“There Is No Substitute for Experience”

DOW-KEY MICROWAVE

MS KIT

MATRIX KIT

Rev 2

THE RF/MICROWAVE SWITCHING TECHNOLOGY SOLUTION COMPANY
Revision History

The revision history shown below lists all revisions and addendums created for this document. The revision level increases numerically as the document undergoes subsequent updates. Each new revision includes a revised copy of this history page.

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Added GPIB documentation (Section 5) to cover kits that have GPIB enabled
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1 General Information

1.1 Introduction

The Dow-Key Microwave MS Kit is a flexible solution that allows a user to design his/her own multi-switch (MS), multi-position (MP), or crossbar (CB) system. This kit along with any Dow-Key CANBUS switch is all that is needed to build a switching system. The supplied main controller board comes with either the Ethernet or GPIB port enabled which allows the user to easily access the matrix remotely. Other interfaces included are an RS-232 port, a USB port (used as a virtual serial port) and a CAN Bus port. Also available from Dow-Key is a front panel display which can be connected to the main controller board and display a graphical user interface. This is to simplify local control of the system. **Note: Most but not all system functionalities are available in the non-display configuration.**

This kit is not intended to be used to power or control anything other than Dow-Key supplied switches. Connection of other CAN Bus products or other devices not described herein will void quality certifications and the warranty.
2 Hardware Connections

2.1 Power Connection

2.1.1 Voltage Requirements

The MS KIT operates at 12VDC.

Using 1 Power Supply Only:

When using only 1 power supply, the minimum DC voltage requirement for the controller board is 6VDC. For switches connected to the system, the minimum voltage is usually much higher. For example, a 12VDC switch’s minimum voltage is 9.5VDC. See your switch’s documentation for further details regarding voltage requirements.

Using Redundant Power Supplies:

When using two supplies, the minimum voltage for supply #2 before a power supply failure alarm is triggered in the ‘Matrix Status’ (see Section 4.4), is 5.5VDC. As previously stated, power supply #1 needs to maintain >6VDC at all times.

CAUTION: Operating the unit on an incorrect voltage may cause damage, possibly voiding the warranty.
2.1.2 Power Connection

The main controller board (DK PN: 41054-152) has a green Phoenix 8 pin connector (PN: MCV 1.5/ 8-G-3.81). This is where up to 2 DC power supplies can be connected as redundant sources. The controller board can operate with 1 power supply only if desired.

Note: When connecting only power supply #1 and to avoid alarms generated by a missing power supply #2 as noted in Section 4.4 ‘Matrix Status’, a jumper will be placed during manufacturing as shown below. If and when power supply #2 is connected, the jumper is to be removed and the second PS connected as per the silkscreen labeling.

Refer to the controller board’s silkscreen labeling for correct polarity of the 12VDC supply.

2.1.3 Fuse Replacement

Each 12VDC input has a fuse (Littlefuse PN: 0154005.DRT) which protects the DC power input of the controller board. If the fuse needs replacement, perform the steps below:

WARNING: Power down the unit before changing the fuse.

1. The fuses are located next to the 12VDC green input connector. Using tweezers grab a hold of the fuse and gently pull out.
2. Insert the new fuse until it is properly seated inside the fuse holder.

CAUTION: For continued protection against fire or unit damage, replace the fuse only with the type and rating listed.
2.2 Communications Connections

There are up to 5 connections that need to be made to complete assembly of the MS Kit:

1. Ethernet or GPIB cable
2. RS-232 cable
3. USB cable
4. 4-pin modular cable for each CANBUS switch
5. LCD Screen (If equipped)
2.3 Optional LCD

There are 2 LCD options available from Dow-Key:

**Touchscreen version (MS-xxx KIT-TS)**

**Keypad version (MS-xxx KIT-KP)**

Both have the same functionality and features from a control aspect:

1. Touchscreen LCD (DK PN: 40201-009)

![Touchscreen LCD](image1)

2. Keypad LCD (DK PN: 40201-008)

![Keypad LCD](image2)

**Note:** Refer to Appendix A for details related to manual operation of the Touchscreen LCD

**Note:** Refer to Appendix B for details related to manual operation of the Keypad LCD.
3 Configuring the Ethernet Connection
(Ethernet Version)

All devices connected to an Ethernet and communicating via TCP/IP must have a unique IP address and TCP Port number.

The main controller board is programmed at the time of its manufacture to have a Dynamic IP address (Dynamic Host Configuration Protocol is ON).

When the IP address is obtained dynamically (DHCP is ON) the IP address is displayed for a few seconds at power up (Only if the LCD is connected to the controller board).

The main controller board is programmed at the time of its manufacture to have the following default settings:

- IP Address: obtained dynamically
- TCP Port Number: 10

3.1 Connection to an Ethernet

The use of a standard “Straight Through” Ethernet cable is required to connect the main controller board to an Ethernet LAN hub. Connection to a single computer requires the use of “Crossover” Ethernet cable.

3.2 Retrieving and Changing TCP/IP Settings (Non-Display Version)

Via Conventional RS-232

If your kit does not have a front panel LCD/keypad the TCP port settings (IP address and TCP port number) need to be retrieved and changed (if needed) using the RS 232 serial port.

The baud rate of the RS-232 interface is set to 9600.

Data bits: 8, Parity: None, Stop bit: 1, Flow control: None

Use any common software like HyperTerminal (or the LabView based DowKey ‘Universal Matrix Driver’) to communicate via the RS232 port.

You can retrieve the IP settings or change them as assigned by your network administrator by using the commands listed here below.
**Via USB Virtual Serial Port**
The above can also be accomplished by way of the USB Virtual Serial Port. The port acts just like a conventional serial port and accepts the same command sets. Prior to use of this port, the USB drivers (USB Driver New Gen Matrix 49102-125) need to be installed from the supplied CD.

- Power on and Plug in USB cable between the main controller board and the PC. The ‘Found New Hardware Wizard’ will appear and prompt user on how to proceed. Select ‘Advanced’ option and hit ‘Next’.
- Guide the wizard to where the folder is located that contains the drivers (mchpcdc). Select ‘Next’
- The following Windows compatibility warning can be ignored by selecting ‘Continue Anyways’
- The drivers will be installed and the user will be prompted to select ‘Finish’. The drivers are now installed and the virtual port is ready to use just like any conventional serial port.
NOTE: Each command must be terminated with a carriage return (0x0D) followed by a line feed (0x0A).

SYST:IPADDRESS?

Syntax
SYSTem:IPADDRESS?

Description
Returns the matrix current IP address.

Result
xxx.yyy.zzz.aaa

SYST:IPADDRESS xxx.yyy.zzz.aaa

Syntax
SYSTem:IPADDRESS xxx.yyy.zzz.aaa

Description
Sets matrix IP address to xxx.yyy.zzz.aaa.

Factory default value
192.168.0.111

Power on behavior
Keeps last value

*RST effect
None

Timing
In order for the new IP address to take effect the matrix needs to be power cycled.

SYST:TCPPORT?

Syntax
SYSTem:TCPPORT?

Description
Returns the matrix TCP Port number.

Result
n
SYST:TCPPORT x

Syntax
SYSTem:TCPPORT x

Description
Sets the matrix TCP Port number to x.

Factory default value
10

Power on behavior
Keeps last value

*RST effect
None

Timing
In order for the new TCP Port to take effect the matrix needs to be power cycled.

3.3 Testing Ethernet Connection
The main controller board’s ability to communicate should be tested once it has been configured and connected to an Ethernet network.

Connection thru a network:
Assuming the main controller board’s default IP address setting has not been changed from obtaining the IP address dynamically; take note of its IP address retrieved from Section 3.2.
Assuming the connection has been made with a personal computer connected to the same network and running some version of Microsoft Windows©, select Start>Run
and type
Ping nnn.nnn.nnn.nnn
where nnn.nnn.nnn.nnn is the matrix IP address previously noted.
Connection to a standalone PC:

If the main controller board is connected directly to a standalone PC (rather than a network), set the IP address of the matrix as described in Section 3.2 so that the first 3 numbers match the PC's IP address. The last number must be different.

Example:  
PC IP address:   200.169.200.180  
Matrix IP address:  200.169.200.181

Assuming the connection has been made with a personal computer running some version of Microsoft Windows®, select

Start>Run

and type

```
Ping nnn.nnn.nnn.nnn
```

where nnn.nnn.nnn.nnn is the matrix IP address. In this example 200.169.200.181

In both the above scenarios a valid and working connection will yield a response similar that shown in the example below:

```
C:\>ping 200.169.200.181

Pinging 200.169.200.181with 32 bytes of data:

Reply from 200.169.200.181:  bytes=32  time=5ms  TTL=64
Reply from 200.169.200.181:  bytes=32  time=2ms  TTL=64
Reply from 200.169.200.181:  bytes=32  time=2ms  TTL=64
Reply from 200.169.200.181:  bytes=32  time=3ms  TTL=64

Ping statistics for 200.169.200.181
Packets: Sent=4, Received=4, Lost=0 (0% loss)
Approximate round trip times in milliseconds:
Minimum=2ms, Maximum=5ms, Average=3ms
```

The Ethernet interface was designed to operate with common network utilities and drivers. If the Matrix fails to communicate, contact your network administrator for additional assistance. If your network administrator is unable to locate the problem, please contact Dow-Key Microwave Corporation at 1-805-650-2327.
Web Page Server ‘HTTP’ (Ethernet Version)

4.1 Web Page Server Control

The system may be controlled by way of web pages served by the main controller board over its Ethernet port. With the main controller board properly connected to an Ethernet, (See section 3) type the matrix’s current IP address into a browser’s Address Bar. The following page should appear:

The Operator may select ‘Matrix Control’, ‘Matrix Configuration’, or ‘Matrix Status’; ‘Factory Configuration’ is reserved for the sole use by Dow-Key Microwave.
4.2 Matrix Control

Clicking on ‘Matrix control’ will show the below page.

![Matrix Control Page]

Note: the screen of your matrix might slightly vary from the above screen shot.

Remote mode commands may be typed into the Command text box and then clicking on the ‘Send’ button. See rest of this document for the remote command list and its syntax.

If the command implies that the matrix responds (for instance when querying the matrix) the matrix’s response will be shown next to the ‘Answer:’ label.

The bottom half displays the current position of all switches currently configured to the matrix. Their positions may be set by selecting one from a switch’s drop down box and then clicking ‘Set’. Clicking on the ‘Get’ button returns the position of all switches.

Note: Since the MS Kit does not contain any switches upon delivery, no switches will be displayed on this page until the user adds them (See section 6.3 for instructions on adding switches).
4.3 Matrix Configuration

Clicking on 'Matrix configuration' will show the below page.

This page allows the user to Add/Delete switches from the matrix configuration. (See section 6.3 for additional information).

This page also allows the user to set the temperature alarm threshold of the temperature sensors. This feature is disabled by setting all 4 temperature alarm thresholds to 0°C. The MS Kit do not contain any devices that produce significant heat, therefore this model does not feature any temperature sensors. Leave all 4 temperature alarm thresholds to 0°C.
4.4 Matrix Status

Clicking on ‘Matrix status’ will show the below page.

Note: the screen of your matrix might slightly vary from the above screen shot.

This page displays the current status of alarm sources (power supplies, fans, temperatures).
If 2 DC power sources are being used, this page will display status of both and an alarm will be triggered if one were to go offline OR if the voltage drops below requirements. See Section 2.1.
5 IEEE 488.2 Register Model
(GPIB Version)

5.1 Introduction to IEEE 488.2

The topics discussed in sections 5.2 to 5.6 are for the most part transparent to the user during normal operation of the matrix. These sections are here mainly for informational purpose. These sections describe a minimal register model that is required to be able to perform a safe handshaking between the controller and the matrix. In the matrix a status system records various conditions and states in 2 registers. Each of the register groups is made up of several low-level registers called Condition Registers, Event Registers, and Enable Registers.

5.2 Condition Register

A condition register continuously monitors the state of the instrument. The bits in the condition register are updated in real time and the bits are not latched or buffered. This is a read-only register and bits are not cleared when you read the register. A query of a condition register returns a decimal value which corresponds to the binary-weighted sum of all bit set in that register.

5.3 Event Register

An event register latches the various events from the condition register. There is no buffering in this register; while an event bit is set, subsequent events corresponding to that bit are ignored. This is a read-only register. Once a bit is set, it remains set until cleared by a query command (such as *CLS). A query of this register returns a decimal value that corresponds to the binary-weighted sum of all bits in that register.

5.4 Enable Register

An enable register defines which bits in the event register will be reported to the Status Byte register group. You can write to or read from an enable register. A *CLS command will not clear the enable register but it does clear all bits in the event register. To enable bit in the enable register to be reported to the Status Byte register, you must write a decimal value that corresponds to the binary-weighted sum of the corresponding bits.
5.5 The Status Byte Register

The Status Byte register reports conditions from the other registers. Data in the instruments output buffer is immediately reported on the “Message Available” bit (bit 4). Clearing an event register from one of the other registers will clear the corresponding bits in the Status Byte condition register. Reading all messages from the output buffer, including any pending queries, will clear the “Message Available” bit. To set the enable register mask and generate an SRQ (service request), you must write a decimal value to the register using the *SRE command.

Table 6-1 Bit definitions – Status Byte Register

<table>
<thead>
<tr>
<th>Bit Number</th>
<th>Decimal Value</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>Free for manufacturer to assign</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Free for manufacturer to assign</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>Free for manufacturer to assign</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>Free for manufacturer to assign</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>Data is available in the instruments output buffer</td>
</tr>
<tr>
<td>5</td>
<td>32</td>
<td>One or more bits are set in the Standard Event Register (bits must be enabled)</td>
</tr>
<tr>
<td>6</td>
<td>64</td>
<td>One or more bits are set in the Status Byte Register (bits must be enabled)</td>
</tr>
<tr>
<td>7</td>
<td>128</td>
<td>Free for manufacturer to assign</td>
</tr>
</tbody>
</table>

The Status Byte condition register is cleared when:

- The *CLS command is executed.
- One of the event registers in the other registers are read (only the corresponding bits are cleared in the Status Byte condition register).

The Status Byte enable register is cleared when:

- The *SRE 0 command is executed.
The Standard Event Register

The Standard Event Register reports different types of events that may occur in the instrument. Any or all of these conditions can be reported to the Standard Event summary bit through the enable register. To set the enable register mask, you must write a decimal value to the register using the *ESE command.

<table>
<thead>
<tr>
<th>Bit Number</th>
<th>Decimal Value</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>All commands prior to and including *OPC have been executed.</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Free for manufacturer to assign</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>The instrument tried to read the output buffer but it was empty. Or a new command line was received before a previous query has been read. Or both the input and output buffers are full.</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>A self-test or calibration error occurred.</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>An execution error occurred.</td>
</tr>
<tr>
<td>5</td>
<td>32</td>
<td>A command syntax error occurred.</td>
</tr>
<tr>
<td>6</td>
<td>64</td>
<td>Free for manufacturer to assign</td>
</tr>
<tr>
<td>7</td>
<td>128</td>
<td>Free for manufacturer to assign</td>
</tr>
</tbody>
</table>

The Standard event register is cleared when:

- The *CLS command is executed.
- A query of the event register using the *ESR? Command.

The Standard Event enable register is cleared when:

- The *ESE 0 command is executed.
5.7 IEEE 488.2 Common Commands

This matrix implements common commands that the IEEE-488.2 standard defines. The following contains a list of a subset of these commands. For more details refer to the related section.

Table 6-3 Common Commands

<table>
<thead>
<tr>
<th>Mnemonic</th>
<th>Name</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>*CLS</td>
<td>Clear Status Command</td>
<td>7.4.1</td>
</tr>
<tr>
<td>*ESE</td>
<td>Standard Event Status Enable Command</td>
<td>7.4.2</td>
</tr>
<tr>
<td>*ESE?</td>
<td>Standard Event Status Enable Query</td>
<td>7.4.3</td>
</tr>
<tr>
<td>*ESR?</td>
<td>Standard Event Status Register Query</td>
<td>7.4.4</td>
</tr>
<tr>
<td>*IDN?</td>
<td>Identification Query</td>
<td>7.4.5</td>
</tr>
<tr>
<td>*OPC</td>
<td>Operation Complete Command</td>
<td>7.4.6</td>
</tr>
<tr>
<td>*OPC?</td>
<td>Operation Complete Query</td>
<td>7.4.7</td>
</tr>
<tr>
<td>*RST</td>
<td>Reset Command</td>
<td>7.4.8</td>
</tr>
<tr>
<td>*STB?</td>
<td>Read Status Byte Query</td>
<td>7.4.9</td>
</tr>
<tr>
<td>*SRE</td>
<td>Service Request Enable Command</td>
<td>7.4.10</td>
</tr>
<tr>
<td>*SRE?</td>
<td>Service Request Enable Query</td>
<td>7.4.11</td>
</tr>
<tr>
<td>*WAI</td>
<td>Wait-to-Continue Command</td>
<td>7.4.12</td>
</tr>
</tbody>
</table>
6 Configuring the Device for Operation

6.1 Main Controller Configuration

The main controller board has been designed to be as generic as possible in regards to how many switches of what positions it may control. Therefore, the main controller board must first be informed as to the set of switches it is able to control before it can operate successfully, and this information must be updated as switches are added and deleted to the main controller board or connected to the CAN bus port. The knowledge of what switches are to be controlled and how many positions each of those switches has is known as the matrix’s Configuration Data.

In addition to switch information, the Matrix Configuration also contains other information such as the base MAC address (for Ethernet based matrices), unit’s Serial Number, alarm enabling, Model Name, etc. This information must remain intact for the matrix to operate properly.

The matrix configuration is already performed at the factory and does not need to be done by the user unless the Matrix Controller board has been replaced.

Adding and removing switches automatically updates the matrix configuration. No further action is required by the user.

6.2 Dow-Key CAN bus switches

A CAN Bus switch may assume a maximum CAN ID of 127. Individual switches delivered by Dow-Key will be programmed with either ID=0 or ID=1, depending on the particular procedure utilized to manufacture the switch. The matrix provides the means to change CAN Bus ID’s at will.

A CAN Bus switch may have a maximum of 255 positions (0 through 254). 255 is reserved as a return value indicating that the switch is either in an erroneous position, or is reported to the Operator to when a switch fails to respond to a query for current position.

A switch whose ID is 0 is referred to as a “zero switch”, or also a “0 switch”. A switch whose ID is other than 0 is referred to as an “N switch”.

Zero switches and N switches have different properties:

Only a zero switch may change into an N switch.

An N switch may not change its ID to anything other than 0.

A zero switch will not respond to commands to change or report its position.

A zero switch will not respond to queries as to switch position closure counts.

A zero switch may not be added to a Configuration (see below) as an ID=0.
6.3 Adding and Deleting Switches

The following rules apply when adding a switch to the Matrix Configuration (the desired ID to add is referred to as the “target ID”):

- The desired switch to ADD must be connected to the matrix before executing the ADD procedure.

- If the connected switch is a 0 switch AND the target ID is not yet configured AND a switch possessing the target ID is not already connected, then the 0 switch will change its ID to the target ID and the Configuration will be updated.

- If the connected switch is a 0 switch AND the target ID is already configured AND a switch possessing the target ID is not already connected, AND the 0 switch’s number-of-positions data matches that of the Configuration’s, then the 0 switch will change its ID to the target ID.

- If the connected switch is an N switch AND the target ID=N is not yet a configured ID, then the N switch will be added, i.e. the Configuration will be updated.

- If the connected switch is an N switch AND the target ID=N is already a configured ID, AND the N switch’s number-of-positions data matches that of the Configuration’s, then the N switch will be added, i.e. the Configuration will be updated (actually, the ID isn’t really added since the ID is already configured, however a Configuration match is performed).

The following rules apply when deleting a switch from the Configuration (the desired ID to delete is referred to as the “target ID”):

- Only an N switch may be deleted from a Configuration; 0’s are not Configurable.

- If the N switch to delete is connected and is not a Configured ID, AND a zero switch is not connected, then the N switch will be returned to a 0 switch.

- If the N switch to delete is connected and is already a Configured ID, AND a zero switch is not connected, then the N switch will be removed from the Configuration and its ID set to 0 (i.e. turning the N switch into a 0 switch).

- If the N switch to delete is connected and is already a Configured ID, AND a zero switch is connected, then the N switch will be removed from the Configuration, but the N switch’s ID will remain N.

- If the N switch to delete is not connected and is already a Configured ID, then the ID will be removed from the Configuration

NOTE:

THE MATRIX MUST BE POWER CYCLED AFTER MAKING ANY CHANGES TO THE CONFIGURATION BEFORE THOSE CHANGES BECOME FULLY APPARENT.

NOTE:

It’s a good idea to keep unused switches stored as 0 switches. Also, if a switch is to be dedicated to a particular CAN Bus ID, it should be marked such on the switch’s enclosure.
6.3.1 Examples (LCD Version)

Example procedure:

Adding a switch to the Configuration usually starts by finding the ID of the physical switch to add. From the LCD select **Main Menu>System Settings>Find Switch ID** and follow the instructions in Appendix A or B under the ‘System Settings’

If the switch’s ID is the one desired to add (0 or N), the switch may be left connected and the BACK key may be pressed to return to the Main Menu. To ADD the switch, select **Main Menu>System Settings>Add Switch**. The LCD will indicate if the switch to add is a 0 switch and then prompt the user with the next available-to-configure ID, or the user may enter a different, un-configured ID.

If the switch’s ID is not zero, LCD will prompt to add the next available-to-configure ID, and the user must enter the connected switch’s ID.

Suppose a switch’s ID has been found to be N=x, but a 0 switch is required to add the switch as N=y: Therefore the switch’s ID must first be changed to zero. With the N=x switch connected and with no other N=x switches connected, select **Main Menu>System Settings>Delete Switch**. Enter the ID (N=x) of the connected switch, and its ID will be set to 0. Briefly disconnect and reconnect the switch to allow the switch’s internal firmware to reboot with its new ID 0.

Now the process to add the switch as N=y may be executed via **Main Menu>System Settings>Add Switch**.

**Note**: Deleting a switch from the matrix configuration data does not require the switch being connected, but when it is connected its ID will be returned to 0. If it is not connected, it is still removed from the Matrix Configuration Data.
6.3.2 Examples (non-LCD Version)

Example procedure:

The ‘Find Switch ID’ feature is not available in the non-LCD version of this kit. An LCD is needed to use this feature if a switch's ID is not known.

Dow-Key Microwave does offer a model ‘5060’ addressing box. This devise allows a user to overwrite any unknown switch ID with a desired ID. For further details contact your sales representative.

If the switch’s ID is the one desired to add (0 or N), connect the switch. As seen in Section 4.3, the user can enter the switch’s ID in the section ‘Add a Switch’ and press ‘Add’ to add the switch to the main controller boards’ configuration. Power cycle is not required. Returning to ‘Matrix Control’ page, the added switch will be displayed with its associated drop down menu.

Suppose a switch’s ID is N=x, but a 0 switch is required to add the switch as N=y: Therefore the switch’s ID must first be changed to zero. With the N=x switch connected and with no other N=x switches connected, go to ‘Matrix Configuration’ (as seen in Section 4.3) and enter the ID of switch N=x in the ‘Remove a Switch’ section. After pressing ‘Remove’, the system will respond by confirming that the desired switch has been deleted successfully. At which point the switch ID has now been changed to ‘0’. Power Cycle the switch to reboot the firmware Now the process to add a switch N=y can be performed as in the previous paragraph of this section.

Note: Deleting a switch from the matrix configuration data does not require the switch being connected, but when it is connected its ID will be returned to 0. If it is not connected, it is still removed from the Matrix Configuration Data.
7 Remote Operation

7.1 Introduction to SCPI

SCPI is a command structure that is based on the IEEE-488.2 specification which Dow-key has adapted to work with GPIB, Ethernet, RS-232 and USB controls. The matrix has internal software loaded that uses SCPI command structure. SCPI is the abbreviation of Standard Commands for Programmable Instruments. These commands are standard messages for the (remote) control of programmable instruments, which are sent by the GPIB, Ethernet, RS-232, and USB controller. The principal objective of SCPI is to make the programming of a test system easier for the user. When the basic concepts and command structure of SCPI is understood, it will be easy for the user to write or modify a control program for the matrix.

The Socket Type of the matrix is server while your remote control computer is the client.

NOTE: Not all commands for SCPI are compatible with GPIB, Ethernet, RS-232 and USB, only the ones stated in this document.

7.2 Command Syntax Structure

[ROUTE]:SWITch<id>[:VALue] <number>|MAX

- **Square brackets** [ ] indicate optional keywords or parameters.
- **Braces** { } enclosure parameter choices with a command string
- **Triangle brackets** < > enclose parameters for which you must substitute a value.
- **Vertical bar** | separates multiple parameter choices.

The command syntax shows most commands as a mixture of upper and lower case letters. The upper case letters indicate the abbreviated spelling for the command. For shorter program lines, the abbreviated form is used. For better program readability, the long form is used. For example, in the above syntax statement, ROUT and ROUTE are both acceptable forms. Since both upper and/or lower case letters are acceptable, ROUT, rout and Rout are all acceptable. Other forms, such as RO and ROU are not acceptable and will generate an error.

NOTE: For GPIB no ASCII termination is required, but the End Or Identify (EOI) line shall be asserted at the end of each command.

For RS232 and USB each command must be terminated with a carriage return (0×0D) followed by a line feed (0×0A).

e.g. ”ROUT:SWITx n
\r\n”
    “ ROUT:SWITx n; SWITx?\r\n”

Where “\r” stands for carriage return (0×0D) and “\n” stands for line feed (0×0A).
7.3 Command Separators and conventions

- A *colon* (:) is used to separate a command keyword from a lower level keyword.
- A *blank space* is used to separate a parameter from a command keyword.
- A *comma* (,) is used if a command requires more than one parameter.
- A *semicolon* (;) is used to combine multiple commands into one message string. Commands from the same *subsystem* are permitted to skip repeating the upper-level keyword.
  Eg. "Route:Switch1 8; Switch2 5; Switch3 2"
- A *colon* is used when linking commands from different subsystems into one message string, allowing a new upper-level keyword to be introduced. Since the keyword is optional, such keyword could also be omitted (see example 2).
  Only the first command requires the colon. Any subsequent commands of the same subsystem do not require the colon (see example 3).

  Ex. 1: “Route:Switch1 8; Switch2 5; Switch3 2; System:Error?”
  Ex. 2: “Route:Switch1 8; Switch2 5; Switch3 2; :Error?”
  Ex. 3: “Route:Switch1 8; Switch2 5; Switch3 2; :Error?; Timeout 2; status?”

- (For Ethernet Version) When linking multiple commands the maximum number of characters supported is 220. The limit of 220 characters is valid in transmission and receiving.
- (For GPIB Version) When linking multiple commands the maximum number of transmitted commands to the matrix in one message string is 8.
- (For GPIB Version) When reading responses from the matrix, the maximum number of characters that can be received (read) is 100 characters.
- (For GPIB Version) Commands related to the GPIB controller’s registers can NOT be concatenated. These commands are *ESE, *ESE?, *ESR?, *STB?, *SRE, *SRE?.
- All messages are in ASCII format (numeric values are represented in decimal format with exception of the MAC address which is expressed in hex format).
- Timing, sequences and action requirements are only shown where applicable and are under the TIMING sub-paragraphs on each command description.
- For RS232 and USB communication: Any string returned by the matrix is terminated with a carriage return (0×0D) followed by a line feed (0×0A).

  e.g. "ROUTE:SWIT2?\r\n"

    will return

    “1\r\n”

*Where “\r” stands for carriage return (0×0D) and “\n” stands for line feed (0×0A).*
7.4 Common Commands

The following contains the common SCPI commands that the controller is compatible with.
The possible error codes assume that the correct syntax is used and, in case of a multiple command string the string is not too long.
If these conditions are not met, any given command can generate these error codes: 3, 4, 30

7.4.1 *CLS (GPIB Version)

Syntax
*CLS

Description
This command is used to clear the event register in all register groups.

7.4.2 *ESE (GPIB Version)

Syntax
*ESE <value>

Parameters
value  Decimal value which corresponds to the binary-weighted sum of the bits you wish to enable in the register.

Description
Enable bits in the Standard Event Status enable register.
The selected bits are then reported to the Status Byte register.
To enable bits in the Standard Event Status enable register, you must write a decimal value that corresponds to the binary-weighted sum of the bits you wish to enable in the register.

Note: This command can NOT be concatenated with other commands. It must be issued as a single command.
7.4.3  *ESE? (GPIB Version)

Syntax
*ESE?

Description
This query allows the user to determine the current contents of Standard Event Status enable register.
The value returned corresponds to the binary-weighted sum of all bits enabled by the *ESE command.

Note: This command can NOT be concatenated with other commands. It must be issued as a single command.

7.4.4  *ESR? (GPIB Version)

Syntax
*ESR?

Description
This query allows the user to determine the current contents of Event Status register. Reading the Event Status Register clears it.
The status is returned as a decimal value which corresponds to the binary-weighted sum of all bits set in the register.

Note: This command can NOT be concatenated with other commands. It must be issued as a single command.

7.4.5  *IDN?

Syntax
*IDN?

Result
A string is returned which consists of the following parts:

Model       Matrix model number

Possible error codes
None

Example
“*IDN?”

Result
“MS KIT”
7.4.6 *OPC (GPIB Version)

Syntax
*OPC

Description
This command causes the device to set the Operation Complete bit in the Standard Event Register when all pending operations have been finished.

7.4.7 *OPC?

Syntax
*OPC?

Description
This query returns an ASCII character “1” when all pending operations have been finished.

Result
ASCII character “1”.

Possible error codes
None

Example 1
*OPC?

Result
“1”

Example 2
:SWIT1 4; SWIT2 4; *OPC?

Result
“0”

Timing
In example 2 the matrix did not have the time to execute the command. Hence a “0” is returned. A subsequent *OPC? will return a “1” as shown in example 1. The timing to execute a command depends on the length of the command (in case of concatenated commands).
In case of switching commands like on example 2, the controller will first command each switch to set its new position, then query each switch to ensure that the positions are closed and finally respond with a “1” to the *OPC? query. As a rule of thumb Dow-Key electromechanical switches require approximately 10-15ms to switch position. But the *OPC? query will return a “1” only after the switches have not only changed its positions, but rather also confirmed its position. So it is safe to consider some safety margin and expect a response of “1” after about 70ms per switch. As an example if 2 switches are commanded, wait about 140ms before issuing an *OPC? query that will return a “1”.


7.4.8  *RST

**Syntax**
*RST

**Description**
This command performs a device reset.
This will set the instrument so that all switches are in the default state.
For SPnT switches the default state is: all RF ports are open.
For a transfer switch the default state is: position 1 is closed.

**Possible error codes**
11, 12, 13

**Timing**
Before issuing any other command after a *RST use the following considerations.
The *RST command is 'translated' by the internal controller board to command, on the CAN bus level, each switch to position 0 (open). The amount of these commands depends on the amount of switches present in the matrix.
Each switch requires approximately 10-15ms to switch position. So to execute a *RST command (to open all positions without verifying the switch's positions) will require at least n x (10 - 15ms), where n is the number of switches in the matrix.

7.4.9  *STB? (GPIB Version)

**Syntax**
*STB?

**Description**
Query the Status Byte Register
This command is similar to a Serial Poll but is processed like any other instrument command. This command returns the same result as a Serial Poll but the Master Summary bit is not cleared if a Serial Poll has occurred.

**Result**
STB    decimal value which corresponds to the binary-weighted sum of all bits set in the register.

**Note:** This command can NOT be concatenated with other commands. It must be issued as a single command.
7.4.10 *SRE (GPIB Version)

Syntax
*SRE <enable_value>

Parameters
Enable_value Value that corresponds to the binary-weighted sum of the bits you wish to enable in the register.

Description
Enable bits in the Status Byte enable register.
To enable bits in the Status Byte enable register, you must write a decimal value that corresponds to the binary-weighted sum of the bits you wish to enable in the register.

Note: This command can NOT be concatenated with other commands. It must be issued as a single command.

7.4.11 *SRE? (GPIB Version)

Syntax
*SRE?

Description
The *SRE? query returns a decimal value which corresponds to the binary-weighted sum of all bits enabled by the *SRE command.

Result
Returns a decimal value which corresponds to the binary-weighted sum of all bits enabled by the *SRE command.

Example
"*SRE?"
Result was “16”

Note: This command can NOT be concatenated with other commands. It must be issued as a single command.

7.4.12 *WAI (GPIB Version)

Syntax
*WAI

Description
This command prevents the instrument from executing any further commands or queries until the current commands have been processed.
Remote Operation

7.5 System Commands

The following contains the system SCPI commands that the GPIB, Ethernet and RS-232 control is compatible with.

7.5.1 SYST:ERR?

Syntax
SYSTem:ERRor?

Description
Query the instrument’s error queue. A record of up to N errors is stored in the instrument’s error queue. Errors are retrieved in first-in first-out (FIFO) order. The first error returned is the first error that was stored. Each additional error up to N is read by N subsequent queries (one for each error). For this instrument N=20. The error queue has to be read until no more errors are returned, otherwise the error status is not cleared.

Note: some of the listed error codes are here for backwards compatibility with legacy products and other are reserved for future applications. Not all error codes are applicable to this matrix.

Result
String with the following syntax:
code, message
code: Numeric value with the error code (0 if no error).
Message: String with error message.
Example

"SYST:ERR?"
Result was “1, INVALID CHARACTER”, check for more errors.
Description: This error is no longer supported. The error code is maintained and reserved for legacy purposes only.

"SYST:ERR?"
Result was “2, OUTPUT BUFFER OVERFLOW”, check for more errors.
Description: This error is no longer supported. The error code is maintained and reserved for legacy purposes only.

"SYST:ERR?"
Result was “3, TOO MANY COMMANDS”, check for more errors.
Description: The maximum of 220 characters per command line has been exceeded.

"SYST:ERR?"
Result was “4, SYNTAX ERROR”, check for more errors.
Description: There is a misspelling in your command or a non-numeric character was included in a command where a number should have been, or use of unrecognized symbols such as %, &, #, etc.

"SYST:ERR?"
Result was “5, DATA OUT OF RANGE”, check for more errors.
Description: The value transmitted is not acceptable.
Eg. 1: A non existing switch positions has been commanded. Sending Route:Switch1 8. When switch 1 is a SP6T (6 position switch)
Eg. 2: This error code is set if the IP address or MAC address is an invalid one. Sending SYSTEM:IPADDRESS 55.57.2 would generate this error code since 4 numbers are required for a valid IP address.

"SYST:ERR?"
Result was “6, ILLEGAL PARAMETER VALUE”, check for more errors.
Description: This error is no longer supported. The error code is maintained and reserved for legacy purposes only.

"SYST:ERR?"
Result was “7, INPUT BUFFER UNDERFLOW”, check for more errors.
Description: This error is no longer supported. The error code is maintained and reserved for legacy purposes only.

"SYST:ERR?"
Result was “8, MATRIX SOCKET NOT AVAIL”, check for more errors.
Description: This error is no longer supported. The error code is maintained and reserved for legacy purposes only.
SYST:ERR?" Result was “10, SWITCH DID NOT RESPOND,x”, check for more errors.
Description: Switch x did not respond to a position query.
E.g. CAN bus communication failure or damaged switch.

SYST:ERR?"
Result was “11, SWITCH’S RESPONSE INVALID,x”, check for more errors.
Description: Switch x responded but with the wrong response code. This error is related to wrong internal CAN bus communication codes.

SYST:ERR?"
Result was “12, SWITCH’S POSITION INCORRECT,x”, check for more errors.
Description: Switch x reported to be closed on a position different than what it was commanded to be.
E.g. Commanded position is 4, reported position is 3.

SYST:ERR?"
Result was “13, SWITCH’S POSITION UNKNOWN,x”, check for more errors.
Description: Switch x reported to be closed on an unknown position. E.g. A defective / damaged switch.

SYST:ERR?"
Result was “20, MATRIX IS NOT CONFIGURED”, check for more errors.
Description: The configuration file (factory configuration) defining all switches configured inside the matrix has not been uploaded. The matrix does not ‘know’ what and how many switches to control.

SYST:ERR?"
Result was “21, CONFIGURATION FILE IS CORRUPT”, check for more errors.
Description: The configuration file (factory configuration) defining all switches configured inside the matrix is corrupted.

SYST:ERR?"
Result was “22, CONFIGURATION FILE DOES NOT MATCH INSTALLED SWITCHES”, check for more errors.
Description: The configuration file (factory configuration) defining all switch types configured inside the matrix does not match the actual installed switch types.
This error code is generated only at boot up and refers only to answering switches. A switch not answering to CAN messages would result into an error code 10.

SYST:ERR?"
Result was “23, MATRIX CONTAINS A 0 ID”, check for more errors.
Description: The matrix contains a switch that has not been assigned a valid CAN bus address. ID 0 is not a valid CAN bus address.
SYST:ERR?"
Result was “30, COMMAND UNRECOGNIZED”, check for more errors.
Description: This error code is generated when the commanded string
does not contain any valid keyword (e.g. Route, System, *IDN?, *RST,
...) at all.

SYST:ERR?"
Result was “36, ID IS OUT OF RANGE”, check for more errors.
Description: A non existing switch ID has been commanded.
Eg. Sending Route:Switch11 8. When switch 11 does not exist.

SYST:ERR?"
Result was “50, UNABLE TO AQUIRE IP ADDRESS”, check for more errors.
Description: DHCP is enabled (ON), but the IP address could not be
acquired dynamically.
Eg. Ethernet connection cable is disconnected.

SYST:ERR?"
Result was “51, FAN STALL”, check for more errors.
Description: On models with fans equipped with sensors, one or more fans
have stalled (only when this alarm has been enabled at the factory).
Note: Not applicable for most models.

SYST:ERR?"
Result was “52, INTERNAL TEMPERATURE EXCEEDS THERSHOLD”, check
for more errors.
Description: On models with temperature sensors, one or more
temperature sensors has exceeded its alarm threshold (only when this
alarm has been enabled at the factory).
Note: Not applicable for most models.

SYST:ERR?"
Result was “53, POWER SUPPLY FAILURE”, check for more errors.
Description: On matrices with redundant power supplies it will indicate that
one of the power supplies does not operate.
Eg. Damaged power supply or blown fuse on the power supply.

Result was “0"NO ERROR"”, No more errors, error queue is empty.
7.5.2 SYST:IPADDRESS? (Ethernet Version)

Syntax
SYSTem:IPADDRESS?

Description
Returns the matrix IP address.

Result
xxx.yyy.zzz.aaa

Possible error codes
None

7.5.3 SYST:IPADDRESS xxx.yyy.zzz.aaa (Ethernet Version)

Syntax
SYSTem:IPADDRESS xxx.yyy.zzz.aaa

Description
Sets system IP address to xxx.yyy.zzz.aaa.

Possible error codes
5

Factory default value
200.169.200.180

Power on behavior
Keeps last value

*RST effect
None

Timing
In order for the new IP address to take effect the matrix needs to be power cycled.
7.5.4 SYST:TCPPORT? (Ethernet Version)

Syntax
SYSTem:TCPPORT?

Description
Returns the matrix TCP Port number.

Result
n
Possible error codes
None

7.5.5 SYST:TCPPORT x (Ethernet Version)

Syntax
SYSTem:TCPPORT x

Description
Sets the matrix TCP Port number to x.

Possible error codes
5

Factory default value
10

Power on behavior
Keeps last value

*RST effect
None

Timing
In order for the new TCP Port to take effect the matrix needs to be power cycled.
7.5.6 SYST:GATEWAY? (Ethernet Version)

**Syntax**
SYSTem:GATEWAY?

**Description**
Returns the matrix gateway address.

**Result**
xxx.yyy.zzz.aaa

**Possible error codes**
None
7.5.7 SYST:GATEWAY xxx.yyy.zzz.aaa *(Ethernet Version)*

**Syntax**
SYSTem:GATEWAY xxx.yyy.zzz.aaa

**Description**
Sets matrix gateway address to xxx.yyy.zzz.aaa.

**Possible error codes**
5

**Factory default value**
200.169.200.5
(note: this value might change on your matrix)

**Power on behavior**
Keeps last value

**RST effect**
None

**Timing**
In order for the new Gateway address to take effect the matrix needs to be power cycled.

7.5.8 SYST:MASK? *(Ethernet Version)*

**Syntax**
SYSTem:MASK?

**Description**
Returns the matrix subnet mask address.

**Result**
xxx.yyy.zzz.aaa

**Possible error codes**
None
7.5.9 SYST:MASK xxx.yyy.zzz.aaa *(Ethernet Version)*

**Syntax**

SYSTem:MASK xxx.yyy.zzz.aaa

**Description**

Sets the matrix subnet mask address to xxx.yyy.zzz.aaa.

**Possible error codes**

5

**Factory default value**

255.255.255.0

**Power on behavior**

Keeps last value

**RST effect**

None

**Timing**

In order for the new Mask address to take effect the matrix needs to be powered cycled.

7.5.10 SYST:MACADDRESS? *(Ethernet Version)*

**Syntax**

SYSTem:MACADDRESS?

**Description**

Returns the matrix MAC address in hex format

**Result**

aa.bb.cc.dd.ee.ff

**Possible error codes**

None
7.5.11 SYST:SERIALNUMBER?

Syntax
SYSTem:SERIALNUMBER?

Description
Returns the matrix serial number.

Result
n
Possible error codes
None

7.5.12 SYST:TIMEOUT? (Ethernet Version)

Syntax
SYSTem:TIMEOUT?

Description
The Timeout is used to automatically close the TCP/IP socket after a certain amount of seconds of inactivity on the port.

Returns the Time out setting for the TCP/IP connection (n is in seconds).

n = 0 means no Time out is set.

Result
n
Possible error codes
None
7.5.13 SYST:TIMEOUT x (Ethernet Version)

Syntax
SYSTem:TIMEOUT x

Description
The Timeout is used to automatically close the TCP/IP socket after a certain amount of seconds of inactivity on the port.

Sets the Time out setting for the TCP/IP connection (n is in seconds).
x = 0 means no Time out is set.

Possible error codes
5

Factory default value
0

Power on behavior
Keeps last value

*RST effect
None
7.5.14 SYST:STATUS?

Syntax
SYSTem:STATUS?

Description
This command will return all Switch positions, Local/Remote mode, Power supply status, High temperature alarm status, Fan stall alarm and Errors list separated by a semicolon. The status response will reflect ALL items in the matrix, while the error portion of the response is limited to the first 20 errors.

Note 1: Power supply status, High temperature alarm status and Fan stall alarm are only returned if enabled.

Note 2: Multiple instances of the same error code will appear multiple times. E.g. if two different switches fail to respond to CAN messages, two instances of error 10 will be returned. But multiple error instances of the same switch will appear only once.

Result
“SWITx y;SWITx y;SWITx y;…….;SWITx y;LOC;PWR1 OK;PWR2 FAULT; ERRORS 5,3;0”

SWIT = Switch
X = Switch number (ID)
Y = Switch position
LOC = Local mode
REM = Remote mode
PWR1 = Power supply 1
PWR2 = Power supply 2 (Only for systems with dual power supplies)
TEMP1= Temperature sensor 1 (Only if temp sensor 1 is enabled)
TEMP2= Temperature sensor 2 (Only if temp sensor 2 is enabled)
TEMP3= Temperature sensor 3 (Only if temp sensor 3 is enabled)
TEMP4= Temperature sensor 4 (Only if temp sensor 4 is enabled)
FAN1 = Fan 1 (Only if Fan sensor 1 is enabled)
FAN2 = Fan 2 (Only if Fan sensor 2 is enabled)
FAN3 = Fan 3 (Only if Fan sensor 3 is enabled)
FAN4 = Fan 4 (Only if Fan sensor 4 is enabled)
ERRORS = Error codes (Each number corresponds to a specific error code described in the user manual. Not all error codes apply to the matrix).

Possible error codes
None
7.5.15 SYST:SCREENSAVER? (LCD Version)

Note: Command is available but only needed when using display

Syntax
SYSTem:SCREENSAVER?

Description
This command will return the screen saver time settings n (n is in minutes).
Possible values for n are 0, 2, 3, 4, 5, …
Note that 1 is not a valid value.

0 = Screen saver is disabled

Possible error codes
5

Factory default value
5

Power on behavior
Keeps last value

*RST effect
None

7.5.16 SYST:SCREENSAVER x (LCD Version)

Note: Command is available but only needed when using display

Syntax
SYSTem:SCREENSAVER x

Description
This command will set the screen saver time settings x (x is in minutes).
Possible values for x are 0, 2, 3, 4, 5, …
Note that 1 is not a valid value.

0 = Screen saver is disabled

Possible error codes
5

Factory default value
5

Power on behavior
Keeps last value

*RST effect
None
7.6 Switch [Module] Command Set

The following contains the switch [module] commands of SCPI that the Ethernet control is compatible with.

7.6.1 :SWITch<id>[:VALue] <number>

Syntax

[ROUTe]:SWITch<id>[:VALue] <number>

Description
This command is used to control the position of the switches. The switch specified by the numeric suffix <id> is set to position <number>. Switch positions are specified in a 0 to N fashion, therefore legal values for <number> are from 0 to the maximum number of position for the switch. For example, a SP10T switch has 11 positions, 0 thru 10. Position 0 means the switch is set to its default position.
For most switches the default position is pos 0 (open switch). So in case of a SP10T switch this means no position is closed.
In case of a transfer switch, since it does not have an open position, the default position is pos 1. So commanding it to pos 0 will close it to position 1.
7.6.2 Setting switch x to position n

x = switch [module] address.
n = position to set and must be within the switches parameter.
(Example: SP10T valid positions are 0 thru 10 only).

Examples:
- ROUTE:SWITCHx n
- ROUT:SWITCHx n
- ROUTE:SWITx n
- ROUT:SWITx n
- :SWITCHx n
- :SWITx n
- ROUTE:SWITCHx:VALUE n
- ROUTE:SWITCHx:VAL n
- :SWITx:VAL n

Possible error codes
5, 10, 11, 12, 13

Factory default value
N.a.

Power on behavior
Keeps last value

Timing
The timing to execute a command depends on the length of the command (in case of concatenated commands). In case of switching commands the controller will first command each switch to set its new position, then query each switch to ensure that the positions are closed. Only after this internal verification (that happens automatically) the controller will respond with a “1” to the *OPC? query and update the error status.

As a rule of thumb electromechanical switches require approximately 10-15ms to switch position.
But the *OPC? query will return a “1” or the error status is updated only after the switches have not only changed its positions, but rather also confirmed its position. So it is safe to consider some safety margin and expect a response of “1” or an updated error status after about 70ms per switch.
As an example if 2 switches are commanded, wait about 140ms before issuing an *OPC? query that will return a “1” or issuing an SYST:ERR? query or issuing a ROUTE:SWITCHx? query.
7.6.3 Requesting Switch x current position

x = switch address.

Examples:
- ROUTE:SWITCHx?
- ROUT:SWITx?
- :SWITx?

Result:
Returns the current position of switch x.

Possible error codes
None

Timing
The timing to execute a command depends on the length of the command (in case of concatenated commands). In case of switching commands the controller will first command each switch to set its new position, then query each switch to ensure that the positions are closed. Only after this internal verification (that happens automatically) the controller will respond with a “1” to the *OPC? query and update the error status.

As a rule of thumb electromechanical switches require approximately 10-15ms to switch position.

But the *OPC? query will return a “1” or the error status is updated only after the switches have not only changed its positions, but rather also confirmed its position. So it is safe to consider some safety margin and expect a response of “1” or an updated error status after about 70ms per switch.

As an example if 2 switches are commanded, wait about 140ms before issuing an *OPC? query that will return a “1” or issuing an SYST:ERR? query or issuing a ROUTE:SWITCHx? query.
7.7 DHCP Command Set

The following contains the DHCP (Dynamic Host Configuration Protocol) commands of SCPI that the Ethernet control is compatible with.

7.7.1 SET:DHCP ON or SET:DHCP OFF (Ethernet Version)

Syntax
SET:DHCP ON | OFF

Description
Turns DHCP mode ON or OFF

Possible error codes
5

Factory default value
ON

Power on behavior
Keeps last value

*RST effect
None

Timing
In order for the new DHCP settings to take effect the matrix needs to be power cycled.

7.7.2 GET:DHCP (Ethernet Version)

Syntax
GET:DHCP

Description
Returns DHCP mode

Result
ON
or
OFF

Possible error codes
None
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## RS232, USB and Ethernet Command description for standard matrices

<table>
<thead>
<tr>
<th>Command Syntax</th>
<th>Response</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  *IDN?</td>
<td>MS KIT</td>
<td>Returns string in 'Model Name' in the configuration file. As a minimum will have model name. Could also have: Vendor, model, serial number, firmware revision (The response shown in this table is just an example).</td>
</tr>
<tr>
<td>2  *OPC?</td>
<td>1 or 0</td>
<td>Gives 1 if previous operation was completed and gives 0 if previous operation is still not complete.</td>
</tr>
<tr>
<td>3  *RST</td>
<td></td>
<td>Puts all switches in the default position. (Transfer switches in pos. 1. Most other switches in pos. 0 = open).</td>
</tr>
<tr>
<td>4  ROUTE:SWITCHx y or :SWITCHx y</td>
<td></td>
<td>Closes position y on switch x</td>
</tr>
<tr>
<td>5  ROUTE:SWITCHx? or :SWITCHx? n</td>
<td></td>
<td>Gives current position of switch x</td>
</tr>
<tr>
<td>6  ROUTE:SAVEPOSITIONS x</td>
<td></td>
<td>Saves the current switch's configuration (position settings) in the 'preset record' x</td>
</tr>
<tr>
<td>7  ROUTE:RECALLPOSITIONS x</td>
<td></td>
<td>Recalls the current switch's configuration (position settings) previously saved in the 'preset record' x</td>
</tr>
<tr>
<td>8  ROUTE:POSITIONS?</td>
<td>0 to 30</td>
<td>Returns the current switch configuration (position settings) x set. If no switch configuration is set a 0 (zero) is returned.</td>
</tr>
<tr>
<td>9  SET:DHCP ON or SET:DHCP OFF</td>
<td></td>
<td>Turns DHCP mode ON or OFF</td>
</tr>
<tr>
<td>10 GET:DHCP</td>
<td>ON or OFF</td>
<td>Returns DHCP mode</td>
</tr>
<tr>
<td>11 SYST:IPADDRESS?</td>
<td>xx.yy.zz.aa</td>
<td>Returns system IP address</td>
</tr>
<tr>
<td>12 SYST:IPADDRESS xx.yy.zz.aa</td>
<td></td>
<td>Sets system IP address to xx.yy.zz.aa</td>
</tr>
<tr>
<td>13 SYST:TCPPORT?</td>
<td>n</td>
<td>Returns TCP port number</td>
</tr>
<tr>
<td>14 SYST:TCPPORT x</td>
<td>xx.yy.zz.aa</td>
<td>Sets TCP port number to x</td>
</tr>
<tr>
<td>15 SYST:GATEWAY?</td>
<td>xx.yy.zz.aa</td>
<td>Returns system gateway address</td>
</tr>
<tr>
<td>16 SYST:GATEWAY xx.yy.zz.aa</td>
<td></td>
<td>Sets system gateway address to xx.yy.zz.aa</td>
</tr>
<tr>
<td>17 SYST:MASK?</td>
<td>xx.yy.zz.aa</td>
<td>Returns system subnet mask address</td>
</tr>
<tr>
<td>18 SYST:MASK xx.yy.zz.aa</td>
<td></td>
<td>Sets system subnet mask address to xx.yy.zz.aa</td>
</tr>
<tr>
<td>19 SYST:MACADDRESS?</td>
<td>xx.yy.zz</td>
<td>Returns system MAC address</td>
</tr>
<tr>
<td>20 SYST:SERIALNUMBER?</td>
<td>n</td>
<td>Returns system serial number</td>
</tr>
<tr>
<td>21 SYST:TIMEOUT?</td>
<td>n</td>
<td>Returns Time out setting for TCP/IP connection (n is in seconds)</td>
</tr>
<tr>
<td>22 SYST:TIMEOUT x</td>
<td></td>
<td>Sets Time out setting for TCP/IP connection (x is in seconds)</td>
</tr>
<tr>
<td>23 SYST:ERR? or SYST:ERROR?</td>
<td>-4, SYNTAX ERROR</td>
<td>Returns system error number and error description. (The response shown in this table is just an example).</td>
</tr>
<tr>
<td>24 SYST:STATUS?</td>
<td>SWITx y;SWITx y;SWITx y;...;SWITx y;LOC;PWR1 OK;PWR2 FAULT; ERRORS 5;3;0</td>
<td>This command will return all Switch positions, Local/Remote mode, Power supply status and Errors list in the error buffer separated by a semicolon.</td>
</tr>
<tr>
<td>25 SYST:SCREENSAVER?</td>
<td>n</td>
<td>Returns time setting for the screen saver (n is in minutes)</td>
</tr>
<tr>
<td>26 SYST:SCREENSAVER x</td>
<td></td>
<td>Sets time setting for the screen saver (x is in minutes)</td>
</tr>
<tr>
<td>27 SYST:FIRMWARE?</td>
<td>49102-xxx_xx</td>
<td>Returns Dow-Key’s Firmware part number running in the matrix controller board</td>
</tr>
<tr>
<td>28 SYST:FIRMREV?</td>
<td>x.x</td>
<td>Returns Dow-Key’s Firmware revision running in the matrix controller board</td>
</tr>
</tbody>
</table>
### GPIB, RS232 and USB Command description for standard matrices

<table>
<thead>
<tr>
<th>Command Syntax</th>
<th>Response</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 *IDN?</td>
<td>MS KIT</td>
<td>Returns string in ‘Model Name’ in the configuration file. As a minimum will have model name. Could also have: Vendor, model, serial number, firmware revision (The response shown in this table is just an example).</td>
</tr>
<tr>
<td>2 *OPC?</td>
<td>1 or 0</td>
<td>Gives 1 if previous operation was completed and gives 0 if previous operation is still not complete.</td>
</tr>
<tr>
<td>3 *RST</td>
<td></td>
<td>Puts all switches in the default position. (Transfer switches in pos.1. Most other switches in pos. 0 = open).</td>
</tr>
<tr>
<td>4 ROUTE:SWITCHx y or :SWITCHx?</td>
<td></td>
<td>Closes position y on switch x</td>
</tr>
<tr>
<td>5 ROUTE:SWITCHx? or :SWITCHx y</td>
<td>n</td>
<td>Gives current position of switch x</td>
</tr>
<tr>
<td>18 SYST:SERIALNUMBER?</td>
<td>n</td>
<td>Returns system serial number</td>
</tr>
<tr>
<td>22 SYST:ERR? or SYST:ERROR?</td>
<td>-4,SYNTAX ERROR</td>
<td>Returns system error number and error description. (The response shown in this table is just an example).</td>
</tr>
<tr>
<td>23 SYST:STATUS?</td>
<td></td>
<td>This command will return all Switch positions, Local/Remote mode, Power supply status and Errors list in the error buffer separated by a semicolon.</td>
</tr>
<tr>
<td>24 SYST:SCREENSAVER?</td>
<td>n</td>
<td>Returns time setting for the screen saver (n is in minutes)</td>
</tr>
<tr>
<td>25 SYST:SCREENSAVER x</td>
<td></td>
<td>Sets time setting for the screen saver (x is in minutes)</td>
</tr>
<tr>
<td>26 SYST:GPIBADDRESS?</td>
<td>9</td>
<td>Returns matrix system’s GPIB address</td>
</tr>
<tr>
<td>27 SYST:GPIBADDRESS x</td>
<td></td>
<td>Sets matrix system’s GPIB address to x</td>
</tr>
<tr>
<td>31 *CLS</td>
<td></td>
<td>Clear Status Command used to clear the Event Register in all register groups.</td>
</tr>
<tr>
<td>32 *ESE</td>
<td></td>
<td>Command used to enable bits in the Standard Event Status Enable register.</td>
</tr>
<tr>
<td>33 *ESE?</td>
<td></td>
<td>Query used to read the content of the Standard Event Status Enable register.</td>
</tr>
<tr>
<td>34 *ESR?</td>
<td></td>
<td>Query used to read the content of the Event Status Register.</td>
</tr>
<tr>
<td>35 *OPC</td>
<td></td>
<td>Sets the Operation Complete bit in the Event Status Register when all pending operations have been finished.</td>
</tr>
<tr>
<td>36 *STB?</td>
<td></td>
<td>Query used to read the content of the Status Byte Register.</td>
</tr>
<tr>
<td>37 *SRE</td>
<td></td>
<td>Command used to enable bits in the Service Request Enable register.</td>
</tr>
<tr>
<td>38 *SRE?</td>
<td></td>
<td>Query used to read the content of the Service Request Enable register.</td>
</tr>
<tr>
<td>39 *WAI</td>
<td></td>
<td>This command prevents the matrix from executing any further commands or queries until the current commands have been processed.</td>
</tr>
</tbody>
</table>

**Note 1:** Missing command numbers are commands reserved for Ethernet matrices and not applicable to GPIB models.

**Note 2:** Commands related to the GPIB controller’s registers *ESE, *ESE?, *ESR?, *STB?, *SRE, *SRE? can NOT be concatenated.
Remote Operation

Note:

1. Commands are **NOT** case sensitive.

2. **(Ethernet Version)** Every command and response on the Ethernet and serial port should have "\r\n" Carriage return (0x0D) and Line Feed (0x0A) at the end.

3. **(GPIB Version)** For GPIB communication no ASCII termination is required, but the End Or Identify (EOI) line shall be asserted at the end of each command.

4. Every command and response on the serial or USB port shall have "\r\n" Carriage return (0x0D) and Line Feed (0x0A) at the end.

5. Multiple commands with same header can be given in a single command line. (See rule # 7 for an exception to this).
   - e.g. SYST:IPADDRESS?;TCP_PORT?;SERIALNUMBER 2 or ROUTE:SWITCH1 2;SWITCH1?;
   - note that the commands have to be separated by ';'

6. **(Ethernet Version)** The default settings for the Ethernet interface are:
   - IP Address: Assigned dynamically by your server (DHCP = ON)
   - TCP Port number: 10
   - Gateway address: 200.169.200.5
   - Subnet mask: 255.255.255.0
   - In command SYST:TIMEOUT? The returned value n is in seconds. The default value is 0. 0 = no timeout.

7. **(GPIB Version)** Exception to rule # 5 are commands related to the GPIB controller’s registers *ESE, *ESE?, *ESR?, *STB?, *SRE, *SRE?. These commands can **NOT** be concatenated.

8. **(GPIB Version)** The default GPIB address is: 9

9. **(Display Version)** In command SYST: SCREENSAVER? and SYST:SCREENSAVER x, the value n and x is in minutes. The default value is 5 (minutes). 0 = no screen saver. Valid values for x are: 0, 2, 3, 4, 5, 6,....
The Touch Screen Interface

Note: The booting sequence will last up to 1 minute in which the LCD can at times appear blank.

The matrix will power up in LOCAL Operating Mode. LOCAL Operating Mode means that the matrix is receiving commands from the front panel (LCD/Touch Screen).

When in LOCAL Operation Mode the matrix will switch automatically in REMOTE mode as soon as commands coming from a remote control computer are received (GPIB, Ethernet, Serial or USB). The only buttons that will respond while in REMOTE mode are:

- From the ‘Main Menu’ the ‘Switch Operations’ button.
- From the ‘Switching Menu’ the ‘Current Positions’ button.

Other than the above two buttons the matrix will not accept any other local commands until the operator switches to LOCAL mode by pushing the ‘Go Local” button on the LCD.

As stated before, to switch to REMOTE Operation Mode the operator needs to send a command (GPIB, Ethernet, Serial or USB) by means of a remote control computer or push on the ‘Go Remote’ button on the LCD.

All LOCAL operation of the matrix is accomplished via the front panel’s Touch Screen LCD. Regions that respond to touches are called Active Areas or Buttons.

IMPORTANT NOTE: The touch screen is best operated with a stylus, rather than a fingertip. The LCD will respond better to a taping action rather than just touching it.
The figure above shows the matrix LCD touch screen (sometimes referred to as the “User Interface”, or “UI”) at the main menu screen.

Most buttons have a gray background, while indicators will be either green or red. All screens, with exception of the ‘Main Menu’ screen, will have a green ‘back’ button to return to the previous screen.

In the above picture the matrix is indicating that there are No Errors (see green indicator) and the matrix is in LOCAL mode (see green indicator).

If an error condition is detected the green “Error” indicator will illuminate red.

The LCD in the figure above shows the top level of the matrix’s operational screen, which happens to be a menu; the gray buttons are used to select menu items. Other screens encountered allow the operator to modify various parameters’ values; all such “data fields” are presented with a currently set or default value blinking, prompting the operator to modify the value. Some screens present multiple data fields, and a virtual keypad with arrows will appear to navigate around them and change the values.

! Note:
To preserve the life of the LCD, it has a ‘screen saver’ feature. After 5 minutes the LCD backlight will turn off. To turn it back on, tap anywhere.

The various screens encountered in the matrix’s operation contain the following controls:
Main Menu

Switching Operations

Switch Operations Menu

Set Switch Positions
View the currently set position and change the position of a switch who’s ID has been configured to the matrix. Use the arrows to change switch and position numbers.

Refer to Appendix B to set the RF switches in the correct desired positions.

Current Positions
View the currently set positions of all switches whose ID’s have been configured to the matrix. This screen can show a maximum of 30 switches at a time. BACK will bring the Operator back to the Switching Menu.

Remember that a switch position reported as 255 (0xFF) is meant to mean “position unknown”, and is often the result of a switch not responding to a query for position.

Note that all Dow-Key switches have “open” defined but not all switch types have an actual open position (the switch is not closed to any of its RF ports).
For most switches this “open” is the default position and is defined as position 0. But for transfer switches there is no “open” condition, hence the default position is pos.1. As a result of this, commanding the switch to pos 0 or pos 1 will have the same result, closing it to its default position 1.

Switching History
View the last 10 switching actions. The latest action is presented first.

Save Positions
Save to non-volatile memory the state of the positions of all switch ID’s configured to the matrix, as 1 through 30.
Recall Positions
Recall from non-volatile memory the state of the positions of all switch ID’s configured to the matrix, saved as 1 through 30, and set the positions of those switches.

Clear Positions
Cause all switches configured to the matrix to assume their default position. For most switches this is position 0 (open positions). Note that all Dow-Key switches have “open” defined but not all switch types have an actual open position, such as a transfer switch. In this case “open” means “close on its default position 1”.

Cycle Positions
Step all switches configured to the matrix through all of their positions. NOTE: the Cycle Position function is intended for use at the Dow-Key factory during the assembly process. In fact, the Cycle Position function will generate errors when commanding a Transfer switch to switch from position 0 to position 1, which may be ignored. For this reason, the Operator is discouraged from exercising Cycle Positions.
Appendix A

Error Operations

View the contents of the Error Log. Each entry is displayed with the oldest being first (First In First Out), showing the Error Record Number (its place in the Error Log), an associated Error Code, an associated Error Data, and a text explanation of the Error.

The Error Data contains various parameters associated with certain Errors. For instance, an Error Code 10 “Switch Did Not Respond” will show the offending switch ID in the Error Data field.

As each error is being read (displayed locally or queried remotely) it will also be removed from the Error Log.

System Settings

System Settings Menu

System Information
View the Dow-Key Matrix Product’s Model Number, its Serial Number (set at factory), and the Dow-Key part number and revision level of firmware running on the Matrix Controller.

Add Switch
Add switches to the Matrix Configuration.

Delete Switch
Delete switches from the Matrix Configuration.

Find Switch ID
Discover and view the ID of any switch by following these steps:

1. Using a matrix with at least one unused CAN Bus connector, and leaving the switch in question unconnected, select Main Menu>System Settings>Find Switch ID. The screen will indicate that no switch is connected.

2. Connect the switch in question. The screen will now display the unknown switch ID. NOTE: occasionally, the switch will not immediately report its ID; in this case, simply disconnect and reconnect the switch.

3. Multiple switches may be connected and disconnected one at a time while in this screen.
Appendix A

4. NOTE: this operation “puts the matrix’s switches to sleep” thereby rendering the matrix inoperable during the process. ENTER or CLEAR or rebooting returns the matrix to normal.

5. NOTE: proper performance of Find Switch ID relies on the behavior of Dow-Key Switch firmware revision 4 and above – revision 3 and below does not allow “putting the switch to sleep”. So, this feature is best executed on a matrix that does not contain switches with firmware revision 3 or less, or those switches will respond with their ID’s as well as the switch in question. The revision of firmware of any switch configured to the matrix may be learned with **Main Menu>System Settings>Switch Information** (see below).

**Temperatures**

View current values of a maximum of 4 temperature sensors, and set thresholds at which an Over Temperature alarm should occur. Setting all 4 alarm thresholds to 0° Celsius disables Over Temperature alarms and causes the current temperatures to read out 0° as well; this is the recommended setting for Matrix Products that contain no temperature sensors.

**Most standard Models do not feature temperature sensors.**

**Switch Closure Counts**

View the number of times any position of any switch configured to the matrix has been closed upon, to a maximum of 1,000,000.
Ethernet Options

Actual changes to the Ethernet variables referred to below will not take effect nor be shown on the front panel until the matrix has been powered down and back up.

**Ethernet Menu**

Set/Acquire IP Address
View and/or modify the current IP Address and Acquisition Mode, Static or Dynamic (DHCP off or on).

Set Subnet Mask
View and/or modify the current Subnet Mask.

Note: the Acquisition Mode needs to be Manually (DHCP = OFF) for this parameter to be changed.

Set Gateway
View and/or modify the current Gateway.

Note: the Acquisition Mode needs to be Manually (DHCP = OFF) for this parameter to be changed.

Set Port Number
View and/or modify the current Port Number. The factory default is 10.

Set Timeout
View and/or modify the current Timeout settings (in seconds). The factory default is 0 seconds.

The Timeout is used to automatically close the TCP/IP socket after a certain amount of seconds of inactivity on the port.

Note: A settings of 0 seconds means that the timeout is disabled. The TCP/IP socket will never be closed automatically and only one remote TCP/IP connection at the time is possible.
LCD Options

This LCD has no adjustable parameters.

Set RS232 Baud Rate

View and select the Serial Port’s Baud rate from a set of preselected values from 1200 to 115,200 b/s.
Use the arrows to change the baud rate settings.

Default value is 9600b/s.

Set GPIB Address

View and select the GPIB address. The default address is 9
Not applicable to ENET (Ethernet) models.
Appendix B
The Keypad / LCD Interface

Note: The booting sequence will last about 15 seconds in which the LCD will appear blank.

The figure above shows the LCD/Keypad (sometimes referred to as the “User Interface”, or “UI”) at the top level of UI screens.

The “COMM” LED should normally be blinking green as an indication of normal program execution.

The “REMOTE” LED, normally dark, will illuminate green when the matrix is in REMOTE Mode.

The “ERROR” LED, normally green, will illuminate red upon the occurrence of an error event, or the persistence of several error conditions.

The LCD in the figure above shows the top level of the operational screen, which happens to be a menu; the keypad is used to scroll through and select menu items. Other screens encountered allow the operator to modify various parameter values; all such “data fields” are presented with a currently set or default value blinking, prompting the operator to modify the value. Some screens present multiple data fields, and the keypad is used to navigate around them.

The keypad’s keys have multiple functions depending on which screen is being presented.

The keypad’s round, center key is referred to as “ENTER” and serves as “set”, “select”, “done”, or “return”.

The keypad’s arrow keys (pointing the 4 cardinal directions) are referred to as “UP”, “DOWN”, “LEFT”, and “RIGHT”.

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UP and DOWN serve as “scroll up”, “scroll down”, “increment”, or “decrement”. Many data fields’ values are modified by UP and DOWN, and many of those allow the pressing and holding of the UP and DOWN keys to cause an acceleration of the incrementing or decrementing.

The keypad’s upper left diagonal key is referred to as UP DIAG. This key serves as “back”, “clear”, or “escape”.

The keypad’s lower left diagonal key causes no action in the context of any screen.

LEFT and RIGHT serve as “next” and “previous”; these keys are used almost exclusively to navigate around the user data entry fields many screens present.

Caveats:
The UI device may demonstrate a “speed limit” when it comes to how rapidly the Operator may actuate keys and still get the correct response on the LCD: the Operator is encouraged to find a comfortable cadence when operating the keypad.

Note: To preserve the life of the LCD, it has a ‘screen saver’ feature. After 5 minutes the LCD backlight will turn off. Once dark, pressing any key will have no effect other than to re-illuminate the backlight.

The matrix will power up in LOCAL Operating Mode. LOCAL Operating Mode means that the matrix is receiving commands from the front panel (Keypad).

When in LOCAL Operation Mode the matrix will switch automatically in REMOTE mode as soon as commands coming from a remote control computer are received (GPIB, Ethernet, Serial or USB). The matrix will return to LOCAL Mode upon the pressing of any key.

The matrix will not accept any other local commands until the operator switches to LOCAL mode by pushing any button on the keypad.

As stated before, to switch to REMOTE Operation Mode the operator needs to send a command (GPIB, Ethernet, Serial or USB) by means of a remote control computer.

All LOCAL operation of the matrix is accomplished via the front panel’s Keypad / LCD.

The various screens encountered in the matrix’s operation contain the following controls:
Main Menu

Switching Operations

Switch Operations Menu

Set Switch Positions
View the currently set position and change the position of a switch who’s ID has been configured to the matrix. Use the arrows to change switch and position numbers.

Refer to Appendix B to set the RF switches in the correct desired positions.

Current Positions
View the currently set positions of all switches whose ID’s have been configured to the matrix. This screen can show a maximum of 12 switches at a time; press UP or DOWN to view the next set of a maximum of 12. Note: the presentation of switch positions is a “one way” experience in that the operator can only view successively greater ID’s. BACK will bring the Operator back to the Switching Menu.

Remember that a switch position reported as 255 (0xFF) is meant to mean “position unknown”, and is often the result of a switch not responding to a query for position.

Note that all Dow-Key switches have “open” defined but not all switch types have an actual open position (the switch is not closed to any of its RF ports).
For most switches this “open” is the default position and is defined as position 0. But for transfer switches there is no “open” condition, hence the default position is pos.1. As a result of this, commanding the switch to pos 0 or pos 1 will have the same result, closing it to its default position 1.

Switching History
View the last 10 switching actions. The latest action is presented first.

Save Positions
Save to non-volatile memory the state of the positions of all switch ID’s configured to the matrix, as 1 through 30.
Recall Positions
Recall from non-volatile memory the state of the positions of all switch ID's configured to the matrix, saved as 1 through 30, and set the positions of those switches.

Clear Positions
Cause all switches configured to the matrix to assume their default position. For most switches this is position 0 (open positions). Note that all Dow-Key switches have “open” defined but not all switch types have an actual open position, such as a transfer switch. In this case “open” means “close on its default position 1”.

Cycle Positions
Step all switches configured to the matrix through all of their positions. NOTE: the Cycle Position function is intended for use at the Dow-Key factory during the assembly process. In fact, the Cycle Position function will generate errors when commanding a Transfer switch to switch from position 0 to position 1, which may be ignored. For this reason, the Operator is discouraged from exercising Cycle Positions.
Appendix B

Error Operations

View the contents of the Error Log. Each entry is displayed with the oldest being first (First In First Out), showing the Error Record Number (its place in the Error Log), an associated Error Code, an associated Error Data, and a text explanation of the Error.

The Error Data contains various parameters associated with certain Errors. For instance, an Error Code 10 “Switch Did Not Respond” will show the offending switch ID in the Error Data field.

Once a particular Error has been logged, no further occurrences of it will be entered. For instance multiple subsequent misspelled Commands, would not result in multiple Syntax Errors being logged until the original entry was cleared.

As each error is being read (displayed locally or queried remotely) it will also be removed, always clearing the oldest remaining entry, from the Error Log. Entries in the Error Buffer are removed by successive presses of the up or down arrow keys.

The Error LED will illuminate green when the Error Log is empty unless a persistent error condition exists, such as a Power Supply failure that remains failed.
System Settings

System Settings Menu

System Information
View the Dow-Key Matrix Product’s Model Number, its Serial Number (set at factory), and the Dow-Key part number and revision level of firmware running on the Matrix Controller.

Add Switch
Add switches to the Matrix Configuration.

Delete Switch
Delete switches from the Matrix Configuration.

Find Switch ID
Discover and view the ID of any switch by following these steps:

6. Using a matrix with at least one unused CAN Bus connector, and leaving the switch in question unconnected, select Main Menu>System Settings>Find Switch ID. The screen will indicate that no switch is connected.

7. Connect the switch in question. The screen will now display the unknown switch ID. NOTE: occasionally, the switch will not immediately report its ID; in this case, simply disconnect and reconnect the switch.

8. Multiple switches may be connected and disconnected one at a time while in this screen.
9. NOTE: this operation “puts the matrix’s switches to sleep” thereby rendering the matrix inoperable during the process. ENTER or CLEAR or rebooting returns the matrix to normal.

**Temperatures**

View current values of a maximum of 4 temperature sensors, and set thresholds at which an Over Temperature alarm should occur. Setting all 4 alarm thresholds to 0° Celsius disables Over Temperature alarms and causes the current temperatures to read out 0° as well; this is the recommended setting for Matrix Products that contain no temperature sensors.

*Most standard Models do not feature temperature sensors.*

**Switch Closure Counts**

View the number of times any position of any switch configured to the matrix has been closed upon, to a maximum of 1,000,000.

**Switch Information**

View the Part Number, Serial Number, Firmware Number, Firmware Revision Level, maximum number of positions, its PCBA Code (factory), and Coil Delay Time, of any switch configured to the matrix.

**Default Settings**

This password protected option is used during the assembly process and is not intended for Operator use.
Ethernet Options

Actual changes to the Ethernet variables referred to below will not take effect nor be shown on the front panel until the matrix has been powered down and back up.

**Ethernet Menu**

**Set/Acquire IP Address**
View and/or modify the current IP Address and Acquisition Mode, Static or Dynamic (DHCP off or on).

**Set Subnet Mask**
View and/or modify the current Subnet Mask.

Note: the Acquisition Mode needs to be Manually (DHCP = OFF) for this parameter to be changed.

**Set Gateway**
View and/or modify the current Gateway.

Note: the Acquisition Mode needs to be manually (DHCP = OFF) for this parameter to be changed.

**Set Port Number**
View and/or modify the current Port Number. The factory default is 10.

**Set Timeout**
View and/or modify the current Timeout settings (in seconds). The factory default is 0 seconds.

The Timeout is used to automatically close the TCP/IP socket after a certain amount of seconds of inactivity on the port.

Note: A settings of 0 seconds means that the timeout is disabled. The TCP/IP socket will never be closed automatically and only one remote TCP/IP connection at the time is possible.
LCD Options

View and adjust the brightness and contrast of the LCD. Changes made here are persistent over power down and up.

Set RS232 Baud Rate

View and select the Serial Port’s Baud rate from a set of preselected values from 1200 to 115,200 b/s.

Use the arrows to change the baud rate settings.

Default value is 9600b/s.

Set GPIB Address

View and select the GPIB address. The default address is 9

Not applicable to ENET (Ethernet) models.