, ensure that only one channel is closed per relay, and that no more than two relays are energized simultaneously per bank.*

For further information on operation and programming, refer to the Models 7001 and 7020 Instruction Manuals.

## Switch life

The life of a switch is usually specified in cycles, that is the number of times it switches from one position to another and back. System 40 RF switches have lives from one-million to ten-million (1,000,000 to 10,000,000) cycles per switch position without noticeable performance degradation.

**NOTE** Cold switching (no RF power applied), hot switching (RF power applied) may rapidly degrade switch performance.

That is:

- No intermittent contacts
- Less than 0.1 dB increase in insertion loss
- Less than 0.3 ohm increase in DC contact resistance

## Model 7020-MWS/7020-QCC specifications

### Digital I/O

<b>Capability:</b>	40 independent inputs. 40 independent outputs.
<b>Output configuration:</b>	40 open collector drivers (channels). Each driver has an internal flyback diode.
<b>Pull-up voltage:</b>	5.3 V internally supplied, external connection provided for user supplied voltage, 30V max. Removal of internal jumper allows user to use two different pull-up voltages.
<b>Maximum sink current:</b>	Per Channel: 300mA Per Card: 2.5A
<b>Current limit:</b>	Output current limited to 500mA per channel.
<b>Collector-emitter:</b>	<1V @ 300mA
<b>Logic:</b>	Negative true.
<b>Input configuration:</b>	40 inputs with internal 10k $\Omega$ pull-up resistors.
<b>Characteristics:</b>	Input logic low voltage: 0.8V max. Input logic high voltage: 2V min. Input logic low current: -600 $\mu$ A max. @0V Input logic high current: 50 $\mu$ A max. @5V
<b>Maximum voltage level:</b>	42V pk.
<b>Logic:</b>	Positive true.
<b>General</b>	
<b>Connector:</b>	96-pin DIN 50-pin Header (7020-MWS only)
<b>Warranty:</b>	1 year
<b>Standards:</b>	Safety: Conforms with European Union Directive 73/23/EEC EMC: Conforms with European Union Directive 89/336/EEC
<b>Environment:</b>	Operating: 0°C to 50°C, <80% relative humidity: (0° to 35°C) Storage: -25°C to +65°C

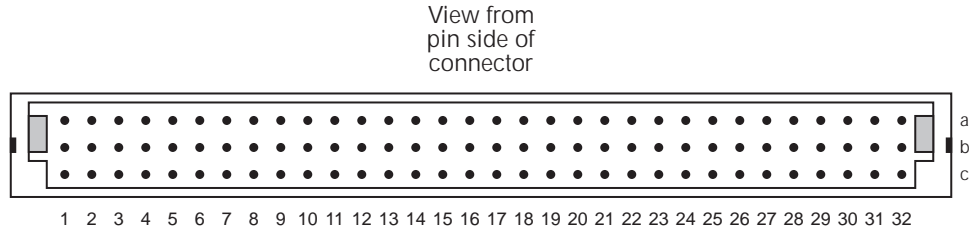
Specifications subject to change without notice.

**CAUTION** Exceeding the output sink current specifications may cause damage to the Model 7020-MWS/QCC card. This card is not intended for use in applications other than the System 40.



## Model 7020-MWS 96-pin DIN connector pinout

**Figure 2-2**  
96-pin DIN connector pinout



**Table 2-2**  
Output channel terminal identification

Output channel	Connector pin no.	Output channel	Connector pin no.
OUT1	2a	OUT21	10b
OUT2	4a	OUT22	12b
OUT3	6a	OUT23	14b
OUT4	8a	OUT24	16b
OUT5	10a	OUT25	18b
OUT6	12a	OUT26	20b
OUT7	14a	OUT27	22b
OUT8	16a	OUT28	24b
OUT9	18a	OUT29	26b
OUT10	20a	OUT30	28b
OUT11	22a	OUT31	30b
OUT12	24a	OUT32	32b
OUT13	26a	OUT33	2c
OUT14	28a	OUT34	4c
OUT15	30a	OUT35	6c
OUT16	32a	OUT36	8c
OUT17	2b	OUT37	10c
OUT18	4b	OUT38	12c
OUT19	6b	OUT39	14c
OUT20	8b	OUT40	16c

**Table 2-3**  
Input channel terminal identification

Input channel	Connector pin no.	Input channel	Connector pin no.
IN1	1a	IN21	9b
IN2	3a	IN22	11b
IN3	5a	IN23	13b
IN4	7a	IN24	15b
IN5	9a	IN25	17b
IN6	11a	IN26	19b
IN7	13a	IN27	21b
IN8	15a	IN28	23b
IN9	17a	IN29	25b
IN10	19a	IN30	27b
IN11	21a	IN31	29b
IN12	23a	IN32	31b
IN13	25a	IN33	1c
IN14	27a	IN34	3c
IN15	29a	IN35	5c
IN16	31a	IN36	7c
IN17	1b	IN37	9c
IN18	3b	IN38	11c
IN19	5b	IN39	13c
IN20	7b	IN40	15c

**Table 2-4**  
Miscellaneous terminal identification

Terminal	Connector pin no.
GND	17c
5.3V	18c
5.3V	19c
GND	20c
VEXT1	21c
VEXT1	22c
GND	23c
GND	24c
VEXT2	25c
VEXT2	26c
NC	27c
NC	28c
NC	29c
NC	30c
NC	31c
NC	32c

**Table 2-5**  
*Model 7020-MWS 50 pin header connector pinout*

<b>Output channel terminal identification</b>			
<b>Output channel</b>	<b>Connector pin no.</b>	<b>Output channel</b>	<b>Connector pin no.</b>
OUT1	1	OUT21	21
OUT2	2	OUT22	22
OUT3	3	OUT23	23
OUT4	4	OUT24	24
OUT5	5	OUT25	25
OUT6	6	OUT26	26
OUT7	7	OUT27	27
OUT8	8	OUT28	28
OUT9	9	OUT29	29
OUT10	10	OUT30	30
OUT11	11	OUT31	31
OUT12	12	OUT32	32
OUT13	13	OUT33	33
OUT14	14	OUT34	34
OUT15	15	OUT35	35
OUT16	16	OUT36	36
OUT17	17	OUT37	37
OUT18	18	OUT38	38
OUT19	19	OUT39	39
OUT20	20	OUT40	40

**Table 2-6**  
*Miscellaneous terminal identification*

<b>Terminal</b>	<b>Connector pin no.</b>
+5.2V	41
VEXT1	42
VEXT2	43
GND	44
GND	45
IN1	46
IN2	47
IN3	48
IN4	49
IN5	50

## Model 7020-QCC 96-pin DIN connector pinout

**Table 2-7**

*Output channel terminal identification*

<b>Output channel</b>	<b>Connector pin no.</b>	<b>Output channel</b>	<b>Connector pin no.</b>
OUT1	01a	OUT21	07b
OUT2	02a	OUT22	08b
OUT3	03a	OUT23	09b
OUT4	04a	OUT24	10b
OUT5	05a	OUT25	11b
OUT6	06a	OUT26	12b
OUT7	07a	OUT27	13b
OUT8	08a	OUT28	01c
OUT9	09a	OUT29	02c
OUT10	10a	OUT30	03c
OUT11	11a	OUT31	04c
OUT12	12a	OUT32	05c
OUT13	13a	OUT33	06c
OUT14	14a	OUT34	07c
OUT15	01b	OUT35	08c
OUT16	02b	OUT36	09c
OUT17	03b	OUT37	10c
OUT18	04b	OUT38	11c
OUT19	05b	OUT39	12c
OUT20	06b	OUT40	13c

**Table 2-8**

*Input channel terminal identification*

<b>Input channel</b>	<b>Connector pin no.</b>	<b>Input channel</b>	<b>Connector pin no.</b>
IN1	19a	IN21	26b
IN2	20a	IN22	27b
IN3	21a	IN23	28b
IN4	22a	IN24	29b
IN5	23a	IN25	30b
IN6	24a	IN26	31b
IN7	25a	IN27	32b
IN8	26a	IN28	20c
IN9	27a	IN29	21c
IN10	28a	IN30	22c
IN11	29a	IN31	23c
IN12	30a	IN32	24c
IN13	31a	IN33	25c
IN14	32a	IN34	26c
IN15	20b	IN35	27c
IN16	21b	IN36	28c
IN17	22b	IN37	29c
IN18	23b	IN38	30c
IN19	24b	IN39	31c
IN20	25b	IN40	32c

**Table 2-9**  
*Miscellaneous terminal identification*

<b>Terminal</b>	<b>Connector pin no.</b>
VEXT1	15a
VEXT1	16a
NC	17a
+5.3V	14b
GND	15b
VEXT2	16b
N/C	17b
GND	18b
N/C	19b
GND	14c
VEXT2	15c
+5.3V	16c
N/C	17c
N/C	18c
GND	19c

# 3

## Service

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### Introduction

The Keithley Model 7116-MWS is the standard product that the System 40 is derived from. An explanation of its troubleshooting procedure is presented here to demonstrate switch system troubleshooting.

The following paragraphs contain troubleshooting and replacement parts information. Schematic diagrams and component layout drawings for the System 40 chassis are in the as-built documentation package. Refer to Model 7001 and 7020 manuals for further information about these components.

### Troubleshooting

***WARNING*** The information in this section is intended for qualified service personnel only. Some of the procedures may expose you to hazardous voltages that could result in personal injury or death. Do not attempt to perform these procedures unless you are qualified to do so.

### Troubleshooting equipment

The Model 2000 Digital Multimeter is recommended for troubleshooting.

### Troubleshooting procedure

Table 3-1 summarizes the procedure for verifying operation of the Model 7116-MWS. Refer to the system schematic and the chassis wiring diagram for component locations.

**Table 3-1**  
Troubleshooting procedure

Step	Item/component	Required condition	Comment
1	Chassis		All voltages referenced to chassis
2	K1-K5, pin COM	< 29VDC	Relay coil voltage
3	K1 pin 1, K5 pin 1	< 1.5V	Close channel 1
4	K1 pin 2, K5 pin 1	< 1.5V	Close channel 2
5	K1 pin 3, K5 pin 1	< 1.5V	Close channel 3
6	K1 pin 4, K5 pin 1	< 1.5V	Close channel 4
7	K2 pin 1, K5 pin 2	< 1.5V	Close channel 5
8	K2 pin 2, K5 pin 2	< 1.5V	Close channel 6
9	K2 pin 3, K5 pin 2	< 1.5V	Close channel 7
10	K2 pin 4, K5 pin 2	< 1.5V	Close channel 8
11	K3 pin 1, K5 pin 3	< 1.5V	Close channel 9
12	K3 pin 2, K5 pin 3	< 1.5V	Close channel 10
13	K3 pin 3, K5 pin 3	< 1.5V	Close channel 11
14	K3 pin 4, K5 pin 3	< 1.5V	Close channel 12
15	K4 pin 1, K5 pin 4	< 1.5V	Close channel 13
16	K4 pin 2, K5 pin 4	< 1.5V	Close channel 14
17	K4 pin 3, K5 pin 4	< 1.5V	Close channel 15
18	K4 pin 4, K5 pin 4	< 1.5V	Close channel 16

NOTE: See Table 2-1 for information on closing channels.

## Ordering information

To place an order or to obtain information concerning replacement parts, contact your Keithley representative or the factory. When ordering parts, be sure to include the following information:

- Model numbers 7020-MWS, and 7001/2, System 40
- Serial number of the chassis, card, or mainframe, workorder number on System 40 chassis
- Part description
- Circuit designation (if applicable)
- Keithley part number

## Factory service

If the System 40 system must be returned to Keithley for repair, perform the following:

1. Call the Repair department at 1-800-552-1115 for a Return Material Authorization (RMA) number.
2. Complete the service form at the back of this manual and include it with the card.
3. Carefully pack the card in the original packing carton.
4. Write ATTENTION REPAIR DEPT and the RMA number on the shipping label.



# Service Form

Model No. \_\_\_\_\_ Serial No. \_\_\_\_\_ Date \_\_\_\_\_

Name and Telephone No. \_\_\_\_\_

Company \_\_\_\_\_

List all control settings, describe problem and check boxes that apply to problem. \_\_\_\_\_

- |  |  |  |
|--|--|--|
| <input type="checkbox"/> Intermittent            | <input type="checkbox"/> Analog output follows display   | <input type="checkbox"/> Particular range or function bad; specify _____ |
| <input type="checkbox"/> IEEE failure            | <input type="checkbox"/> Obvious problem on power-up     | <input type="checkbox"/> Batteries and fuses are OK                      |
| <input type="checkbox"/> Front panel operational | <input type="checkbox"/> All ranges or functions are bad | <input type="checkbox"/> Checked all cables                              |

Display or output (check one)

- |                                   |  |
|-----------------------------------|--|
| <input type="checkbox"/> Drifts   | <input type="checkbox"/> Unable to zero              |
| <input type="checkbox"/> Unstable | <input type="checkbox"/> Will not read applied input |
| <input type="checkbox"/> Overload |  |

- |   |  |
|---|--|
| <input type="checkbox"/> Calibration only | <input type="checkbox"/> Certificate of calibration required |
| <input type="checkbox"/> Data required    |  |

(attach any additional sheets as necessary)

Show a block diagram of your measurement system including all instruments connected (whether power is turned on or not). Also, describe signal source.

Where is the measurement being performed? (factory, controlled laboratory, out-of-doors, etc.)

What power line voltage is used? \_\_\_\_\_ Ambient temperature? \_\_\_\_\_ °F

Relative humidity? \_\_\_\_\_ Other? \_\_\_\_\_

Any additional information. (If special modifications have been made by the user, please describe.)

Be sure to include your name and phone number on this service form.





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