

Keysight Technologies

Migrating from the 34401A RS-232 Serial Interface to the Truevolt DMM 34461A USB/LAN Interface

Migration Guide



Introduction

The 34461A DMM is the next generation of 34401A that is a virtual drop-in replacement for 34401A. RS-232 is no longer being offered as an interface on newer instrument. For example, the 34461A does not support RS-232 interface and GPIB is optional on the 34461A. You may have difficulty when you want to upgrade your system with newer instruments which the instrument I/O interface is not compatible with your system controller's RS-232 serial I/O. This note explains how to migrate the 34401A programming via RS-232 to the new 34461A DMM programming with VISA via USB or LAN interface with faster measurement speed.

The 34461A Truevolt DMM is a next generation DMM intended to replace the 34401A. Unlike the 34401A, the 34461A does not have an RS-232 IO interface. LAN and USB are standard, and GPIB is optional with the new 34461A DMM. This can present a challenge when upgrading your system with newer instruments whose IO interface is not compatible with the system controller's RS-232 serial IO. This guide explains how to migrate existing 34401A programs developed for the RS-232 interface for use with the USB and LAN interfaces.

Tip 1: Use RS-232 to Ethernet converters for RS-232 controller to communicate with LXI instruments

Users who want to continue to use an RS-232 controller to communicate with their instruments can use RS-232 to Ethernet converters permanently mounted to the system controller. Connect the RS-232 to the controller side and the LAN to the 34461A DMM. This implementation is simple and effortless, as you do not need to rewrite the program to compensate for I/O interface changes. A test solution has been identified and is described under the following link:

<http://gpete-neil.blogspot.com/2013/07/rs232-to-control-lxi-instruments.html>

The details of the configuration and setup processes are also provided here.

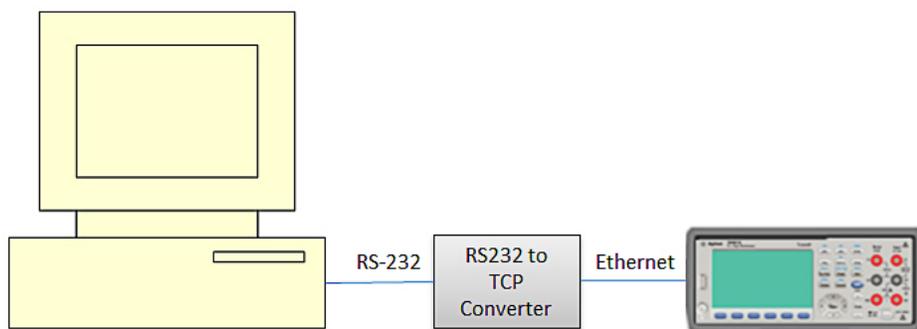


Figure 1. RS-232 Serial Controller to communicate to a LAN instrument

Step I - Configuring the converter

An RS-232 to Ethernet converter such as StarTech NETRS232_1 has good reviews regarding reliability and driver support. The default configurations for this type of converter enable you to connect to a single serial device from multiple Ethernet devices. However, this is not the use case that many would prefer. You need to be able to connect a serial device (system's controller) to a single instrument.

1. Connect converter's LAN port to your PC using a crossover Ethernet cable to configure the NETRS232_1.
2. Run the IP Extender Manager software that came with the device.
3. Activate and unlock the device by right clicking on device in the software when the software found the converter. This allows the access the properties of the converter.
4. Retain the converter's default network settings:
 - Static IP: 192.168.0.35
 - Subnet mask: 255.255.255.0
 - Gateway address: 0.0.0.0
 - Name: [empty]
 - Workgroup: [empty]
 - DHCP detection: Disabled
5. NETRS232_1 has a RawClient Port Mode that will allow specifying a target IP address and TCP port for the converter to use. Right click the on the converter in the right hand pane and choose properties to change to that mode.
6. Enter an IP address of 192.168.0.61 for the DMM and specify TCP port 5025 in the Target Settings tab. Port 5025 is the port that should be used for LAN socket connections on most of the Keysight LXI instruments and is important for these applications.

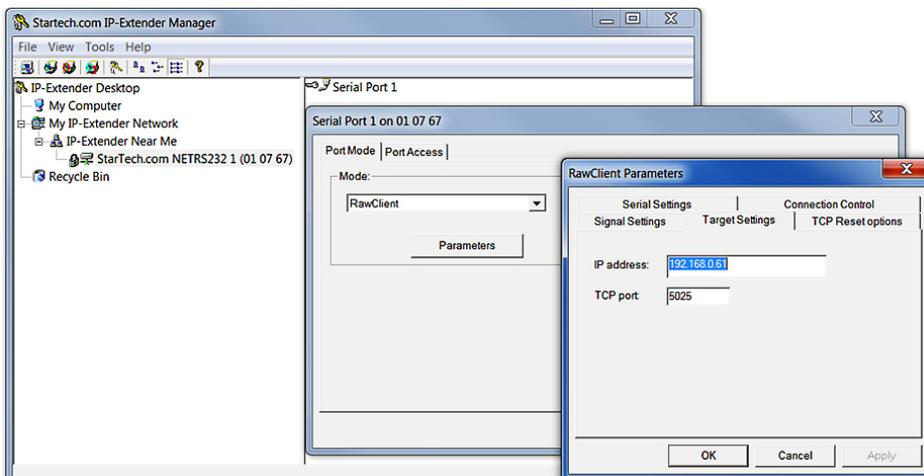


Figure 2. Configuring RawClient Mode

1. Retain converter's default serial settings:
 - Bits per second: 9600
 - Data Bits: 8
 - Parity: None
 - Stop bits: 1
 - Flow control: None
 (All other settings were left at the converter's default RawClient settings)

Step II - Configuring the DMM

1. Configure the LAN settings on the DMM to match the converter's settings. Go to the Utility>I/O config>LAN settings>Modify Settings screen to change to Manual (static IP) mode.
2. Change the Subnet Mask to match the converter's default 255.255.255.0. The converter can only communicate with the DMM if the first three fields matched the converter's static IP address (i.e. put it in the same subnet). This should not be a problem since the only IP devices will be the converter and the DMM.
3. Set the DMM's address to 192.168.0.61. Note that this address has to match the address that was set in the converter's RawClient's Target IP Address step shown above.

The screenshot displays the LAN configuration interface on a DMM. At the top, it shows 'Manual / DHCP' and 'MAC Address: 0030D31F192B'. The main configuration area lists the following settings:

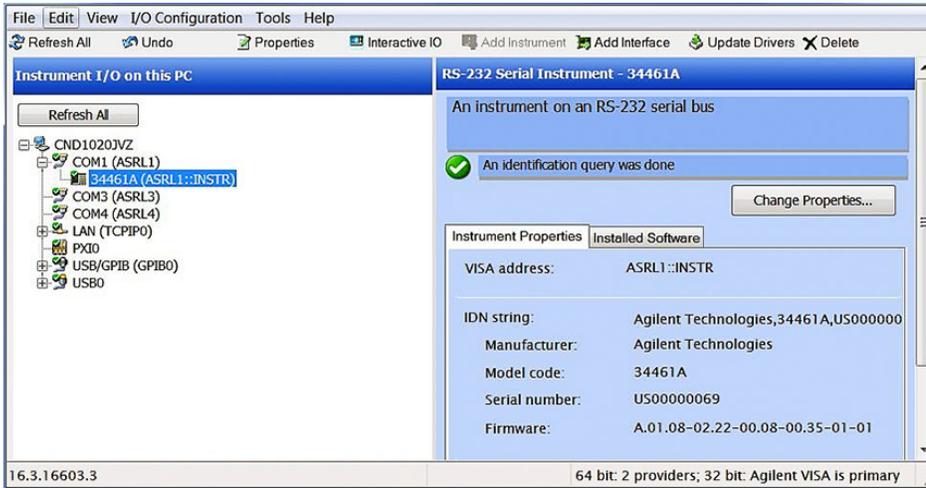
- IP Address:** 192.168.0.61
- Subnet Mask:** 255.255.255.0
- DNS Prim Addr:** 0.0.0.0
- WINS Prim Addr:** 0.0.0.0
- DNS Hostname:** A-34461A-00069
- mDNS Service:** Agilent 34461A Digital Multimeter - US00000069
- mDNS Hostname:** A-34461A-00069.local
- LAN Status:** Good
- Gateway:** 169.254.4.61
- DNS Sec Addr:** 0.0.0.0
- WINS Sec Addr:** 0.0.0.0

At the bottom, there is a navigation bar with the following buttons: 'Manual DHCP', 'Host Name', 'IP Address', 'Subnet Mask', 'Done', and 'More 1 of 3'. The 'IP Address' and 'Subnet Mask' buttons have green circular icons with arrows, indicating they are currently selected or active.

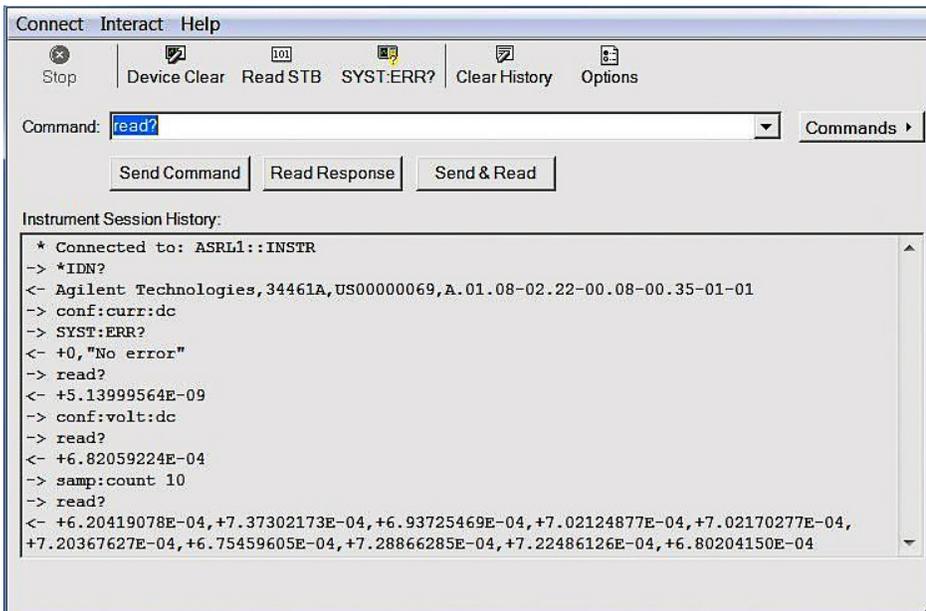
Step III – Testing the solution

The PC is only aware of the RS-232 interface and does not recognize the 34461A as a LXI instrument. The easiest way to communicate via RS-232 is to use Keysight Connection Expert from the Keysight IO Libraries Suite.

1. Open Keysight Connection Expert and configure the COM1 port to the same RS-232 serial settings as the converter.
2. The picture below shows that Keysight Connection Expert is able to communicate with the 34461A via RS-232. ASRL1::INSTR is the convention that Keysight uses for addressing RS-232 communication on the COM1 port.



3. Perform basic configuration and readings using Interactive IO. The picture below shows it is able to take single readings and 10 readings per sample. You will not be able to get maximum DMM reading and transfer rates with the converter due to the limited transfer speeds of RS-232.



Additional tips for the solution

The IP address of the DMM must be in the same IP address range of the converter. Even with the same subnet mask, there is problem to get the converter to communicate with the DMM using the DMM's default Auto-IP address of 169.254.4.61. You need to set the IP address to be within the same range as the default settings of the converter at 192.168.0.35 - to put it onto the same subnet. This means to set the address to 192.168.0.xxx, where xxx is any number between 0 and 255.

- Converter settings take longer than expected to be applied. After settings are changed, communication with the DMM is delayed - giving the impression that some settings may be incorrect. The converter for example, did not apply the target IP address for 2-3 minutes - after which communication was restored.
- This solution should not require IT approval for using the DMM's Ethernet port. Since this is a direct connection from the PC to converter to the DMM, all Ethernet traffic is isolated to the converter and DMM.
- Using the converter with DHCP has not been tested. Most applications that require RS-232 have direct connections from the controller to instrument. However, it is believe that DHCP mode would work provided that the IP address of the DMM/ instrument is static so that you can configure the converter's Target IP address. Use of DHCP and your LAN might require IT department approval.

Tip 2: Simple changes on the codes for programming with VISA via USB-TMC interface

You do not need to rewrite the programs when you migrate from the 34401A to 34461A DMM. The 34461A was designed to ensure it will work with SCPI commands that were written for 34401A. If you do not want to invest in a converter, only minor changes to the test program is needed to support the different instrument I/O interface. Follow the simple steps below; using VISA to communicate over USB to the instrument.

Step I - Add 'VISA Alias' at Keysight IO libraries

The device will be detected automatically by Keysight IO Libraries, or you may need to add the instrument manually if it doesn't appear in the instrument list. You may change the VISA alias according to your preference, for example "myDMM". When the VISA alias is set, the instrument manager will skip the VISA address identification.

This will be easier for users if they implement the same test code on multiple DMMs. If the program is hard coded to search for VISA address "USB00::0x2A8D:0x-201::MY54700218::0::INSTR", the user of this program will need to insert the specific DMM VISA address when a different DMM with a different serial number/VISA address is used in the test system.

Details for Keysight Technologies 34465A

Manufacturer:	Keysight Technologies
Model:	34465A
Serial Number:	MY54500177
Firmware Version:	A.02.08-02.37-02.08-00.49-02-01

Connection Strings

VISA Addresses

- ✔ USB1::0x2A8D::0x0101::MY54500177::0::INSTR

VISA Aliases

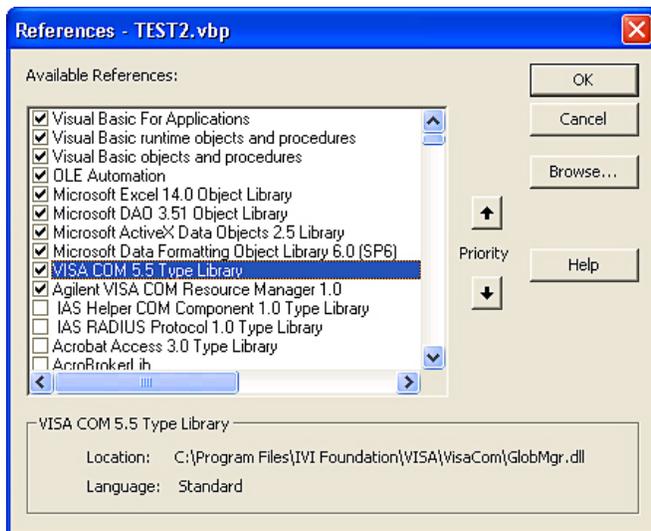
- myDMM

Step II - Import VISA libraries

System controllers often communicate to the instrument through an I/O Library. The VISA library is typically used because it provides uniform access to GPIB, USB-TMC and LAN instruments. It is important to link to the VISA import library in your program. The steps below will help you to do this. The information is specific to your programming development environment.

Visual Basic 6.0 development environment

1. Select Project>Reference from the menu. Include “VISA COM 5.5 Type Library” and “VISA COM Resource Manager”, check the selection box and click OK. This adds the reference for Keysight IO Libraries. Having these references gives you benefits such as typing aids for program lines involving VISA COM commands. Keysight IO Libraries Suites 17 uses VISA COM 5.5 where Agilent IO Libraries Suites 14 uses VISA COM 3.0. Only Visual Basic 6.0 and Excel VBA can call VISA COM 1.0 Type Library and automatically get access to VISA COM 3.0 Type Library.



Microsoft Visual C++ development environment

2. Select Project>Project Properties from the menu. Click the Linker tab, select Additional Library Directories and add “visa32.lib” to the object list box from the directories:

```
C:\Program Files\IVI Foundation\VISA\WinNT\lib\msc
```

(This assumes you used the default installation location for VISA.)

Optionally you may add the library directly to your project file, use a pragma in your compiler source file.

```
#include "stdafx.h"
#include "visa.h"
#pragma comment(lib,"visa32.lib")
```

3. Select Project>Project Properties from the menu. Click the VC++ Directories tab, select Include Directories and add "visa.h" to the object list box from the directories:

C:\Program Files\IVI Foundation\VISA\WinNT\include

(This assumes you used the default installation location for VISA)

4. Select Project>Project Properties from the menu. Click the VC++ Directories tab, select Library Directories and choose from the directories:

C:\Program Files\IVI Foundation\VISA\WinNT\lib\msc

(This assumes you used the default installation location for VISA.)

Microsoft Visual VB.NET & Microsoft Visual C# development environment

1. Select Project>Add Reference from the menu and add "Ivi.Visa.Interop.dll" to project's reference. Browse from the directories:

C:\Windows\assembly\GAC_32\Ivi.Visa.Interop

Step III - Example of code for programming with VISA

The example code written in VB 6.0 opens a session for visa alias and configures RS-232 interface parameters.

```
'Variable declaration of the resource manager and the instrument I/O
Dim DMM As VisaComLib.FormattedIO488
Dim mgr As VisaComLib.ResourceManager
Dim sfc As VisaComLib.ISerial
Dim VISAalias As String
'Memory area of the resource manager and instrument I/O are acquired
Set mgr = New VisaComLib.ResourceManager
Set DMM = New VisaComLib.FormattedIO488
VISAalias = "myDMM"
Set DMM.IO = mgr.Open(VISAalias)
' Set RS232 parameters if this is RS232
If DMM.IO.HardwareInterfaceName = "ASRL" Then
    Set sfc = DMM.IO
    sfc.BaudRate = 9600
    sfc.FlowControl = ASRL_FLOW_DTR_DSR
    ' For RS232 set the termination character to LF
    DMM.IO.TerminationCharacter = 10
    DMM.IO.TerminationCharacterEnabled = True
    ' send the remote for RS232 only
    DMM.WriteString "Syst:Rem"
End If
'Talk to the device
DMM.WriteString ("*IDN?")
'Print result
TextBox.Text = DMM.ReadString
```

Here are the examples of the code with multiple programming languages. Remove the code for RS-232 serial I/O setup & configuration and replace with the following examples. The example code opens a session for the VISA alias instead of VISA Address. The VISA alias defined in the code must be identical with VISA alias name in Keysight IO Libraries (Step I).

Visual Basic 6.0 development environment

```

'Variable declaration of the resource manager and the instrument I/O
Dim VISAalias As String
Dim ioMgr As VisaComLib.ResourceManager
Dim DMM As VisaComLib.FormattedIO488
'Memory area of the resource manager and instrument I/O are acquired
Set ioMgr = New VisaComLib.ResourceManager
Set DMM = New VisaComLib.FormattedIO488
'Open session for device
VISAalias = "myDMM"
Set DMM.io = ioMgr.Open(VISAalias)
'Talk to device
DMM.WriteString ("*IDN?")
'Print result
TextBox.Text = DMM.ReadString

```

Microsoft Visual C++ development environment

```

#include "stdafx.h"
#include "visa.h"
#pragma comment(lib,"visa32.lib")

void main ()
{
ViSession defaultRM, vi;
char buf [256] = {0};
/* Open session to device*/
viOpenDefaultRM(&defaultRM);
viOpen(defaultRM, "myDMM",VI_NULL,VI_NULL,
&vi);
/* Initialize device */
viPrintf(vi, "*RST\n");
/* Send an *IDN? string to the device */
viPrintf(vi, "*IDN?\n");
/* Read results */
viScanf(vi, "%t", buf);
/* Print results */
printf("Instrument identification string:%s\n", buf);
printf("Press enter to exit...\n");
scanf_s("%c", buf);
}

```

Microsoft Visual VB.NET development environment

```

'Variable declaration for resource manager and instrument I/O
'Memory area of the resource manager and instrument I/O are acquired
Dim ResMsg As Ivi.Visa.Interop.ResourceManager = New Ivi.Visa.Interop.ResourceManager()
Dim DMM As Ivi.Visa.Interop.FormattedIO488 = New Ivi.Visa.Interop.FormattedIO488()
Dim VISAalias As String
'Open session for device
VISAalias = VISA_alias.Text
DMM.IO = ResMsg.Open(VISAalias, AccessMode.NO_LOCK, 2000, "")
DMM.IO.Timeout = 3000 'You can also set your timeout by doing this command, sets to 3 seconds
'Talk to the instrument, first start off with a reset state
DMM.IO.Clear() 'Send a device clear first to stop any measurements in process
DMM.WriteString("RST") 'Reset the device
DMM.WriteString("IDN?") 'Get the IDN string
Data_Print.Text = DMM.ReadString() 'Print result

```

Microsoft Visual C# development environment

```
public partial class Form1 : Form
{
    public Form1()
    {
        InitializeComponent();
    }

    private ResourceManager ResMsg = new ResourceManager();
    private FormattedIO488 DMM = new FormattedIO488();

    #region IDN?

    private void button1_Click(object sender, EventArgs e)
    {
        string VISAalias = "";

        VISAalias = Visa_alias.Text;

        DMM.IO = (ResMsg.Open(VISAalias) as IMessage);

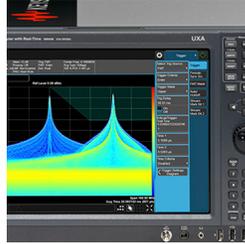
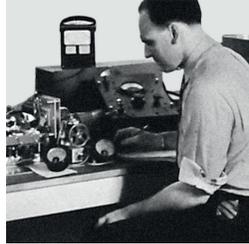
        DMM.WriteString("*IDN?", true);
        Data_Print.Text = DMM.ReadString();
    }
    #endregion
}
```

Conclusion

You can easily migrate from a 34401A to the Keysight 34461A Truevolt DMM with just a few simple steps, even if using an RS-232 serial IO port. Additional benefits of the USB interface are that it provides a robust and easy connection for the 34461A, and faster reading rates compared to the RS-232 serial interface.

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