

Application Note:

AN2008-08-ENET Rev. 1.1

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Ethernet Software Configuration Application Note

Abstract:

This Application Note describes how the Ethernet software is configured for communication via the Ethernet protocol. It details out the available syntax and commands to use for programming the Dow-Key CANbus switches. In addition, it shows by example how to control the electro-mechanical switches in a Dow-Key matrix solution.

IP Address and TCP Port Set up

Before you configure your matrix, you will need to contact your network administrator to obtain the following information:

- An IP address for the matrix
- TCP port number

Each device on your network must have a unique address so that all devices can communicate simultaneously over the same network. These unique addresses are called IP addresses, and are assigned by your network administrator. An IP address is a set of four decimal numbers, separated by periods. For example: 169.254.111.111

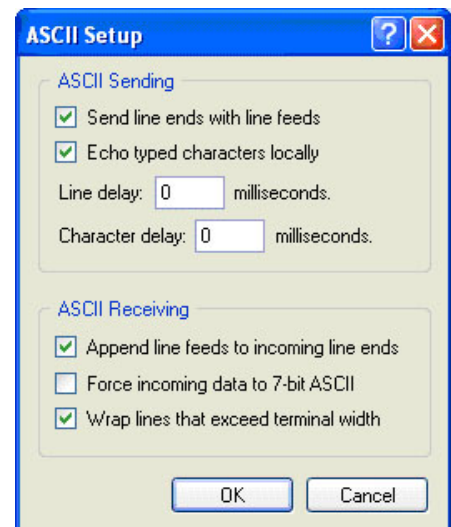
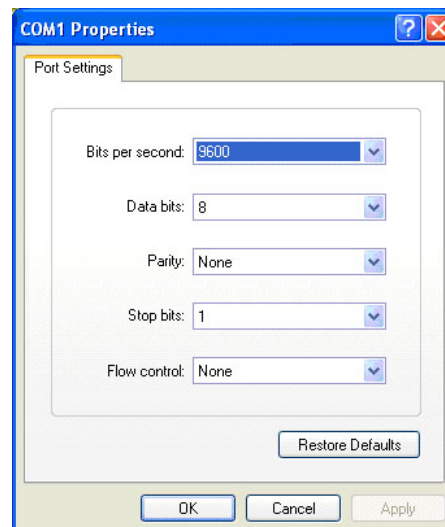
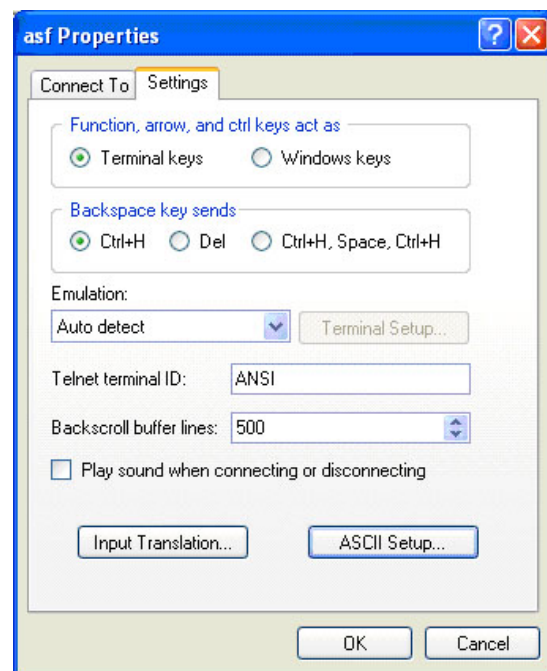
CAUTION: It is important that no two devices are assigned the same IP address. Both devices may fail to communicate on the network.

Procedure to SET an IP ADDRESS

1. Connect the matrix to a computer using RS-232.
2. Open **Hyper Terminal** and start a new session with following RS-232 settings.
 - a. Baud rate 9600
 - b. Data bits 8
 - c. Parity None
 - d. Stop bits 1
 - e. Flow control none

 Make sure to select the correct COM port.

3. Go to connection properties and click on ASCII setup. Check options 'send line ends with line feeds', 'echo typed characters locally' and 'append line feeds to incoming line ends'.




- Turn ON the power of the system.
- Type ***IDN?** in the *Hyper Terminal* window. You should get the identification string from the matrix. If you do not get any response, check your RS-232 connections.

- After getting a responds type in the desired IP address.

SYST:IPADDRESS <IPADDRESS><ENTER>

- To verify the entered IP address type:

SYST:IPADDRESS?<ENTER>


 If you set a wrong IP address by mistake, repeat step 6 and 7 with the correct IP address.

- Now you have the correct IP adress on this unit.

Procedure to SET a TCP PORT

- Now we need to set the TCP port of the ENET board in similar manner as above. Type below command and '23' (Telnet port) for <TCPPOINT>

SYST:TCPPOINT<TCPPOINT><ENTER>

 Note that if your matrix setup is directly connected to the PC, you can choose any TCP port as long as you choose the same TCP port on both ends. The factory default TCP port is '10'. You may want to enter the port number assigned by your network administrator.

- To verify the entered TCP port type:

SYST:TCPPOINT?<ENTER>

 If you set a wrong TCP port by mistake, repeat step 9 and 10 with the correct TCP port.

- Now you are set to use your ETHERNET connection.

MAC Address

Your matrix has a unique built-in MAC address associated with the Ethernet card inside the matrix. The MAC address is a 48-bit number assigned at the factory. You don't need to know the MAC address to configure your matrix.

Ethernet Connections

To connect your matrix to a LAN hub, the use of a

"straight-through" cable is required. To connect to a single computer and avoid using a LAN hub, a "cross-over" cable or adapter that acts like a LAN hub must be used. If you try to connect to a single computer, using a "straight-through" cable will not work.

Test the Ethernet Communication

To test the communication between your computer and your matrix, the ping utility is typically used.

Enter the following at the command prompt of a DOS window on your computer.

Ping <IP address>

<IP address> is the number that was assigned by your network administrator and was entered into your matrix in "Configuring the Matrix".

If there is a valid working connection, you should see a response similar to this:

```
C:\>ping 169.254.111.111

Pinging 169.254.111.111 with 32 bytes of data:
Reply from 169.254.111.111: bytes=32 time=5ms TTL=64
Reply from 169.254.111.111: bytes=32 time=2ms TTL=64
Reply from 169.254.111.111: bytes=32 time=2ms TTL=64
Reply from 169.254.111.111: bytes=32 time=3ms TTL=64
Ping statistics for 169.254.111.111
    Packets: Sent=4, Received=4, Lost=0 (0% loss)

Approximate round trip times in milli-seconds:
    Minimum=2ms, Maximum=5ms, Average=3ms
```

Communication Problems

Your Matrix interface does not need or include any proprietary driver software. It 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 1-805-650-0260.

Power Failure

If a power failure should occur, the matrix upon power up will set the latching switches to last settings before the failure.

CAUTION: No RF power should be provided to the matrix during power up.

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 Ethernet control. The Ethernet Translator Board has internal software loaded that can be written using SCPI command structure. SCPI is the abbreviation of **S**tandard **C**ommands for **P**rogrammable **I**nstruments. These commands are standard messages for the (re-remote) control of programmable instruments, which are sent by the Ethernet 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 test system.

NOTE: Not all commands for SCPI are compatible with Ethernet, only the ones stated in this document.

Command Syntax Structure

[ROUTE]:SWITCh[<id>]:[VALue]<number>

- 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, ROUTE, rout and Rout are all acceptable. Other forms, such as RO and ROU are not acceptable and will generate an error.

Command Separators

- 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 commands from the same subsystem into one message string.

- A colon and a semicolon is used to link commands from different subsystems.

Common Commands

The following contains the common commands of SCPI which the Ethernet control is compatible with.

*IDN?

Syntax

*IDN?

Result

A string is returned which consists of the following parts:

Vendor,model,serial number,firware revision

| | |
|--------------------------|--|
| <i>vendor</i> | Name of the vendor |
| <i>description</i> | Instrument description |
| <i>serial number</i> | Serial number of the instrument (3-digit number) |
| <i>firmware revision</i> | Revision state of the instrument firmware |

Example

“*IDN?”

Result

“DOW-KEY,AUTO CONFIG ETHERNET MATRIX,101,R1

*OPC?

Syntax

*OPC?

Description

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

Result

ASCII character “1”.

Example

:SWIT1 1;SWIT11 1;*OPC?

Result

“1”

***RST (Only applies to Normally Open Switches)**

Syntax

*RST

Description

This command performs a device reset. This will set the instrument so that all switches are in the "OPEN" state.

System Commands

The following contains the system commands of SCPI that the Ethernet control is compatible with.

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 the Ethernet translator board, the N=10. The error queue has to be read until no more errors are returned, otherwise the error status is not cleared.

Result

String with the following syntax:

String with result message, 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.

"SYST:ERR?"

Result was "-2"INPUT BUFFER OVERFLOW", check for more errors.

"SYST:ERR?"

Result was "-3"TOO MANY COMMANDS", check for more errors.

"SYST:ERR?"

Result was "-4"SYNTAX ERROR", check for more errors.

"SYST:ERR?"

Result was "-5"DATA OUT OF RANGE", check for more errors.

"SYST:ERR?"

Result was "-6"ILLEGAL PARAMETER VALUE", check for more errors.

"SYST:ERR?"

Result was "-7"INPUT BUFFER UNDERFLOW", check for more errors.

"SYST:ERR?"

Result was "-8"MATRIX SOCKET NOT AVAIL", check for more errors.

"SYST:ERR?"

Result was "-0"NO ERROR", No more errors, error queue is empty.

Explanation of Error Queue

"-1"INVALID CHARACTER"

Invalid character detected. Would be caused by "ROUTE:SWITCH2 Y". The software is expecting a switch position number and you have entered a letter instead. Hence 'Y' is an invalid character. Solution: check your syntax in the offending message.

"-2"INPUT BUFFER OVERFLOW"

The output buffer can store up to 8 messages. If there ends up being more than 8 messages in the output buffer, this error will occur. Solution: always read back messages after you ask the matrix for a reply.

"-3"TOO MANY COMMANDS"

More than 8 separate stacked commands were sent in the same single message string. Solution: send less than 8 at a time.

"-4"SYNTAX ERROR"

Would be caused by "RUOTE:SWITCH2 4". Solution: check for spelling.

"-5"DATA OUT OF RANGE"

Would be caused by trying to set a switch outside of its parameters. If you tried to set a 6 position switch to position 7 this would occur. Solution: check the switch parameters.

“-6”ILLEGAL PARAMETER VALUE””

This message is set if the IP address or MAC address is an invalid one. Sending SYSTEM:IPADDRESS 45.57.2 would generate this message since 4 numbers are required for a valid IP address. Solution: check your syntax.

“-7”INPUT BUFFER UNDERFLOW””

This happens if you try to read out a message from the matrix and there is no message there to be read. Solution: always do a write than read.

“-8”MATRIX SOCKET NOT AVAIL””

This occurs when you open a TCP socket, then do not properly close it and then try to open a new TCP socket. Only 1 connection is allowed at a time. Solution: ensure that all old TCP sockets are closed properly before proceeding.

Switch [Module] Command Set

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

:SWITCh[<id>]:[VALue]

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 1 to N fashion, therefore legal values for <number> are from 1 to the maximum number of position for the switch. For example, a SP10T switch has 10 positions, 1 thru 10.

Setting switch x to position n

x = switch [module] address
(can be a number from 1-255).

n = position to set and must be within the switches parameter.

(Example: SP10T valid positions are 1 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

Requesting Switch x current position

x = switch address (can be a number from 1-255).

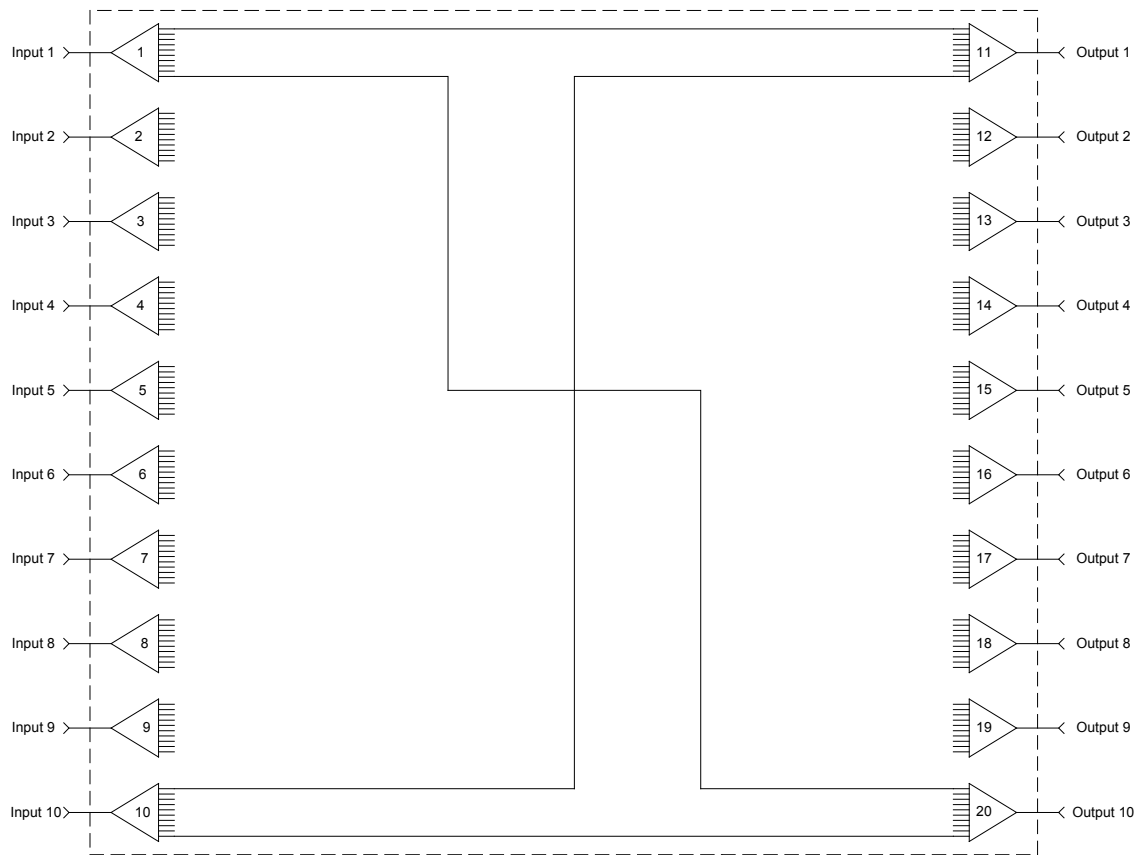
Examples:

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



Sample Command Structure

The following table gives a sample command structure for every possible RF path of a 10x10 Non-blocking Crossbar Matrix (Dow-Key Model 4101-ENET).



| INPUT | OUTPUT | COMMAND STRING | INPUT | OUTPUT | COMMAND STRING |
|-------|--------|--------------------------|-------|--------|--------------------------|
| 1 | 1 | :SWIT1 1;SWIT11 1;*OPC? | 3 | 1 | :SWIT3 1;SWIT11 3;*OPC? |
| 1 | 2 | :SWIT1 2;SWIT12 1;*OPC? | 3 | 2 | :SWIT3 2;SWIT12 3;*OPC? |
| 1 | 3 | :SWIT1 3;SWIT13 1;*OPC? | 3 | 3 | :SWIT3 3;SWIT13 3;*OPC? |
| 1 | 4 | :SWIT1 4;SWIT14 1;*OPC? | 3 | 4 | :SWIT3 4;SWIT14 3;*OPC? |
| 1 | 5 | :SWIT1 5;SWIT15 1;*OPC? | 3 | 5 | :SWIT3 5;SWIT15 3;*OPC? |
| 1 | 6 | :SWIT1 6;SWIT16 1;*OPC? | 3 | 6 | :SWIT3 6;SWIT16 3;*OPC? |
| 1 | 7 | :SWIT1 7;SWIT17 1;*OPC? | 3 | 7 | :SWIT3 7;SWIT17 3;*OPC? |
| 1 | 8 | :SWIT1 8;SWIT18 1;*OPC? | 3 | 8 | :SWIT3 8;SWIT18 3;*OPC? |
| 1 | 9 | :SWIT1 9;SWIT19 1;*OPC? | 3 | 9 | :SWIT3 9;SWIT19 3;*OPC? |
| 1 | 10 | :SWIT1 10;SWIT20 1;*OPC? | 3 | 10 | :SWIT3 10;SWIT20 3;*OPC? |
| 2 | 1 | :SWIT2 1;SWIT11 2;*OPC? | 4 | 1 | :SWIT4 1;SWIT11 4;*OPC? |
| 2 | 2 | :SWIT2 2;SWIT12 2;*OPC? | 4 | 2 | :SWIT4 2;SWIT12 4;*OPC? |
| 2 | 3 | :SWIT2 3;SWIT13 2;*OPC? | 4 | 3 | :SWIT4 3;SWIT13 4;*OPC? |
| 2 | 4 | :SWIT2 4;SWIT14 2;*OPC? | 4 | 4 | :SWIT4 4;SWIT14 4;*OPC? |
| 2 | 5 | :SWIT2 5;SWIT15 2;*OPC? | 4 | 5 | :SWIT4 5;SWIT15 4;*OPC? |
| 2 | 6 | :SWIT2 6;SWIT16 2;*OPC? | 4 | 6 | :SWIT4 6;SWIT16 4;*OPC? |
| 2 | 7 | :SWIT2 7;SWIT17 2;*OPC? | 4 | 7 | :SWIT4 7;SWIT17 4;*OPC? |
| 2 | 8 | :SWIT2 8;SWIT18 2;*OPC? | 4 | 8 | :SWIT4 8;SWIT18 4;*OPC? |
| 2 | 9 | :SWIT2 9;SWIT19 2;*OPC? | 4 | 9 | :SWIT4 9;SWIT19 4;*OPC? |
| 2 | 10 | :SWIT2 10;SWIT20 2;*OPC? | 4 | 10 | :SWIT4 10;SWIT20 4;*OPC? |

| INPUT | OUTPUT | COMMAND STRING |
|-------|--------|--------------------------|
| 5 | 1 | :SWIT5 1;SWIT11 5;*OPC? |
| 5 | 2 | :SWIT5 2;SWIT12 5;*OPC? |
| 5 | 3 | :SWIT5 3;SWIT13 5;*OPC? |
| 5 | 4 | :SWIT5 4;SWIT14 5;*OPC? |
| 5 | 5 | :SWIT5 5;SWIT15 5;*OPC? |
| 5 | 6 | :SWIT5 6;SWIT16 5;*OPC? |
| 5 | 7 | :SWIT5 7;SWIT17 5;*OPC? |
| 5 | 8 | :SWIT5 8;SWIT18 5;*OPC? |
| 5 | 9 | :SWIT5 9;SWIT19 5;*OPC? |
| 5 | 10 | :SWIT5 10;SWIT20 5;*OPC? |
| 6 | 1 | :SWIT6 1;SWIT11 6;*OPC? |
| 6 | 2 | :SWIT6 2;SWIT12 6;*OPC? |
| 6 | 3 | :SWIT6 3;SWIT13 6;*OPC? |
| 6 | 4 | :SWIT6 4;SWIT14 6;*OPC? |
| 6 | 5 | :SWIT6 5;SWIT15 6;*OPC? |
| 6 | 6 | :SWIT6 6;SWIT16 6;*OPC? |
| 6 | 7 | :SWIT6 7;SWIT17 6;*OPC? |
| 6 | 8 | :SWIT6 8;SWIT18 6;*OPC? |
| 6 | 9 | :SWIT6 9;SWIT19 6;*OPC? |
| 6 | 10 | :SWIT6 10;SWIT20 6;*OPC? |
| 7 | 1 | :SWIT7 1;SWIT11 7;*OPC? |
| 7 | 2 | :SWIT7 2;SWIT12 7;*OPC? |
| 7 | 3 | :SWIT7 3;SWIT13 7;*OPC? |
| 7 | 4 | :SWIT7 4;SWIT14 7;*OPC? |
| 7 | 5 | :SWIT7 5;SWIT15 7;*OPC? |
| 7 | 6 | :SWIT7 6;SWIT16 7;*OPC? |
| 7 | 7 | :SWIT7 7;SWIT17 7;*OPC? |
| 7 | 8 | :SWIT7 8;SWIT18 7;*OPC? |
| 7 | 9 | :SWIT7 9;SWIT19 7;*OPC? |
| 7 | 10 | :SWIT7 10;SWIT20 7;*OPC? |
| 8 | 1 | :SWIT8 1;SWIT11 8;*OPC? |
| 8 | 2 | :SWIT8 2;SWIT12 8;*OPC? |
| 8 | 3 | :SWIT8 3;SWIT13 8;*OPC? |
| 8 | 4 | :SWIT8 4;SWIT14 8;*OPC? |
| 8 | 5 | :SWIT8 5;SWIT15 8;*OPC? |
| 8 | 6 | :SWIT8 6;SWIT16 8;*OPC? |
| 8 | 7 | :SWIT8 7;SWIT17 8;*OPC? |
| 8 | 8 | :SWIT8 8;SWIT18 8;*OPC? |
| 8 | 9 | :SWIT8 9;SWIT19 8;*OPC? |
| 8 | 10 | :SWIT8 10;SWIT20 8;*OPC? |
| 9 | 1 | :SWIT9 1;SWIT11 9;*OPC? |
| 9 | 2 | :SWIT9 2;SWIT12 9;*OPC? |
| 9 | 3 | :SWIT9 3;SWIT13 9;*OPC? |
| 9 | 4 | :SWIT9 4;SWIT14 9;*OPC? |
| 9 | 5 | :SWIT9 5;SWIT15 9;*OPC? |
| 9 | 6 | :SWIT9 6;SWIT16 9;*OPC? |
| 9 | 7 | :SWIT9 7;SWIT17 9;*OPC? |
| 9 | 8 | :SWIT9 8;SWIT18 9;*OPC? |
| 9 | 9 | :SWIT9 9;SWIT19 9;*OPC? |
| 9 | 10 | :SWIT9 10;SWIT20 9;*OPC? |

| INPUT | OUTPUT | COMMAND STRING |
|-------|--------|----------------------------|
| 10 | 1 | :SWIT10 1;SWIT11 10;*OPC? |
| 10 | 2 | :SWIT10 2;SWIT12 10;*OPC? |
| 10 | 3 | :SWIT10 3;SWIT13 10;*OPC? |
| 10 | 4 | :SWIT10 4;SWIT14 10;*OPC? |
| 10 | 5 | :SWIT10 5;SWIT15 10;*OPC? |
| 10 | 6 | :SWIT10 6;SWIT16 10;*OPC? |
| 10 | 7 | :SWIT10 7;SWIT17 10;*OPC? |
| 10 | 8 | :SWIT10 9;SWIT19 10;*OPC? |
| 10 | 10 | :SWIT10 10;SWIT20 10;*OPC? |



Technical Support

If the need of technical support is required, please contact Dow-Key Microwave Corporation.

Toll Free: (800) 266-3695
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