INSTRUCTION MANUAL

AUTOMATIC SWITCHING

UNIT

MODEL RM-25

DC – 18 GHz

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ELECTRO-METRICS

MODEL RM-25

SERIAL NO: N/A

ELECTRO-METRICS CORPORATION

231 Enterprise Road, Johnstown, New York 12095
Phone: (518) 762-2600 Fax: (518) 762-2812

EMAIL: info@emihq.com WEB: http://www.electro-metrics.com

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WARRANTY

This Model RM-25 Automatic Switching Unit is warranted for a period of 12 months (USA only) from date of shipment against defective materials and workmanship. This warranty is limited to the repair of or replacement of defective parts and is void if unauthorized repair or modification is attempted. Repairs for damage due to misuse or abnormal operating conditions will be performed at the factory and will be billed at our commercial hourly rates. Our estimate will be provided before the work is started.

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DESCRIPTION AND USE ELECTRO-METRICS MODEL RM-25 AUTOMATIC SWITCHING UNIT

1.0 Introduction

The RM-25 Automatic Switching Unit contains two relays in parallel, each switching five (5) input connectors between an output connector from DC to 18 GHz. The unit can be operated using either the front panel controls or an external computer via the rear panel IEEE-488.2 Interface Bus Connector.

2.0 Specifications

2.1 Electrical

Frequency Range:	DC-18 GHz
Number of Relays:	2
RF Inputs per Relay:	5
RF Outputs per Relay:	1
Insertion Loss:	<0.3 dB @ ≤1 GHz
Input Impedance:	50 ohms.
Output Impedance:	50 ohms.
VSWR (into 50 ohms):	<1.2:1.
Isolation (output to output):	50 dB.
Switching Speed:	<50 ms.
Switching Life:	1×10^6 switches.
Maximum RF Power Input:	200 Watts average, 1000 Watts peak. (Maximum Pulse Width: 10 µs)
RF Connectors (Input/Output):	Type N, female.
Input Voltage:	105-265 VAC, 47-440 Hz.
Power Consumption:	12 Watts (maximum)
Interface:	IEEE-488.2 (GPIB-488.2)

2.2 Environmental

Operating Temperature:	0°C to 50°C
Storage Temperature:	-40°C to 75°C

3.0 Power Supply

3.1 Power Requirements

a. 105 VAC to 265 VAC, 47 Hz-440 Hz.

NOTE: Internal power supplies can operate directly over the stated voltage and frequency range without the need to change either transformer taps or fuses.

3.2 Fuse Specifications

The RM-25 uses the following fuse:

a. 1.0 AMP 3AG SLO-BLO.

NOTE: The fuse is located internally on the rear of the front panel bracket. The top cover must be removed to gain access.

4.0 Description Front/Rear Panel

4.1 Front Panel

a. **POWER SWITCH**

Type: Two cycle rocker switch.

Function: Self-explanatory.

b. **LOCAL SWITCH**

Type: Momentary pushbutton switch.

Function: Returns control of the RM-25 to the local (manual) mode of operation from the remote (computer) mode of operation.

b.1 **REMOTE INDICATOR**

Type: LED.

Color: Green.

Activated whenever the remote mode of operation is selected (via computer only).

c. INPUT SWITCH

Type: Momentary pushbutton switch.

Function: Selects one of five input connectors for signal routing. The connector selected is indicated by an LED indicator above each connector.

1) OUTPUT INDICATOR

Type: LED

Color: Red.

Quantity: 5.

NOTE: One of the output indicator is designated BY-PASS.

e. SELF TEST INDICATOR

Type: LED.

Color: Green.

Function: Indicates that the internal power supplies are operating correctly. If this indicator does not activate during initial unit turn-on or goes out during operation of the unit, a fault has developed within the unit.

For computer operations, a service request is sent to the computer.

f. INPUT/OUTPUT CONNECTORS

Type: SMA coaxial.

Quantity: 12.

4.2 Rear Panel

a. GPIB CONNECTOR

Type: IEEE Std 488.2-1987 GENERAL PURPOSE INTERFACE BUS CONNECTOR (24-pin).

Function: Interfacing a computer with the RM-25.

b. BUS ADDRESS SELECT SWITCH

Type: DIP Switch. Single pole, single throw. Number of positions: 5.

Function: Selects the bus address for the unit. Logic 1: switch down; Logic 0: switch up.

5.0 Theory Of Operation

The RM-25 Automatic Switching Unit designed to switch five input connectors between an output connector from DC to 18 GHz.

This is accomplished internally using two single pole five throw relays in parallel. The relays are powered by +28 VDC and controlled by logic from the microprocessor board.

The unit contains two internal DC power supplies of +28 VDC and +5 VDC operating over an input voltage range of 105-265 VAC, 47-440 Hz. Due to the design of the DC power supplies, no transformer tap changing or fuse replacement is required. The +28 VDC is used to power the microwave relays, while the +5 VDC is utilized by the microprocessor and front panel pc boards.

The front panel board is the interface between the switches/indicator LEDs' on the front panel and the microprocessor board.

The microprocessor board contains the control circuitry for the RM-25. Information is received from either the front panel switches via the front panel pc board or the rear panel GPIB connector, then processed. The resultant logic commands are sent to the front panel board which then controls the appropriate relay path selection and front panel light operation.

The unit can be operated using either the front panel controls or an external computer via the rear panel EEE-488 Interface Bus Connector. The bus address for the unit is set using the BUS ADDRESS SELECT SWITCH on the rear panel. The command to set the RM-25 to the remote of operation can be issued only by the computer. The front panel LOCAL Switch can only switch the unit to LOCAL from the REMOTE mode.

6.0 Operating Procedure

6.1 Initial Power-Up Procedure

a. Connect the AC power cord to the selected AC power source.

b. The unit is turned on by pushing the power switch to the "ON" position.

c. The following front panel LED indicators should be activated:

1) SELF TEST,

2) One INPUT.

If the SELF TEST indicator is "OFF", this may indicate a problems with the internal DC power supplies.

If all of the connector indicators are "OFF" or operates incorrectly, it may indicate problems with the microprocessor or front panel pc boards.

d. The unit is now ready for either manual or remote (computer) operation.

e. For remote operation using an external computer, refer to Section 7.0.

NOTE: The front panel LOCAL Switch can only switch the unit to LOCAL from the REMOTE mode of operation.

6.2 Manual Mode Of Operation

a. The INPUT Switch allows the operator to select one of five inputs to the unit.

Momentarily depressing the pushbutton switch will select, in sequence (1-2-3-4-BYPASS), one of the five inputs. The input connector selected will be indicated by an activated LED above the connector terminal.

7.0 Remote Operation

The RM-25 is operated remotely using a computer\ controller supplying control information through the IEEE Std 488.2-1987 General Purpose Interface Bus (GPIB).

Sections 7.1 thru 7.9 are intended to provide the user with a *BRIEF EXPLANATION* of the GPIB IEEE codes and command information plus the overall RM-25/computer operating command structure. For more complete and detailed information, refer to the ANSI/IEEE Std 488.2-1987 Standards handbook on Standard Codes, Formats, Protocols, and Common Commands.

The commands listed in Section 7.0 are all RM-25 device dependent commands issued as ASCII commands over the GPIB. The syntax of each command is given in Section 7.8 and 7.9. In each case listed, the RM-25 is a listener as defined in the IEEE Std 488.2-1987.

7.1 Interface Function Codes

The RM-25 GPIB operates as both a talker and a listener. The GPIB is compatible with the IEEE STD 488 interface function codes listed in Table 1.

TABLE 1
IEEE STD 488 INTERFACE FUNCTION CODES

CODE	DESCRIPTION
AH1	Acceptor Handshake Capability
L4	Listener (Basic Listener, Unaddressed To Listen On TAG)
SH1	Source Handshake Capability
T6	Talker (Basic Talker, Serial Poll, Unaddressed To Talk On LAG)
SR1	Service Request Capability
PP1	Parallel Poll Capability (Remote Configuration)
DC1	Device Clear Capability
DT0	No Device Trigger Capability
RL1	Remote/Local Capability
C0	No Controller Capabiliy
E1	Open Collector Bus Drivers
TE0	No Extended Talker Capabilities
LE0	No Extended Listener Capabilities

7.2 Bus Address

The bus address can be changed by using the BUS ADDRESS SELECT SWITCH on the rear panel.

The bus address can be changed at any time; however, the new bus address will not go into effect until a power off/power on sequence is implemented.

NOTE: **1)** Verify that no other device is assigned the Bus Address for the RM-25. If assigned to another device, use the rear panel BUS ADDRESS SELECT Switch to select a new bus address for the unit.

2) Always verify that each device on the GPIB network is assign its own unique bus address before activating the network.

7.3 Remote Operation

To put the device into the remote mode, the remote command must be used to toggle the REN line. If the remote command is sent as an addressed command group (UAGC), the RM-25 will go into the remote mode immediately. The format of the commands are shown below for the HP-9836 Computer.

REMOTE 710 <EXECUTE>

Where 710 corresponds to device 10 on the bus.

If a universal command is used, i.e. REMOTE 7 on a HP9836, the device will not go into remote until addressed as a listener or talker.

The front panel REMOTE LED is activated whenever the unit in the remote mode of operation.

The RM-25 can be controlled via the computer without going into the remote mode of operation. This is accomplished by not toggling the REN line. The RM-25 will now accept commands from the computer/controller but is still in the local mode of operation.

7.4 Local/Local Lockout Commands

The RM-25 may be commanded to lockout all the front panel pushbutton switches using a GPIB command. The local lockout command can only be cancelled with a GPIB "GO TO LOCAL" command. The format of the commands are shown below for the HP-9836 Computer.

LOCAL LOCKOUT: **LOCAL LOCKOUT 7**

LOCAL: **LOCAL 7**

NOTE: This command should not be implemented unless the REN line has been asserted by using the Remote command. Otherwise, the user will not be able to control the RM-25 manually or remotely.

If a LOCAL LOCKOUT has not been commanded, the RM-25 may be brought into the LOCAL mode by pushing the front panel LOCAL Switch.

7.5 Polling

The controller may periodically check devices on the bus to determine if a particular device needs service, or in response to SRQ to determine which device requested service. Two types of polling may be performed, serial or parallel.

7.5.1 Serial Poll

When performing a serial poll, the controller can access each device on the bus individually to read an eight-bit status byte. The controller is then informed of the nature of service required by the polled device. The RM-25 returns a status byte as shown in Table 2.

TABLE 2
STATUS BYTE INFORMATION

LINES	(8)	(7)	(6)	(5)	(4)	(3)	(2)	(1)
BITS	7	6	5	4	3	2	1	0
VALUE	128	64	32	16	8	4	2	1

MEANING: **BIT 0: 1 = hardware error**
BIT 4: 1 = MAV: Message Available
BIT 5: 1 = ESB
BIT 6: 1 = requested service

If the status byte read back is equal to 65, then this indicates that **BIT 6 = 1 (64)** and **BIT 0 = 1 (1)**. In this case, the RM-25 has requested service for a hardware error.

7.5.2 Parallel Poll

Parallel polling provides the controller a quick way to check if any devices require service or to determine which device requested service. The controller can configure the RM-25 to respond on any one of eight data lines with up to two devices per data line. When performing a parallel poll the device needing service will assert the particular line assigned to it. This allows the controller to see all devices on the bus at once and attend to only those requiring service. When two devices are assigned to one line, a serial poll of each device will be necessary to determine which of the two require service.

Please refer to your computer software manual for complete details of parallel poll configure and parallel poll unconfigure.

7.6 SRQ (Service Request)

The service request is a signal that the RM-25 can send to the controller to let it know that the unit requires some kind of attention. When the SRQ is enabled, using the Service Request Enable Register (*SRE) common command, the unit will assert the SRQ line of the GPIB. This can occur whenever a hardware error has occurred in the unit dependent upon the SRQ Mask settings.

The unit will assert SRQ until the controller performs a serial poll, or the fault condition is corrected.

To enable the RM-25 to SRQ the controller the *SRE function must be used in the following form:

*SRExxx — where xxx is equal to the value of the bits corresponding to the condition which will SRQ the controller.

If an SRQ is desired for a hardware error condition then the value of xxx will be 1 (**BIT 0 = 1**).

An example is shown below for an HP-9836 Computer:

Type: OUTPUT 701;"*SRE1" (hit Execute)

With **xxx = 0**, the RM-25 will never request service (default condition).

Please refer to previous section on Serial Poll for bit assignments.

NOTE: the SRE function will not put the RM-25 into the remote mode. Only numeric values in the range of 0 to 255 should be used with the *SRE function, otherwise unexpected results may occur.

7.7 Device Clear

The DCL command may be used to clear the output/input buffers, event status register, and reset the command parser of the unit.

An example is shown below for an HP-9836 Computer:

Type: CLEAR 7 (hit Execute)

The SDC command performs the same function as DCL except that only the addressed device responds.

An example is shown below for an HP-9836 Computer:

Type: CLEAR 701 (hit Execute)

7.8 Common Commands Available

The common commands used to operate the RM-25 via the GPIB interface are listed in Table 3.

TABLE 3
IEEE COMMON COMMANDS

MNEMONIC	COMMAND NAME
*CLS	Clear Status Command
*ESE	Standard Event Status Enable Command
*ESE?	Standard Event Status Enable Query
*ESR?	Standard Event Status Register Query
*IDN?	Identification Query
*IST?	Individual Status Query
*OPC[1]	Operation Complete Command
*OPC?[1]	Operation Complete Query
*PRE[2]	Parallel Poll Register Enable Command
*PRE?	Parallel Poll Register Enable Query
MNEMONIC	COMMAND NAME
*RST	Reset Command
*SRE	Service Request Enable Command
*SRE?	Service Request Enable Query
*STB?	Read Status Byte Query
*TST?	Self Test Query
*WAI[1]	Wait-To-Continue Command

NOTE: **1)** *OPC, *OPC?, *WAI are commands used for device synchronization. Since the RM-25 processes all commands in sequence, the *WAI command always continues immediately. *OPC sets the operation complete bit in the event status register as soon as it is parsed. Similarly, the *OPC? query puts an ASCII "1" in the output buffer and sets the MAV status bit in the status byte register when it is parsed.

2) *PRE command is limited to a value of 0-255 ASCII encoded data byte since the status byte register is only 8-bits in length.

For more information concerning the common commands, and their function, refer to the ANSI/IEEE Std 488.2-1987 handbook.

7.9 Device Specific Commands

IN < Decimal Numeric Digit >

This command selects the rf input port of the RM-25. The < Decimal Numeric Digit > shall be a single ASCII encoded byte for "1", "2", "3", or "4" (31 thru 34 hex) corresponding to inputs 1 thru 4.

OUT < Decimal Numeric Digit >

This command selects the rf output port of the RM-25. The < Decimal Numeric Digit > shall be a single ASCII encoded byte for "1" (31, 49 decimal) or "2" (32, 50 decimal) corresponding to output 1 or 2.

STS?

This query will return a compound response message unit consisting of < NR1 > (input selected) ASCII encoded byte for "1" thru "4" with a data seperator (ASCII encoded "," 2c, 44 decimal) and < NR1 > (output selected) ASCII encoded byte for "1" or "2".

The IN and OUT commands are limited to these ranges. Selections outside the possible input and output switch values will result in an execution error.

This device follows the ANSI/IEEE Std 488.2-1987 standard for codes, formats, protocols, and common commands.

Input and output buffer lengths are 80 characters long. The parser strips commands from the input buffer and implements them in sequential fashion. There is no capability for overlapped commands. Because of this, the effect of certain mandatory common commands may be trivial.