Control of Mini-Circuits' Portable Test Equipment (PTE) Using VISA

1 - VISA Overview 1
2 - Configuring as a LAN Instrument 2
2.a - Configuration using Keysight Connection Expert 2
2.b - Configuration using NI MAX 4
3 - Control of a LAN Instrument Using the Keysight / NI Software Suites 5
3.a - Sending Commands using Keysight Connection Expert 5
3.b - Sending Commands Using NI MAX 6
4 - Programmatic Control of a LAN Instrument 8
4.a - Example Using VB.NET for Control of a Power Sensor 8
4.b - Example Using C# for Control of a Power Sensor 8

1 - VISA Overview

VISA (Virtual Instrument Software Architecture) is a commonly used I/O (Input/Output) API (Advanced Programming Interface) for communication with test and measurement equipment. It is intended to provide a common interface, allowing test instrumentation from a variety of manufacturers to be controlled from a single software environment, using common processes.

The standard is managed by the IVI foundation (http://ivifoundation.org/), however there are various differing implementations available from test equipment manufacturers. This application note will focus on 2 of the most common VISA software implementations within the RF/Microwave test and measurement market:

- Keysight IO Libraries Suite, using Keysight Connection Expert
- National Instruments (NI) VISA, using NI's Measurement & Automation Explorer

The initial step to controlling Mini-Circuits' devices through VISA is to define the device as a LAN (Local Area Network) instrument (for Ethernet enabled models only). The device must be connected into the Ethernet network and the VISA software interface just needs to be configured with the device's IP address and port number. For Mini-Circuits' devices the default is port 23, reserved for Telnet communication.

2 - Configuring as a LAN Instrument

This section details the process for configuring any Mini-Circuits Ethernet controlled device through VISA as a LAN instrument, using the device's RJ45 port to connect to an Ethernet network.

2.a - Configuration using Keysight Connection Expert

1. Connect the PTE device to the local network and note the IP address
2. Launch Keysight Connection Expert
3. Navigate to Manual Configuration > Add New Instruments/Interfaces > LAN Instrument

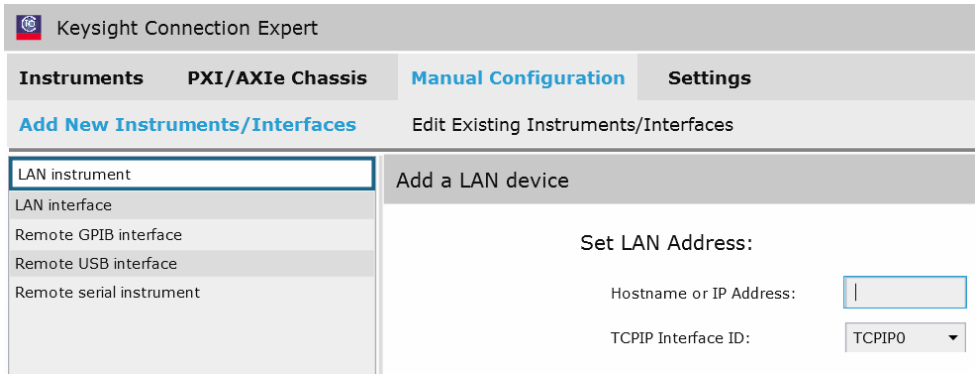

Fig i - Adding a new LAN instrument

4. Enter the IP address of the device in the "Hostname or IP Address" field
5. "TCPIP Interface ID" should usually be left as the default, this is the ID for the LAN itself
6. In the "Set Protocol" section, select "Socket" and enter port number "23"
7. Click "Test This VISA Address" to confirm the connection settings are correct

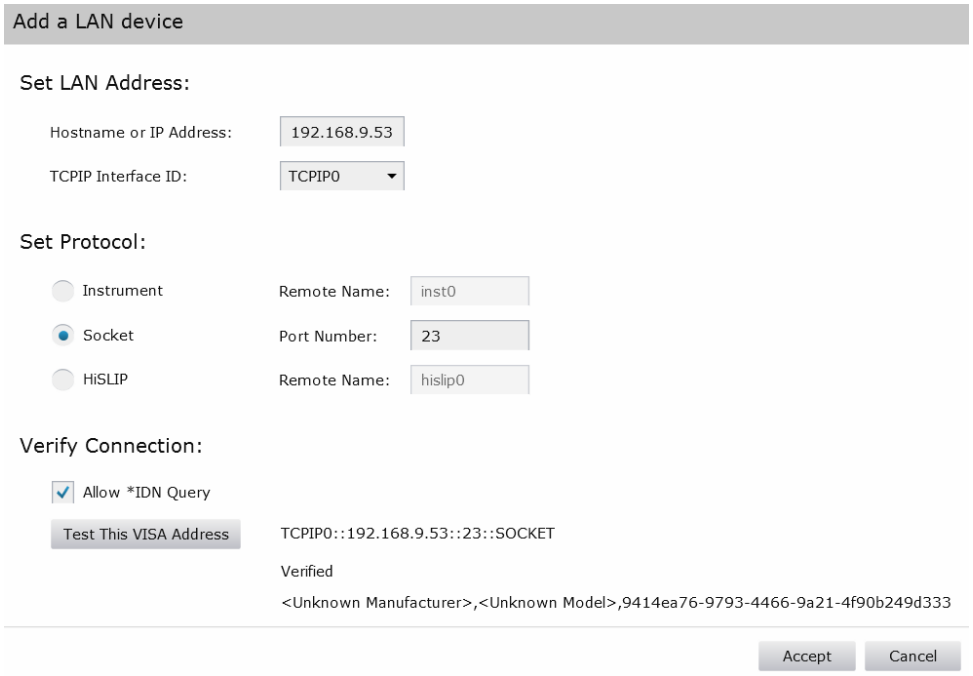

Fig ii - The successfully tested LAN device settings for a power sensor with IP address 192.168.9.53

8. Click Accept to save the configuration and Connection Expert will return to the home screen where the new instrument will be listed along with any other known VISA devices.
9. The Mini-Circuits PTE device will be listed as "Unknown" but will be identifiable by the IP address

10. To add an "alias" in order to make the device more easily identifiable, click on the device and then select "Add or Change Aliases" from the summary screen

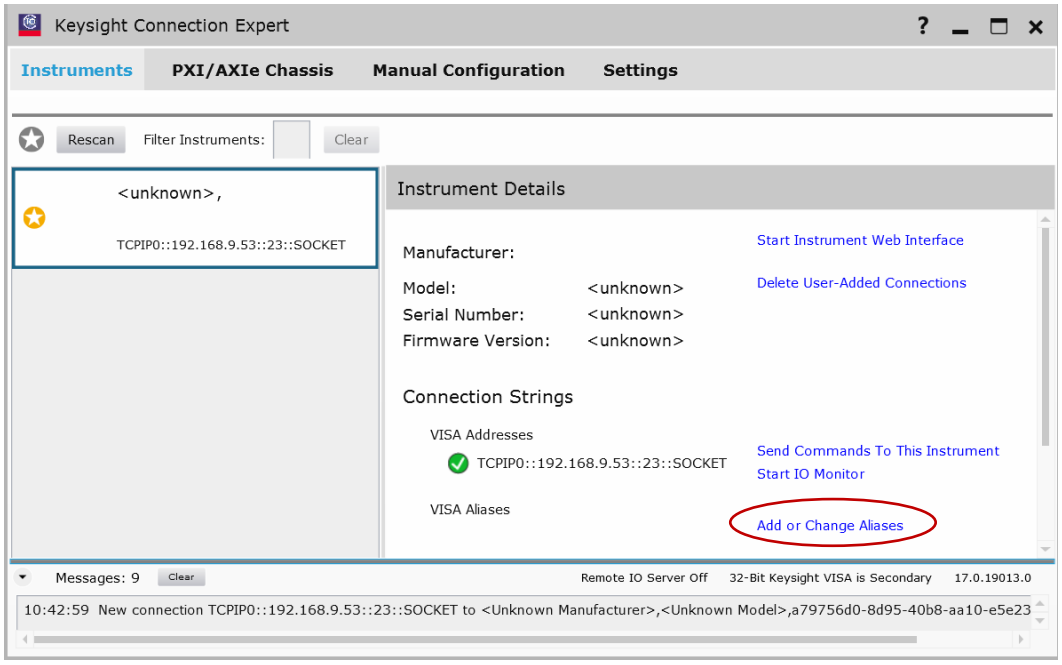

Fig iii - Connection Expert home screen summarising the new LAN instrument (Add or Change Aliases is highlighted)

11. Enter the chosen Alias Name and make sure the correct VISA Address string is selected if there are multiple VISA instruments defined
12. The device is now configured and ready to use with a VISA address that takes the form "[LAN_Interface]::[IP_Address]::[Port]::SOCKET"

2.b - Configuration using NI MAX

1. Connect the PTE device to the local network and note the IP address
2. Launch NI MAX (Measurement & Automation Explorer)
3. In the navigation column on the left of the screen, expand "My System" and then "Devices and Interfaces"
4. Rick-click on "Network Devices" and select "Create New VISA TCP/IP Resource"

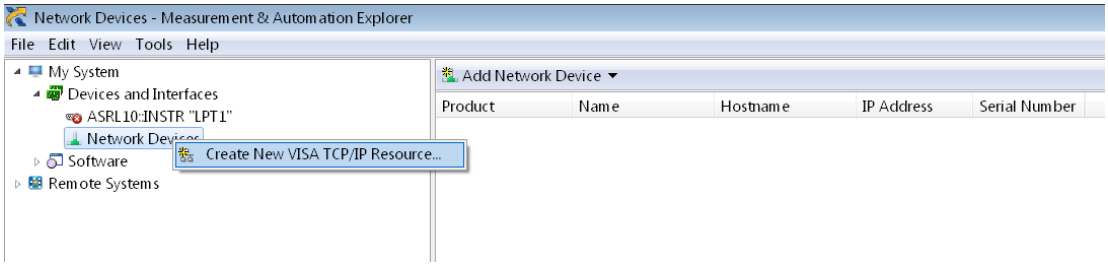

Fig iv - Creating a new VISA TCP/IP Resource in NI MAX

5. Select "Manual Entry of Raw Socket" from the pop-up screen and click Next
6. Enter the IP address and port number "23", then click Validate to test the connection

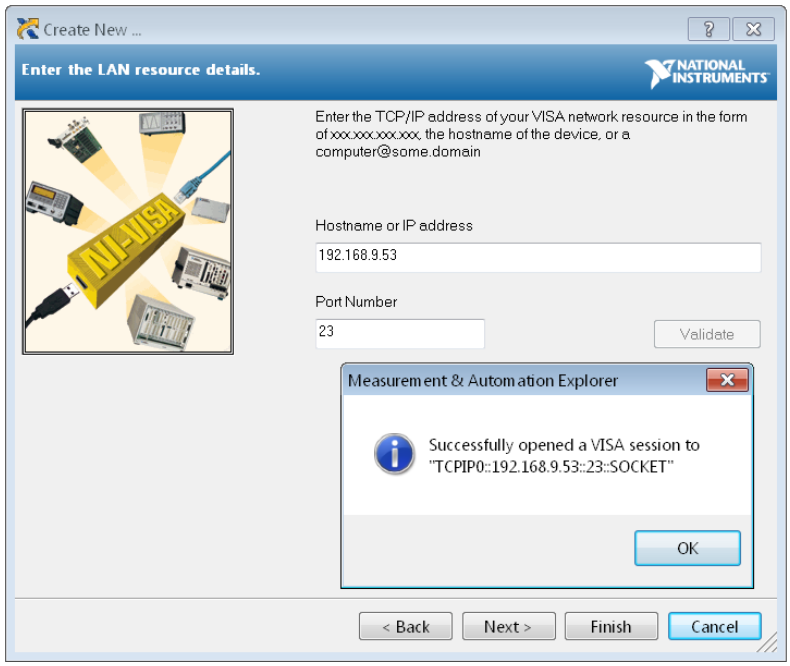

Fig v - Successfully testing the LAN configuration

7. Click Finish to return to the home screen with the new device now listed under the "Network Devices" heading
8. The device configuration has an optional "alias" Name field which can be used to identify the device, just enter a name and click Save

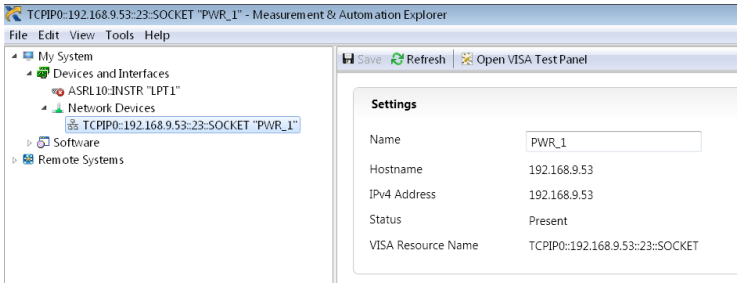

Fig vi - The LAN device summary with PWR_1 entered as an alias name

9. The device is now configured and ready to use with a VISA address that takes the form "[LAN_Interface]::[IP_Address]::[Port]::SOCKET"

3 - Control of a LAN Instrument Using the Keysight / NI Software Suites

The software suites from Keysight and National Instruments both provide a simple interface with which commands can be sent to Mini-Circuits PTE products once they have been configured as LAN instruments.

3.a - Sending Commands using Keysight Connection Expert

1. Open Keysight Connection Expert, select the appropriate LAN instrument and click "Send Commands To This Instrument" to open the Interactive IO interface

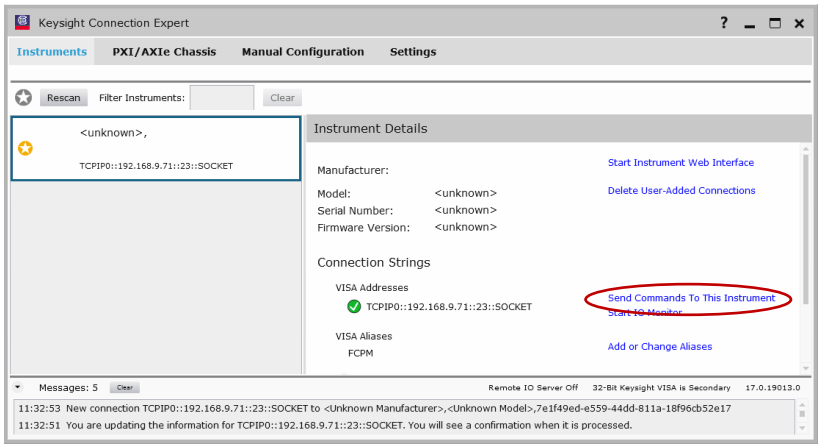

Fig vii - Identifying the LAN instument in Keysight Connection Expert

2. Click on the options tab and set the "EOL Sequence to "\n", this is the terminating character to be sent at the end of each command

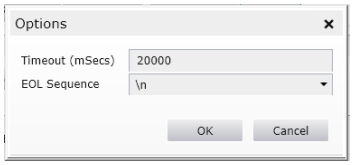

Fig viii - Setting the EOL Sequence

3. The full list of commands/queries available is listed in the programming manual for the Mini-Circuits PTE product, available for download from the Mini-Circuits website; enter these in the command section and click "Send & Read" to see the response
4. To query the model name of the device, enter ":MN?\n" and then click "Send & Read"

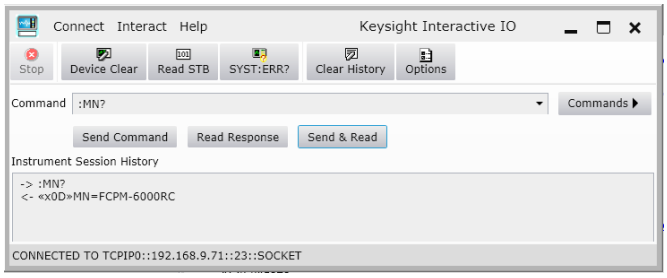

Fig ix - Requesting the model name; the response is FCPM-6000RC

5. To query the serial number of the device, enter ":SN?\n" and then click "Send & Read"

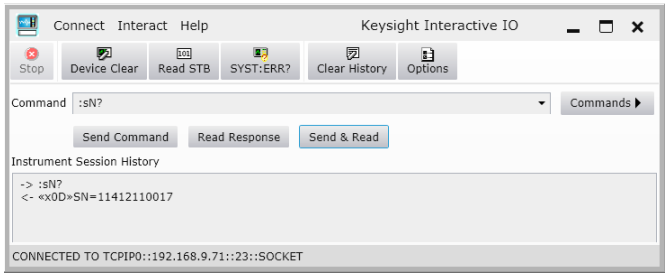

Fig x - Requesting the serial number; the response is 11412110017

3.b - Sending Commands Using NI MAX

1. Open NI MAX, select the appropriate LAN instrument from the list and click "Open VISA Test Panel" to open the interactive communication window

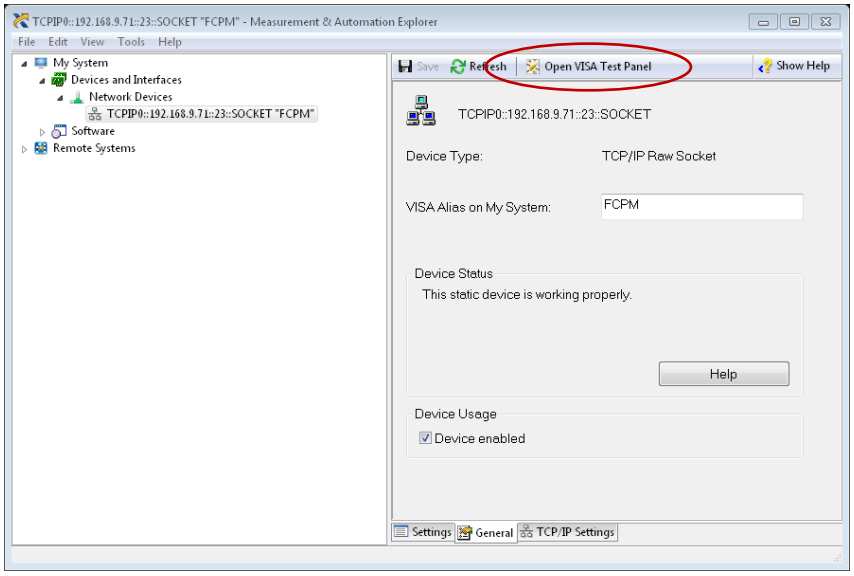

Fig xi - Opening the VISA Test Panel in NI MAX

2. Select the I/O Settings tab of the Configuration screen, uncheck the "Supress End On Reads" tick box and click "Apply Changes"

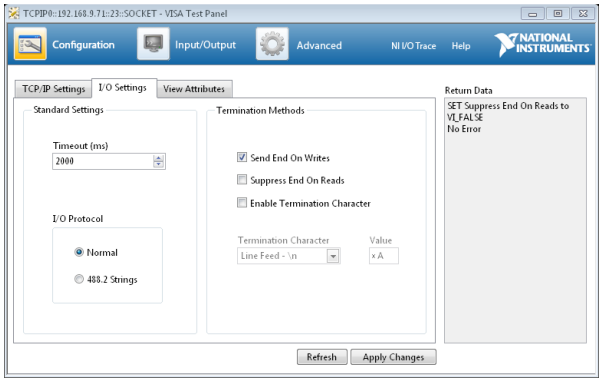

Fig xii - Uncheck the "Suppress End on Reads" option

3. Select the Input/Output tab in order to send commands/queries to the device
4. Commands can be written in the space below the "Select or Enter Command" label:
    a. The full list of commands available is listed in the programming manual for the Mini-Circuits PTE product, available for download from the Mini-Circuits website
    b. All commands must end with a new line character ("\n")
5. To query the model name of the device, enter ":MN?\n" and then click "Query"

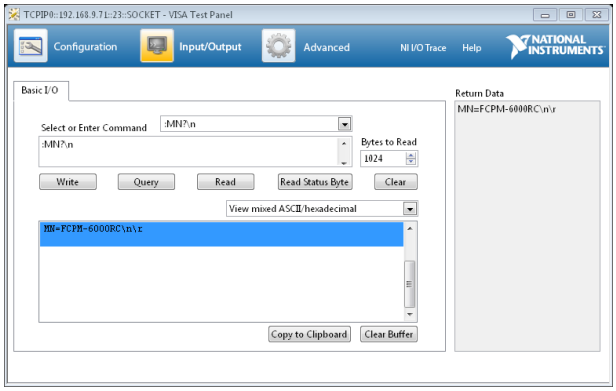

Fig xiii - Requesting the model name; the response (FCPM-6000RC) is highlighted

6. To query the serial number of the device, enter ":SN?\n" and then click "Query"

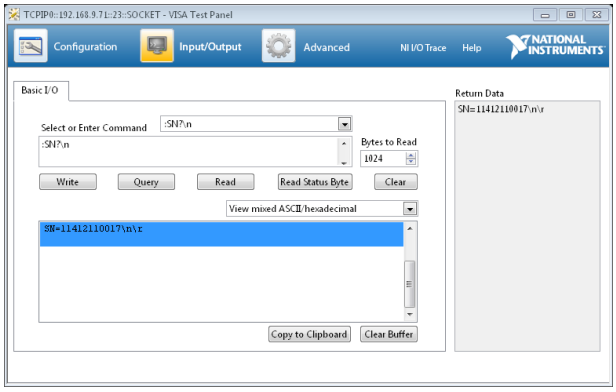

Fig xiv - Requesting the serial number; the response (1141211001) is highlighted

4 - Programmatic Control of a LAN Instrument

It is a simple process to communicate with Mini-Circuits' PTE devices configured as VISA LAN Instruments in most programming environments. Communication is achieved using a message based session defined in the National Instruments API.

This communication process is applicable to all Mini-Circuits' PTE products but detailed examples for each are also available on request.

4.a - Example Using VB.NET for Control of a Power Sensor

```
Imports NationalInstruments.VisaNS                          ' Import the VISA namespace

~~~~~~~~~~~~~~~~~~~~~~~~

Dim mbSession As MessageBasedSession                        ' Create a new message based session

' Open the message based session using the VISA connection string of the device
mbSession = CType(ResourceManager.GetLocalManager().Open("TCPIP0::192.168.9.71::23::SOCKET"),
                                                    MessageBasedSession)
mbSession.TerminationCharacterEnabled = True                ' Important

Dim textToWrite As String = ""
Dim stSerialNo As String
Dim stModelName As String

textToWrite = ":SN?\n\r"                                    ' The text string to send (get serial no)
textToWrite.Replace("\n", vbLf).Replace("\r", vbCr)         ' Remove escape sequences
stSerialNo = mbSession.Query(textToWrite)                   ' The query must be sent twice in VB
stSerialNo = mbSession.Query(textToWrite)

textToWrite = ":MN?\n\r"                                    ' The text string to send (get model name)
textToWrite.Replace("\n", vbLf).Replace("\r", vbCr)         ' Remove the /n/r characters
stModelName = mbSession.Query(textToWrite)                  ' The query must be sent twice in VB
stModelName = mbSession.Query(textToWrite)

mbSession.Dispose()                                         ' Close the session

MsgBox(stModelName & " " & stSerialNo)
```

4.b - Example Using C# for Control of a Power Sensor

```
using NationalInstruments.VisaNS;                           // Use the VISA namespace

~~~~~~~~~~~~~~~~~~~~~~~~

MessageBasedSession mbSession;                              // Create a new message based session

mbSession = (MessageBasedSession)ResourceManager.GetLocalManager().Open(
                                                                        _ "TCPIP0::10.0.6.4::23::SOCKET");

mbSession.TerminationCharacterEnabled = true;               // Important

string textToWrite = ""
string stSerialNo = ""
string stModelName = ""

textToWrite = ":SN?\n\r"                                    // The text string to send (get serial no)
TextToWrite.Replace("\\n", "\n").Replace("\\r", "\r")       // Remove escape sequences
stSerialNo = mbSession.Query(textToWrite);                  // Send the query

textToWrite = ":MN?\n\r"                                    // The text string to send (get model name)
TextToWrite.Replace("\\n", "\n").Replace("\\r", "\r")       // Remove escape sequences
stModelName = mbSession.Query(textToWrite);                 // Send the query


mbSession.Dispose();                                        // Close the session

MessageBox.Show(stModelName + " " + stSerialNo);
```

IMPORTANT NOTICE

This document is provided as an accommodation to Mini-Circuits customers in connection with Mini-Circuits parts only. In that regard, this document is for informational and guideline purposes only. Mini-Circuits assumes no responsibility for errors or omissions in this document or for any information contained herein.

Mini-Circuits may change this document or the Mini-Circuits parts referenced herein (collectively, the "Materials") from time to time, without notice. Mini-Circuits makes no commitment to update or correct any of the Materials, and Mini-Circuits shall have no responsibility whatsoever on account of any updates or corrections to the Materials or Mini-Circuits' failure to do so.

Mini-Circuits customers are solely responsible for the products, systems, and applications in which Mini-Circuits parts are incorporated or used. In that regard, customers are responsible for consulting with their own engineers and other appropriate professionals who are familiar with the specific products and systems into which Mini-Circuits' parts are to be incorporated or used so that the proper selection, installation/integration, use and safeguards are made. Accordingly, Mini-Circuits assumes no liability therefor.

In addition, your use of this document and the information contained herein is subject to Mini-Circuits' standard terms of use, which are available at Mini-Circuits' website at www.minicircuits.com/homepage/terms_of_use.html.

Mini-Circuits and the Mini-Circuits logo are registered trademarks of Scientific Components Corporation d/b/a Mini-Circuits. All other third-party trademarks are the property of their respective owners. A reference to any third-party trademark does not constitute or imply any endorsement, affiliation, sponsorship, or recommendation: (i) by Mini-Circuits of such thirdparty's products, services, processes, or other information; or (ii) by any such third-party of Mini-Circuits or its products, services, processes, or other information.