

IEEE 488

APPLICATION BULLETIN

Extending the GPIB Bus over an Ethernet Link

INTRODUCTION

Original GPIB Bus extension efforts used metallic, coaxial or fiber-optic cable and a pair of Bus Extenders to extend the GPIB bus beyond its 20 meter limit¹. Some software implementations like ICS's GPIB Anywhere™, used a remote PC operated over the internet from your local PC. This Application Note describes how to extend the GPIB Bus over an Ethernet link for a single instrument.

GENERAL CONCEPTS

ICS manufactures interfaces that 'transparently' convert GPIB to Ethernet and Ethernet to GPIB. Using these two interfaces in a back-to-back connection does extend the GPIB Bus over an Ethernet link for a single instrument with some restrictions.

General purpose GPIB Bus extension over a Ethernet network is not feasible because the network is not deterministic. Message delivery time is variable and depends on the network traffic. Messages can be lost which would not be good for a GPIB bus system. In addition, the conversion devices used in this example have limited GPIB conversion capability and would not be suitable for general purpose GPIB Bus extension.

ICS's Model 4865 is a GPIB to Ethernet converter that allows VXI-11 compatible instruments or devices to be connected to a GPIB Bus. The 4865 can be set to look for a LAN instrument at a specific IP address or to search for one in its IP address

range. Once linked, the 4865 serves as the GPIB interface for the LAN instrument.

ICS Model 8055 is an Ethernet to GPIB converter that acts as a VXI-11.3³ interface for a IEEE-488.2² compatible GPIB instrument. As a VXI-11.3 instrument, the 8055-GPIB instrument combination can be controlled over the Ethernet or used in LAN based test system with other LAN and LXI instruments.

Figure 1 shows this general concept where a null-modem cable is used to connect the 4865 to the remote 8055. This concept can be expanded to longer distances by using switches or routers, by using a portion of the company network, by going over the Internet or by using some other form of Ethernet extension.

PREPARATION

The 8055 to GPIB Instrument connection should be setup and tested first. Disconnect the PC from the network and use the supplied null-modem cable to connect the PC to the 8055. Set the PC's network port to an unused IP address of 192.168.0.20 with a Mask of 255.255.0.0 and a Gateway of 192.168.0.1. Turn the 8055 on and it will default to an IP address of 192.168.0.254.

When the 8055's RDY LED is on, launch a browser and enter the 8055's IP address in the browser's URL window. The browser should display the 8055's Welcome Page. Click the 'Go to Configuration Page' button to display the 8055's Configuration Page. Set the 8055 to a static IP address so that the 4865 can later find it. An IP address of 169.254.80.55, with a Mask of 255.255.0.0 and a Gateway of 169.254.0.1 was used in this back-to-back example since the 4865 defaults to an IP address of 169.254.48.65. Other IP addresses can be used as long as the 4865's network settings are adjusted to match.

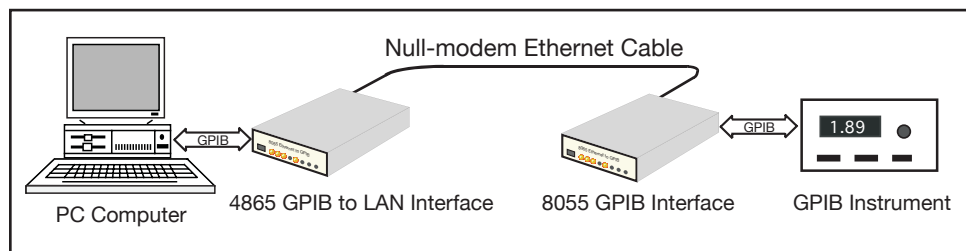


Figure 1 Basic 4865 to 8055 GPIB Bus Extension

settings to an unused IP address such as 169.254.0.20 and with the same Mask and Gateway values used for the 8055.

Connect the 8055's GPIB port to the GPIB instrument and turn the instrument on. Launch ICS's VXI-11 Keyboard Program (VXI-11kybd) and click the 'Find Server' button to search for the 8055. You can also enter the 8055's IP address in the Found Server address window. Click 'Create Link' to link to the 8055. When *inst0* appears in the Instrument Resource box, click the 'Select Inst and Link' button to link to it. Verify that you can communicate with the instrument by querying its IDN message and perform commands to verify its normal operation. The Device Command window pulldown arrow will expose the *ESR? and *IDN? queries. Select one and press 'Send'. Enter other commands in the Device Command window and press 'Send'. If you have a test program that makes VISA calls, you could run it at this time to verify that the 8055 and the GPIB instrument run as expected with your program. You just have to set the device resource to a TCP/IP device. The VXI-11kybd program will display the TCP/IP resource string.

Next, setup the 4865 by disconnecting the null-modem cable from the 8055 and connecting it to the 4865's LAN connector. Turn the 4865 on and launch the browser if it is not running. Enter 169.254.48.65 in the Browser's URL window to display the 4865's Welcome page. Click the 'Go to Configuration Page' button to display the 4865's Configuration Page. Set the 4865 for a static IP address to match the same IP range used in the 8055. The 4865's default IP address of 169.254.48.65, a Mask of 255.255.0.0 and a Gateway setting of 169.254.0.1 were used in this example. In a back-to-back connection, leave AutoFind enabled. For operation on the company network, enter the 8055's IP address in the instrument IP address window and disable AutoFind. Save the configuration and reboot the 4865.

Disconnect the null-modem cable from the PC and connect it to the 8055. Connect the PC's GPIB Controller to the 4865 as shown in Figure 1.

At this time, the 4865's RDY LED should be on, indicating that it is ready to communicate on the GPIB Bus. The 4865's LAN LED should be on and the ACT LED should be flashing indicating Ethernet activity. The 8055's TALK and LSTN LEDs should be blinking showing that the 4865 is polling the 8055 for the instrument's status. If this is not happening, power off all three units and then turn power on starting with the instrument, the 8055 and finally the 4865.

When the 4865's RDY LED is on, you can use any interactive GPIB program such as ICS's GPIB keyboard, NI Measurement and Automation Explorer or Agilent's Connection Expert to find and talk to your instrument. Test the connection by querying the instrument's IDN message or ESR Register. Once you get the correct responses, you are good to go.

PRECAUTIONS

The following precautions should be considered when designing your program.

Power turn-on If possible, apply power to the devices in the following order: the remote instrument, the 8055 and then the 4865.

Remote device status The 4865 only has the correct status if it is able to poll the remote instrument. The polling takes place after the 4865 has compiled a successful read operation. If the last operation was writing a command or if a query timed out, the 4865 will not be doing any polling and its Status Register response may lag that of the instrument.

Timeouts and Serial Polls In the event of a timeout, do not serial poll the 4865. It will not have the correct Status value. Instead, query the instrument's ESR Register to see if your last command was bad or query another status register to learn the cause of the problem. The 4865 will resume polling after the response is read and will then respond correctly to a Serial Poll.

Timeouts should be set to a reasonable value that will include the 4865-8055 and link response times. The recommendation is to use 3 or 10 seconds. Values shorter than 1 second could cause false problems.

SRQs When enabling the instrument's Status Register to generate Service Requests, do not enable the MAV Queue. This will produce erratic results and confuse the 8055 and 4865. Only enable the summary bit(s) for the status or event registers that are expected to generate the Service Request.

EXTENDING OVER THE COMPANY NETWORK

When extending the GPIB Bus over the company network, the user should be considerate of other users. As previously stated, the 4865 polls the 8065 several times a second to update its status response. This generates extra traffic that your IT administrator may not appreciate. Use switches or routers to restrict the 4865's polling to a sub-net such as the Engineering Lab. Placing switches between the sub-net and the rest of the company network will block the 4865-8055 traffic from being broadcast throughout the company. Do not use hubs as they will not block the 4865-8055 traffic.

SUMMARY

This Application Note has described how to use ICS's 4865 and 8055 to extend the GPIB Bus over an Ethernet link for a single instrument. This note includes the setup instructions for operation in back-to-back connections and over the company network. Precautions are given for running successful application programs.

This note is not intended to imply that the 4865 and 8055 can be used for general purpose GPIB Bus extension. The user needs to limit his application to the capabilities of these two devices.

REFERENCES

The following references provide more information on the subjects discussed in this Application Note:

- [1] Application Note AB48-12, Extending the GPIB Bus.
- [2] IEEE Std 488.2-1992, IEEE Standard Codes, Formats, Protocols, and Common Commands For Use With IEEE Std 488.1-1987, IEEE Standard Digital Interface for Programmable Instrumentation.
- [3] VXI-11 description based on VXI-11 Specification Revision 1.0 dated 1995. Copies available from the VXI Consortium at <http://www.vxi.org/>.