Model 2701 Ethernet-Based DMM / Data Acquisition System

Instrument Networking Instruction Manual

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KEITHLEY

A GREATER MEASURE OF CONFIDENCE

Model 2701 Instrument Networking
Instruction Manual

The following safety precautions should be observed before using this product and any associated instrumentation. Although some instruments and accessories would normally be used with non-hazardous voltages, there are situations where hazardous conditions may be present.

This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury. Read and follow all installation, operation, and maintenance information carefully before using the product. Refer to the user documentation for complete product specifications.

If the product is used in a manner not specified, the protection provided by the product warranty may be impaired.

The types of product users are:

Responsible body is the individual or group responsible for the use and maintenance of equipment, for ensuring that the equipment is operated within its specifications and operating limits, and for ensuring that operators are adequately trained.

Operators use the product for its intended function. They must be trained in electrical safety procedures and proper use of the instrument. They must be protected from electric shock and contact with hazardous live circuits.

Maintenance personnel perform routine procedures on the product to keep it operating properly, for example, setting the line voltage or replacing consumable materials. Maintenance procedures are described in the user documentation. The procedures explicitly state if the operator may perform them. Otherwise, they should be performed only by service personnel.

Service personnel are trained to work on live circuits, perform safe installations, and repair products. Only properly trained service personnel may perform installation and service procedures.

Keithley Instruments products are designed for use with electrical signals that are rated Measurement Category I and Measurement Category II, as described in the International Electrotechnical Commission (IEC) Standard IEC 60664. Most measurement, control, and data I/O signals are Measurement Category I and must not be directly connected to mains voltage or to voltage sources with high transient over-voltages. Measurement Category II connections require protection for high transient over-voltages often associated with local AC mains connections. Assume all measurement, control, and data I/O connections are for connection to Category I sources unless otherwise marked or described in the user documentation.

Exercise extreme caution when a shock hazard is present. Lethal voltage may be present on cable connector jacks or test fixtures. The American National Standards Institute (ANSI) states that a shock hazard exists when voltage levels greater than 30V RMS, 42.4V peak, or 60VDC are present. A good safety practice is to expect that hazardous voltage is present in any unknown circuit before measuring.

Operators of this product must be protected from electric shock at all times. The responsible body must ensure that operators are prevented access and/or insulated from every connection point. In some cases, connections must be exposed to potential human contact. Product operators in these circumstances must be trained to protect themselves from the risk of electric shock. If the circuit is capable of operating at or above 1000 volts, no conductive part of the circuit may be exposed.

Do not connect switching cards directly to unlimited power circuits. They are intended to be used with impedance-limited sources. NEVER connect switching cards directly to AC mains. When connecting sources to switching cards, install protective devices to limit fault current and voltage to the card.

Before operating an instrument, make sure the line cord is connected to a properly grounded power receptacle. Inspect the connecting cables, test leads, and jumpers for possible wear, cracks, or breaks before each use.

When installing equipment where access to the main power cord is restricted, such as rack mounting, a separate main input power disconnect device must be provided in close proximity to the equipment and within easy reach of the operator.

For maximum safety, do not touch the product, test cables, or any other instruments while power is applied to the circuit under test. ALWAYS remove power from the entire test system and discharge any capacitors before: connecting or disconnecting cables or jumpers, installing or removing switching cards, or making internal changes, such as installing or removing jumpers.

Do not touch any object that could provide a current path to the common side of the circuit under test or power line (earth) ground. Always make measurements with dry hands while standing on a dry, insulated surface capable of withstanding the voltage being measured.

The instrument and accessories must be used in accordance with specifications and operating instructions, or the safety of the equipment may be impaired.

Do not exceed the maximum signal levels of the instruments and accessories, as defined in the specifications and operating information, and as shown on the instrument or test fixture panels, or switching card.

When fuses are used in a product, replace with the same type and rating for continued protection against fire hazard.

Chassis connections must only be used as shield connections for measuring circuits, NOT as safety earth ground connections.

If you are using a test fixture, keep the lid closed while power is applied to the device under test. Safe operation requires the use of a lid interlock.

If a ⏚ screw is present, connect it to safety earth ground using the wire recommended in the user documentation.

The ⚠ symbol on an instrument indicates that the user should refer to the operating instructions located in the documentation.

The ⚡ symbol on an instrument shows that it can source or measure 1000 volts or more, including the combined effect of normal and common mode voltages. Use standard safety precautions to avoid personal contact with these voltages.

The ♨ symbol on an instrument shows that the surface may be hot. Avoid personal contact to prevent burns.

The ⏚ symbol indicates a connection terminal to the equipment frame.

If this (Hg) symbol is on a product, it indicates that mercury is present in the display lamp. Please note that the lamp must be properly disposed of according to federal, state, and local laws.

The **WARNING** heading in the user documentation explains dangers that might result in personal injury or death. Always read the associated information very carefully before performing the indicated procedure.

The **CAUTION** heading in the user documentation explains hazards that could damage the instrument. Such damage may invalidate the warranty.

Instrumentation and accessories shall not be connected to humans.

Before performing any maintenance, disconnect the line cord and all test cables.

To maintain protection from electric shock and fire, replacement components in mains circuits - including the power transformer, test leads, and input jacks - must be purchased from Keithley Instruments. Standard fuses with applicable national safety approvals may be used if the rating and type are the same. Other components that are not safety-related may be purchased from other suppliers as long as they are equivalent to the original component (note that selected parts should be purchased only through Keithley Instruments to maintain accuracy and functionality of the product). If you are unsure about the applicability of a replacement component, call a Keithley Instruments office for information.

To clean an instrument, use a damp cloth or mild, water-based cleaner. Clean the exterior of the instrument only. Do not apply cleaner directly to the instrument or allow liquids to enter or spill on the instrument. Products that consist of a circuit board with no case or chassis (e.g., data acquisition board for installation into a computer) should never require cleaning if handled according to instructions. If the board becomes contaminated and operation is affected, the board should be returned to the factory for proper cleaning/servicing.

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1
Introduction

General information

Keithley's Model 2701 is the industry's first multipoint measurement and control system that fully integrates instrument quality resolution and sensitivity with Ethernet long distance networking capability. This allows for sensitive measurements in a distributed data acquisition environment using long distance industry standard communications.

Using the Model 2701 can reduce networking costs by requiring only one computer, as compared to traditional systems where separate computer/controllers may be needed with each instrument or DAQ system. In addition, using Ethernet to control the Model 2701 provides reliable measurements without the configuration and installation challenges of traditional GPIB alternatives. With a Model 2701, there is no need to open a PC or install separate communication interfaces such as GPIB boards. Just connect the Model 2701 directly to the PC's Ethernet port via a cross over RJ-45 cable, which is included with the Model 2701.

The Model 2701 can be controlled and provide readings over an Ethernet connection using TCP/IP protocol. The Model 2701 contains an integral web server which provides diagnostic control of the Model 2701 through ActiveX controls. The web pages accessed via the built-in web server allow the user to view diagnostic information, view and edit the Instrument's networking configuration, take and display simple readings, and send the instrument SCPI commands and display the results. The 2701's IP address, as well as Subnet mask, Gateway, DHCP, among other items, can be set from the instruments front panel or over the Ethernet connection (see Section 3). To access this page, type the 2701's IP address into IE's address field (just like any other web address, but without the www, for an example, see Figure 3-2).

Full access to the instrument can be obtained via a TCP/IP socket connection. Using this socket connection, the 2701 may be fully configured and controlled, as well as all measurement data read. A custom software program that uses a socket connection can be written to access the instrument. The ActiveX controls on the web page establish a socket connection to the instrument and use it to obtain the diagnostic information, send commands, and retrieve responses. The Instrument Driver Software also uses this socket connection.

Call Keithley or visit www.keithley.com to order a free Model 2701 application note that discusses programming multiple 2701s using the IVI/VISA driver, as well as the direct Windows socket interface. The requirement for network topology is a functioning Ethernet. This can be a direct connection between a PC and a single 2701 through a cross over cable or over a corporate LAN. This manual provides user information for isolated network connections. For corporate LAN installations, contact your IS/IT department before making any connections to your building's network.

Software

The following is a summary of available Model 2701 software (refer to Section 4 for detailed information):

Built-in web diagnostic tool (free) — Using Microsoft® Internet Explorer® on a PC provides Model 2701 control.

TestPoint runtime (free) — Provides basic data logging capabilities. This can be modified with the TestPoint application development package.

TestPoint application development package (purchase separately) — This powerful and economical programming environment uses object-oriented technology through a drag-and-drop interface to build a basic system quickly and without in-depth programming. Optional toolkits (database and statistical process control) are available to expand ExceLINX-1A capability.

ExceLINX-1A (purchase separately) — This is an economical, easy-to-use, add-in utility for Microsoft Excel® and Keithley Integra Series Multimeter/Switch systems. No programming is required—configure your measurements quickly using pop-up menus and eliminate time-consuming and error prone programming. Acquire data into a spreadsheet on the fly during a scan or transfer data into a spreadsheet after a scan is completed. A few mouse clicks are all it takes to configure channels, set parameters, triggers, and scan lists. There is no need to launch a separate data logging or data-crunching application; live data streams automatically into an Excel workbook, ready for analysis or charting using all of Excel's powerful built-in tools.

IVI (VISA-Based) instrument driver (free) — Provided for programmers, designed for use with application development environments.

Contact information

Worldwide phone numbers are listed at the front of this manual. If you have any questions, please contact your local Keithley representative or call a Keithley Application Engineer at 1-800-348-3735 (U.S. and Canada only).

Features of the Ethernet interface

This section describes the Model 2701 Ethernet interface control. The Model 2701's adapter supports 10BaseT and 100BaseTX Fast Ethernet. Through design, the Model 2701 integrates easily with fast Ethernet hubs and switches.

NOTE *To operate at 10 Mbits/sec, a category 3 (or higher) UTP cable is required. To operate at 100 Mbits/sec, a category 5 UTP cable is required.*

Autosensing

The Model 2701 autosenses the Ethernet connection speed (either 10BaseT or 100BaseTX). This allows the Model 2701 to auto-switch to the proper speed providing compatibility with both network speeds.

Connector location

Figure 1-1 contains the location of the Model 2701 network port (RJ-45 connector). This connector is used to provide either 10BaseT or 100BaseTX connections to an Ethernet.

Figure 1-1
Model 2701 rear panel

Immediate alarm notification independent of the PC provided by built-in open-collector digital I/O lines for control, external triggering, and HI/LO alarm/limit ouputs.

Fast and convenient 10/100BaseTX Ethernet with TCP/IP protocol.

Screw terminals use over-size connectors for easier, mistake-free wiring.

A variety of measurement and control modules makes it simple to mix, match, and change input signals or control lines as needed. Get up to 80 differential channels and up to 500 channels per second scanning rate.

Rugged 50-pin D-sub connectors ensure dependability and quick setup/teardown in production test racks.

Built-in relay cycle counters on each module for ease of maintenance.

Status LEDs

Two status LEDs are located at the top of the RJ-45 connector (Figure 1-1). Refer to Table 1-1 for a description of LED status descriptions.

Table 1-1
LED status descriptions

LED	State	Ethernet status
Link/Act	Off	Network is NOT connected
Link/Act	On	Network is connected
Link/Act	Blinking	Traffic is traversing the port
100bT	Off	10 Mbit/sec network speed
100bT	On	100 Mbit/sec network speed

Supported environments

The Model 2701's software is designed for use with the following Windows™ operating systems:

- Win 98
- Win ME
- Win NT4.0+ (including Win 2000)
- Win XP Professional

Also, Microsoft Internet Explorer Version 5.0 (and greater) is required for network control.

NOTE   Netscape Navigator is not supported. Also, use of a Macintosh computer is not supported. The PC must be at least a Windows 98 compatible machine.

NOTE   If using Internet Explorer 5.5, make sure to have previously installed Service Pack 1 (SP1).

2
Network Connection

Overview

Keithley's Model 2701 is a multipoint measurement and control system that fully integrates instrument quality resolution and sensitivity in an Ethernet-based data acquisition (DAQ) system. The Model 2701 is designed for a 10/100BaseTX network using standard RJ-45 connectors. This is an eight wire connector, but only two sets of wire pairs are used: one pair to transmit and one pair to receive data. A 10BaseT network can accommodate transmission speeds up to 10Mbit per second where a 100BaseTX network operates at speeds of up to 100Mbit per second. Both types of networks usually require Ethernet hubs to make connections. The exception is a one to one connection using a cross over cable, which may be a 10BaseT or 100BaseTX dependent on the PC's Ethernet interface card and which category of cable is used.

Information on four connection schemes is detailed in this section:

- Direct connection—PC to Model 2701 through a cross over cable (provided).
- Hub connection—PC to one or more Model 2701s.
- Dual interface card connection—PC with two interface cards. (One for the Model 2701 network and one for the corporate network—each network isolated.)
- Corporate network connection—requires IS/IT or Network Administrator.

Component specifications

Table 2-1 contains a listing of the different components that may be required for the different Model 2701 connection schemes (not all items are required for all connections).

Table 2-1
Component specifications

Component	Specifications (required by Model 2701)	Other specifications	Typical use
Network Interface Card	Speed: 10 Mbit/sec or 100 Mbit/sec, Connector: RJ-45	As required by PC	All schemes
Cross Over Cable (provided)	CAT 5, Connector: RJ-45	None	PC to Single Model 2701.
Straight-thru Cable	CAT 5, Connector: RJ-45	None	PC to Model 2701 through hub or network drop.
Network Hub	10/100BaseTX, RJ-45 Jacks	None	PC to Model 2701 through hub.

Direct connection

This section contains information on connecting the Model 2701 directly to the Ethernet port on a PC (see Figure 2-1) using an Ethernet cross over cable. This setup provides a one-to-one connection between the PC and the Model 2701. When using this connection scheme, the TCP/IP settings for the PCs Ethernet card and the Model 2701 will need to be set manually (see Section 3).

NOTE　　*A different IP addresses is required for the Model 2701 and the network interface card.*

Figure 2-1
PC to Single Model 2701
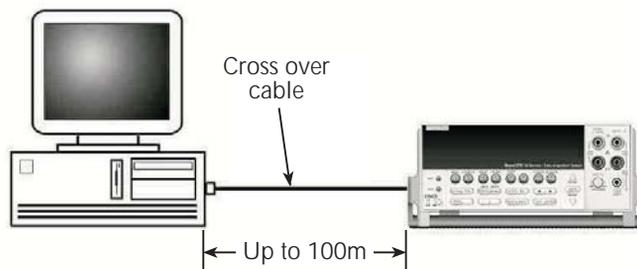
Table 2-2
Additional component requirements for direct connection

Quantity	Component	Note
1	Network Interface Card	Properly installed in PC.
1	CAT 5 Cross over cable	3 meter cross over cable included.

Procedure

NOTE　　*A direct connection requires use of a cross over cable (not the straight-thru cable that connects a PC's Ethernet card to a network hub).*

1. Connect one end CAT 5 cross over cable to Network Interface Card in PC.
2. Connect other end of CAT 5 cross over cable to Network Interface port on the Model 2701.
3. Configure Ethernet setup (see Section 3).

Hub connection

This section contains information on connecting the PC to one or more Model 2701s through an Ethernet hub (Figure 2-2) or switch that is not part of a larger local area network using Ethernet straight through cables. When using this connection scheme, the TCP/IP settings for the PCs Ethernet card and the Model 2701 will need to be set manually (see Section 3).

NOTE   *Different available IP addresses are required for each Model 2701 and the network interface card connected to the Model 2701 network.*

Figure 2-2
Hub to Model 2701

NOTE:
The maximum distance between the PC and hub and between the hub and 2701(s) is 100m.
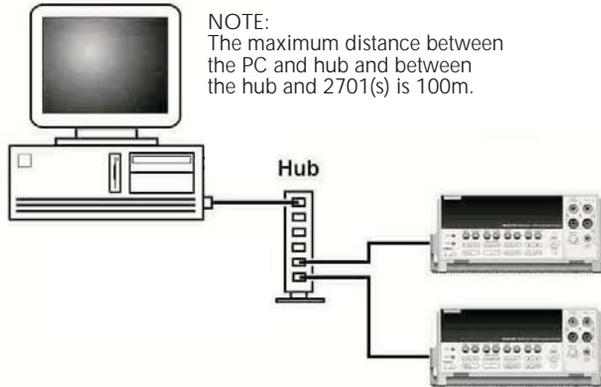
Table 2-3
Additional component requirements for hub connection

Quantity	Component	Note
1	Network Interface Card	Properly installed in PC.
2	CAT 5 straight-thru cable	Add one additional cable for each additional Model 2701 connected through the hub.
1	Network Hub	10/100BaseTX

Procedure

NOTE   *Use this procedure to connect the Model 2701 to an isolated Ethernet. If desired, another connection from this hub to the corporate network (or network drop) can be made with IS/IT department support and an additional CAT 5 cable. Always contact your IS/IT department before connecting to the corporate network (or network drop).*

1. Connect one end of a CAT 5 Cable to network interface card installed in PC (refer to the cards instructions for procedure).
2. Connect other end of the CAT 5 Cable to an available RJ-45 connector in hub. (Do not connect to uplink connector, the uplink connector is used when connecting hubs together.)
3. Connect one end of a CAT 5 Cable to ETHERNET port on the Model 2701 rear panel.
4. Connect other end of the CAT 5 Cable to an available RJ-45 connector in hub. (Do not connect to uplink connector, the uplink connector is used when connecting hubs together.)
5. Connect additional Model 2701(s) as desired in the same manner.
6. Configure Ethernet setup (see Section 3).

Dual interface card connection

>*NOTE* *This scheme requires a second network interface card installed in the PC. The first interface card (connected to other network resources) will remain connected. (Email and other network resources available before connection to the Model 2701 will still be available using this scheme.)*

>*NOTE* *Different available IP addresses are required for each Model 2701 and each network interface card connected to the Model 2701 network.*

   This section contains information on connecting the PC to the Model 2701 while still maintaining connection to a corporate network. Use this type of scheme when it is desirable to have the same PC used for connection to the Model 2701 while retaining the capabilities of connection with the corporate network (such as for email or intranet applications). This scheme maximizes the performance of the network connections to the instruments by isolating corporate network traffic from the 2701 and the PC (i.e., when the instruments are connected to a corporate LAN, the network traffic on the LAN can slow down communications with the 2701).

   When using this connection scheme, the TCP/IP settings for the PC's Ethernet card and the Model 2701 will need to be set manually (see Section 3).

Procedure

   This connection can be made directly to the Model 2701 or to a hub (see Figure 2-3). Table 2-4 contains parts required for a connection through a hub and Table 2-5 contains parts required for a direct connection. Complete connections for the desired scheme. Refer to "Direct connection" on page 2-3 or "Hub connection" on page 2-4 for details. The TCP/IP settings for the Ethernet port the on the PC and the Model 2701s will need to be set manually (refer to Section 3). Make sure to use settings that do not interfere with the existing network (consult IT/IS department if unsure).

Figure 2-3
Dual NIC to Model 2701
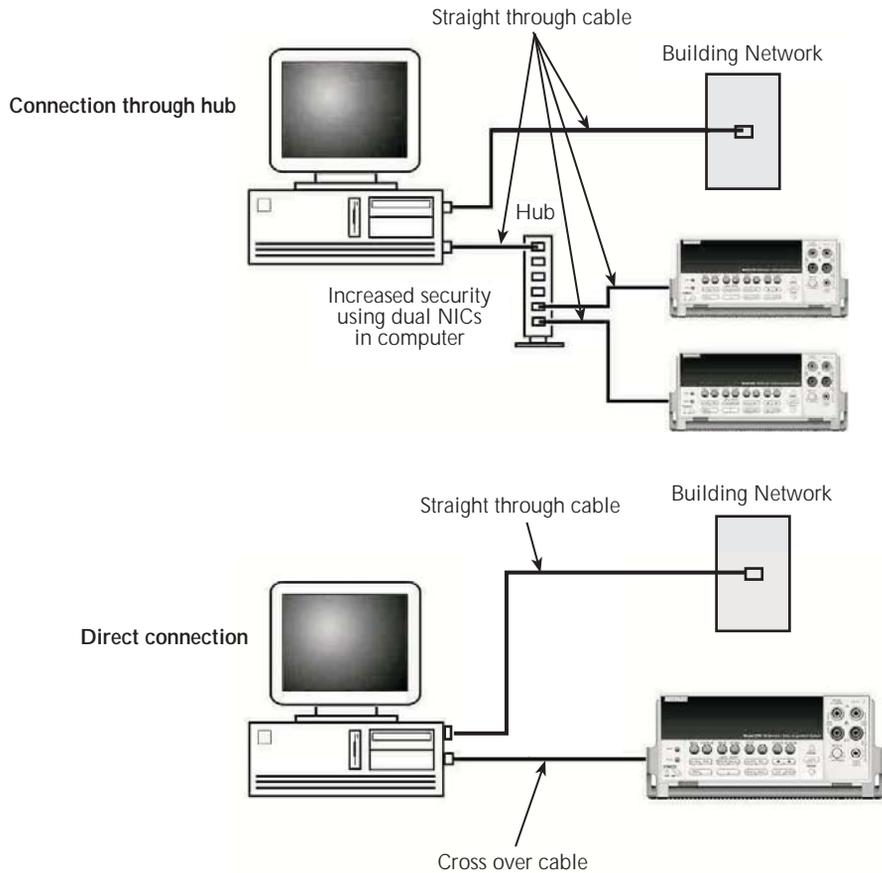
Table 2-4
Additional component requirements—dual NIC connection through hub

Quantity	Component	Note
2	Network Interface Card	Properly installed in PC.
Existing	Existing network cabling	Maintains current network functions.
2	CAT 5 straight-thru cable	Add one additional cable for each additional Model 2701 connected through the hub.
1	Network Hub	10/100BaseTX

Table 2-5
Additional component requirements—dual NIC direct connection

Quantity	Component	Note
2	Network Interface Card	Properly installed in PC.
Existing	Existing network cabling	Maintains current network functions.
1	CAT 5 cross over cable	

Corporate network connection

NOTE   *Although this is the most commonly used Ethernet connection scheme to implement it requires IT/IS support.*

   This section contains information on connecting the Model 2701 to one or more devices using an Ethernet hub or switch (Figure 2-4) that is part of larger local area network (LAN). The LAN administrator must be consulted for the correct settings. Connections require Ethernet straight-thru cables.

Figure 2-4
Corporate network connections
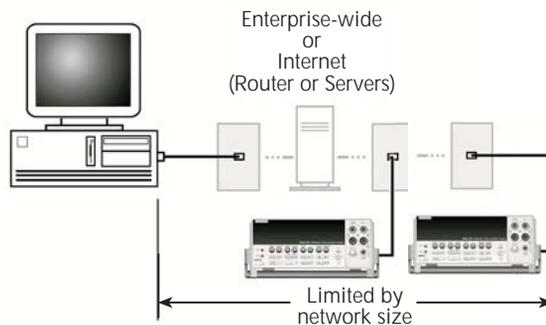
CAUTION   **When connecting the Model 2701 (or any other host) to a corporate net-work, the sites network administrator MUST provide all of the network settings for the Model 2701 including IP address, subnet, and gateway. Failure to use settings provided by the sites Network Administrator could result in failures at other locations on the corporate network. Failure to work through the Network Administrator could also be considered a breech of company policy. Always consult with the Network Administrator before attempting to connect instrumentation to the network.**

NOTE   *Network administrators refer to the IS/IT department section of Communication protocol for specific information about the capabilities of the Model 2701.*

3
Configuring TCP/IP addresses

Communication protocol

The TCP/IP Protocol is the protocol the Model 2701 uses to communicate over the Ethernet connection to the PC. The Model 2701 TCP/IP settings may be configured either manually (on the device) or through the use of a DHCP (Dynamic Host Configuration Protocol) server when connected to a local area network (LAN). The IP settings consist of an IP address, Subnet mask, and gateway address.

A Network Administrator is required to provide the IP settings (addresses) if the connection is made to a LAN. If the network will be isolated from the LAN, the connection can be made without a Network Administrator—refer to "Direct connection (isolated network)" on page 3-4 for information on manual configuration of IP addresses.

CAUTION   **When connecting the Model 2701 (or any other host) to a corporate network, the network administrator MUST provide all of the network settings for the Model 2701 (IP address, subnet, and gateway). Failure to use settings provided by the Network Administrator could result in failures at other locations on the corporate network. Failure to work through the Network Administrator could also be considered a breech of company policy. Always consult the Network Administrator before attempting to connect instrumentation to the network.**

IS/IT department

The Model 2701 supports DCHP. (If a DHCP server is present on the network, it will automatically provide the correct settings to the Model 2701 if the 2701 is powered up while connected to the network.) When adding the device to a network, if a DHCP server is available, the DHCP server will download the IP address, Subnet mask, and gateway address to the Model 2701 upon powering it up on the network. Contact the IS/IT department for access to the DHCP server. The network parameters acquired from the DHCP can be viewed from the Model 2701 front panel menu or queried over the bux. If no DHCP server is available, the Network (LAN) administrator must assign these values to ensure proper operation of the device and to avoid conflicts with other devices on the network.

NOTE   *The Model 2701 supports DCHP. This 2701 setting can be changed over the Ethernet connection using the built-in web page or from the front panel (refer to "Changing Model 2701 TCP/IP addresses" on page 3-7).*

Usually the instruments are kept inside the corporate firewall, but the Network Administrator could assign resources that allow them to be outside the firewall. Placing the resources outside the firewall would allow a Model 2701 connection to the internet using appropriate security methods. This would allow data collection and distribution control from virtually any location in the world.

Use Table 3-1 as a quick reference guide for the IS/IT department. Please refer to the appropriate sections of the this manual as well as the Model 2701 User's Manual for detailed explanations of the information below.

Table 3-1
IT/IS department quick reference guide

Network resource	Action	Description
MAC address	View	Different methods can be used to perform the action listed for each network resource (e.g., use the internal web page or the front panel). SCPI commands can also be used to perform the action on each resource (refer to the Model 2701 User's Manual for further information on SCPI programming).
IP address	View/Set	
Subset Mask	View/Set	
Default Gateway	View/Set	
DHCP	On/Off	
DNS	N.A.	Not Supported.
Number of 2701connections	1	The 2701 will only support a single connection to the instrument at a time.

To set the Model 2701 to use DHCP from the front panel:

Press SHIFT->ETHERNET->VIEW

Dashes will be displayed for Address, Subnet, and Gateway until the unit gets them from the DHCP server.

To set the Model 2701 to use DHCP over the Ethernet, use the internal web page (refer to "Check or set TCP/IP address over Ethernet" on page 3-8).

Direct connection (isolated network)

When connecting the device directly to the Ethernet port of a PC or to a hub that is not part of a larger network, the IP address and Subnet mask must be configured manually (the gateway address is not relevant in this case).

The IP address is a 32-bit identifier consisting of four one byte (8-bits) sections, commonly notated in dotted decimal format (i.e. 145.90.120.240). The Subnet mask is a second 32-bit identifier that designates what portion of the IP address identifies the subnet and what portion identifies the device (i.e. 255.255.255.0). In this example, 145.90.120 is the network address and 240 is the device address. Gateway addresses are typically the device address 1 (e.g., 145.90.120.**1**).

Networks are commonly grouped into three classes based on the first byte of the address:

Table 3-2
Network classes

Class	First Byte	Typical Subnet Mask	IP Address Example
A	1 to 127	255.0.0.0	100.1.1.1
B	128 to 191	255.255.0.0	128.1.1.1
C	191 to 223	255.255.255.0	191.1.1.1

Address restrictions

NOTE *Different available IP addresses are required for each node (this includes each 2701 and each network interface card connected to the instruments network).*

The following IP addresses are reserved—do not assign them to any device (either interface card or Model 2701):

Do not assign…

any address beginning (first byte) with 0 or 127 (reserved for loopback test),
any address beginning (first byte) with 224 through 255,
any address ending (last byte) with 0 or 255.

Other than the restricted addresses, any dis-similar address may be assigned to the PC's Ethernet interface card and to each Model 2701. Keep in mind that when creating and assigning an address, the one assigned to the Model 2701 has to be of the same class as the network. For example, if you want the Model 2701's IP address to be 192.168.0.2 (the default), the Subnet mask should be 255.255.255.0. Also, to communicate with the Model 2701, the PC's Ethernet Interface card must be set to the same class (same Subnet mask and Network ID).

NOTE *Without the correct Subnet mask or Network ID, the direct network will not function.*

Selecting an address

1. Pick a network class. Although most isolated networks are class C type, any class can be selected (see Table 3-2). Use Table 3-3 as a guide to make sure all the required information is available. To make sure a corporate network stays isolated (especially in a dual NIC configuration), it is recommended to use a class C type network.

Table 3-3
IP address example

| Class | Node | IP address | | Subnet mask |
		Network ID	Node	
__C__	Computer	_192_ . _168_ . _0_ .	__1___	_255_ . _255_ . _255_ . __0___
	2701	.	__2___	
	2701	.	__3___	
	2701	.	__4___	
	2701	.	__5___	
	2701	.	__6___	
	2701	.	__7___	

2. With the network class selected, select the First Byte for the class from Table 3-2.

NOTE   *Make sure to not use any restricted numbers as the First Byte number. See "Address restrictions" on page 3-4.*

NOTE   *The first byte is the left most byte of the Network ID.*

3. With First Byte selected, select the second through third bytes of the address. (The first through third bytes of the IP Address make up the Network ID. This as well as the Subnet mask must match for each node.)

4. Select the fourth byte (Node identifier). Use an easily recognizable pattern if assigning numbers to many nodes (see Figure 3-1).
5. Select the Subnet mask for the network class (see Table 3-2).
6. Set the Model 2701 address(es) as required. (See "Changing Model 2701 TCP/IP addresses" on page 3-7.

NOTE   *Since the network scheme in Figure 3-1 does not connect to a corporate LAN, the gateway address selected does not matter (it can be set to 0.0.0.0).*

Figure 3-1
IP address byte location sample

IP Address: 192.168.0.50
Subnet mask: 255.255.255.0

IP Address: 192.168.0.2
Subnet mask: 255.255.255.0

Hub

IP Address: 192.168.0.3
Subnet mask: 255.255.255.0

Network ID

Node designation

IP Address: 192.168.0.2

Subnet mask: 255.255.255.0

IP Address: Made up of two parts:

• Network ID: Must be the same for all nodes on the network that are communicating with each other.

• Node designation: Must be different from each node on the network but within the parameters of the networks class and subnet mask.

Subnet mask: Must be the same for all nodes on the network that are communicating.

Changing Model 2701 TCP/IP addresses

The Model 2701 leaves the factory with the default settings in Table 3-4.

Table 3-4
Model 2701 default TCP/IP addresses

Field	Default value
IP ADDRESS	192.168.000.002
GATEWAY	192.168.000.001
SUBNET	255.255.255.000
DHCP	OFF

If the instrument is not recognized by the network, check the TCP/IP settings and make any changes required. Each Model 2701 ships with a unique MAC address—see the Glossary for a detailed definition.

Front panel

Check the TCP/IP address

1. Press Shift.
2. Press Ethernet (VIEW is displayed).
3. Press Enter to select VIEW.
4. Use the $\blacktriangle$ and f range keys to scroll between:
    *   ADDRESS
    *   SUBNET
    *   GATEWAY
    *   MAC (read-only, cannot change)
5. Press enter to view the desired setting.

Set the IP address

1. Press Shift.
2. Press Ethernet (VIEW is displayed).
3. Use the $\blacktriangle$ and f range keys to scroll the display to SET.
4. Press Enter to select SET.
5. Modify the settings:
    *   Use the $\blacktriangle$ and f range keys to change values. Move the cursor with the $\blacktriangle$ and f arrow keys.
    *   Press enter to set the desired field and open the next setting.

Check or set TCP/IP address over Ethernet

NOTE   *This procedure requires that the Model 2701 is properly connected and configured with the PC over and Ethernet connection. Make sure you can check the TCP/IP address over the Ethernet before installing 2701 drivers or software.*

   1. Open the internal web page using IE 5.0 or greater (see Figure 3-2). Use the IP address of 2701 as the web page address.

NOTE   *Netscape Navigator is not supported. Also, use of a Macintosh computer is not supported. The PC must be at least a Windows 98 compatible machine.*

   2. View settings or modify as desired. Make sure to accept the changes to apply them to the unit.
   3. Open the new address using Internet Explorer.

NOTE   *If you change the Subnet mask or Network ID over the Ethernet, the connection to the PC will be lost. The PC's configuration needs to be changed to match the new configuration of the Model 2701.*

Figure 3-2
Internal web page

Configuring a Network Interface Card (NIC)

> *NOTE   Refer to the network card's documentation for specific installation and configuration information. The following information is provided as an overview.*

Check the IP address to verify that the correct class of network is set. To check, open a command window and use `ipconfig`:

1. Click **Start**>>**Run**.
2. At the prompt, type **command**.
3. Click **OK**. A command window will open.
4. At the prompt, type `ipconfig` and press enter. An output similar to Figure 3-3 will be displayed. Check the Network ID and Subnet Mask. These are required to be of the same class as the Model 2701s.

> *NOTE   The first through third bytes (starting at the left) of the IP Address make up the Network ID. For example, in Figure 3-3, the Network ID is 192.168.0.*

Figure 3-3
Command window w/ipconfig

To configure a network interface card, the TCP/IP protocol must also be installed and configured. In each version of the Windows operating systems, this is done differently.

After determining the network cards (installed in the PC) address and subnet, change the Model 2701's IP address and subnet information to be compatible with the PC's Ethernet card's information. See "Changing Model 2701 TCP/IP addresses" on page 3-7.

The following paragraphs provide additional specific operating information to be used when setting up an isolated network requiring the PC's Ethernet interface card, IP address, and subnet information to be modified.

> *CAUTION   **If your network interface card is configured for connection to a corporate LAN, do not modify the cards settings. Changing the settings may cause the PC to stop functioning on the corporate network.***

Configuration in Windows 98/ME

Refer to Figure 3-4.

1. Click on the Windows Start button.
2. Select Settings, then Control Panel.
3. Open the folder named Network.
4. Look for a TCP/IP entry. If you are configuring a computer with two network cards, there should be two entries, one for each card. You will be able to tell the difference by the listing; after the TCP/IP notation, there will be a reference to the NIC card(s). If there is no TCP/IP protocol listed, you must add one. This is done by clicking the Add button. Then click on Protocol, select Microsoft, and click TCP/IP.
5. After selecting the TCP/IP protocol, click the Properties button. On the IP Address tab, select the method of obtaining your IP address. For an isolated network, click on "Specify An IP Address".
6. Complete the IP Address and Subnet Mask according to your network configuration.
7. The Default Gateway and the DNS settings could be needed when connecting to a corporate network. For an isolated network, these settings are not used.
8. Follow the instructions on the screen and reboot as necessary.

Figure 3-4
Windows 98/ME Ethernet card settings
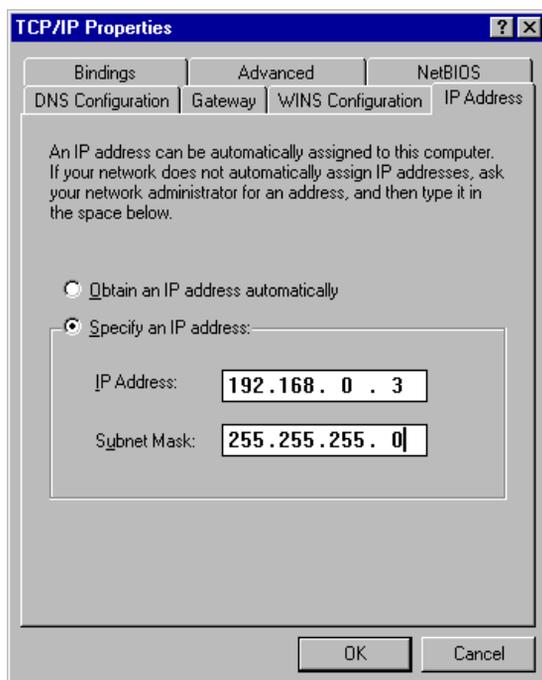
Configuration in Windows NT4

Refer to Figure 3-5.

1.   Click on the Windows Start button.
2.   Select Settings, then Control Panel.
3.   Open the folder named Network.
4.   Select the Protocols Tab.
5.   If there is no entry for TCP/IP, click Add, then select TCP/IP and follow on-screen directions.
6.   After TCP/IP protocol installation, click on Properties. On the IP Address tab, select the proper adapter (NIC), then select the method of obtaining your IP address. For an isolated network, click on "Specify An IP Address".
7.   Complete the IP Address and Subnet Mask according to your network configuration (Figure 3-5).
8.   The Default Gateway and the DNS settings could be needed when connecting to a corporate network. For an isolated network, these settings are not used.
9.   Follow the instructions on the screen and reboot as necessary.

Figure 3-5
Windows NT4 Ethernet card settings
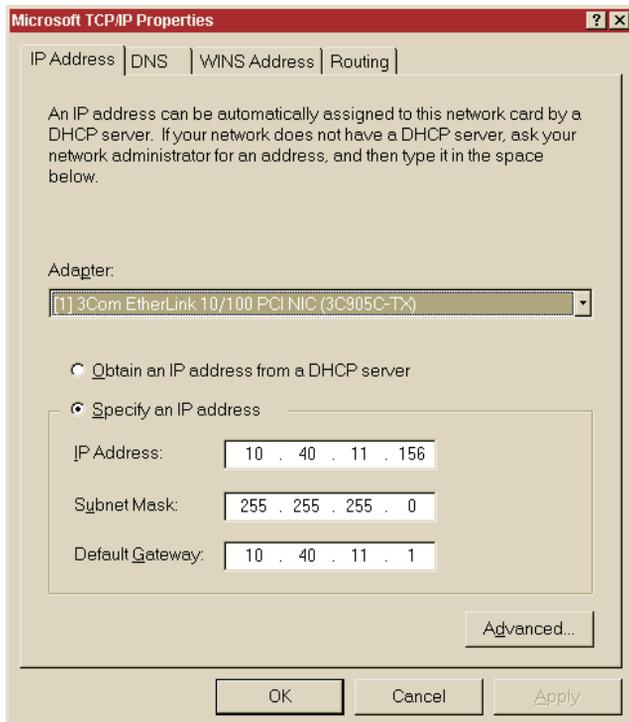
Configuration in Windows 2000

Refer to Figure 3-6.

1.   Click on the Windows Start button.
2.   Select Settings, then Control Panel.
3.   Click on Network and select Dial-Up Connections.
4.   Right click on Local Area Connection, then select Properties.
5.   In the General tab window, you should have the TCP/IP protocol listed and selected. If not, click on Install, then select Protocol, and click Add.
6.   Select the TCP/IP protocol, then click Install.
7.   Go back to the General tab window, select the TCP/IP protocol and click on Properties.
8.   Select "Use the Following IP Address" (Figure 3-6), then enter the IP address and Subnet mask for your network.
9.   The Default Gateway and the DNS settings could be needed when connecting to a corporate network. For an isolated network, these settings are not used.
10.   Follow the instructions on the screen and reboot as necessary.

Figure 3-6
Windows 2000 Ethernet card settings

Configuration in Windows XP

Refer to Figure 3-7.

1. Click on the Windows Start button.
2. Select Network and click Internet Connections.
3. Under "or pick a control panel icon", select Network Connections.
4. Right Click on "Local area connection" and select Properties.
5. In the General tab window, you should have the TCP/IP protocol listed and selected. If not, click on Install, then select Protocol, and click Add.
6. Select the TCP/IP protocol, then click Install.
7. Go back to the General tab window, select the TCP/IP protocol and click on Properties.
8. Select "Use the Following IP Address," then enter the IP address and Subnet mask for your network (Figure 3-7).
9. The Default Gateway and the DNS settings could be needed when connecting to a corporate network. For an isolated network, these settings are not used.
10. Follow the instructions on the screen and reboot as necessary.

Figure 3-7
Windows XP network configuration window
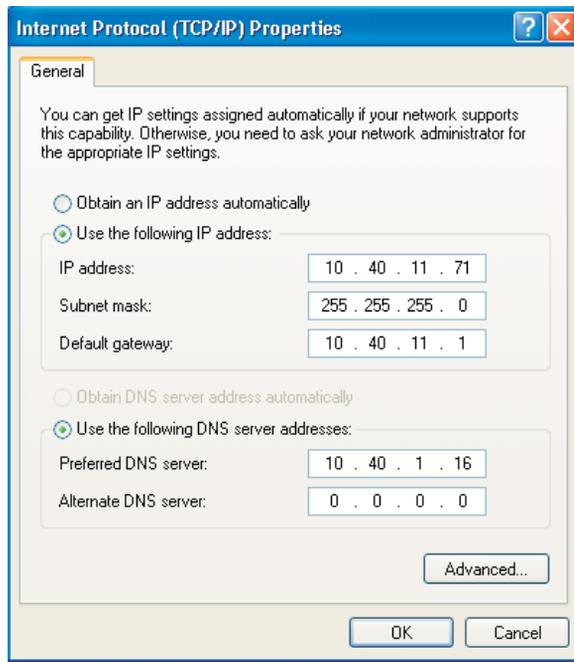
Troubleshooting

Refer to Table 3-5 for troubleshooting tips concerning the Model 2701's Ethernet connection.

Table 3-5
Model 2701 Ethernet troubleshooting

Problem	Possible causes
Web page opens, not able to connect to 2701 (settings and data fields on the web page are blank or filled with dashes or asterisks).	Subnet mask incorrect (check both the Model 2701 and the PC to make sure they are the same).
	Security not correctly set in IE. Add the IP address of the Model 2701 to trusted sites. Make sure the ActiveX controls are allowed.
	There already is a connection to the 2701 (no more than one connection is allowed at a time).
	Past connection not closed. Cycle power the 2701 to close previous connection (turn off and then back on).
Not able to open the Model 2701 web page.	Incorrect cable type (cross over cables should not be used to connect to hub, straight through cables should not be used to connect directly to the Model 2701 without a hub).
	IP address conflict. Make sure each node (interface card and 2701) has a unique IP address, but share the same Subnet mask and network ID.
	Network device problems. Check the interface cards setup (refer to the specific cards instructions or the PC manual for additional information).
	Use of an unsupported web browser or operating system.
	Mistyped IP address. Check for proper IP address and refresh as necessary.
	Instrument is set to use Serial Interface. On the 2701 front panel, press: Shift >> RS-232 and set to OFF.
	Instrument is set to use DHCP but cannot obtain IP address from DHCP server. If you try to view the IP address and only dashes are shown, then instrument could not obtain IP address. Make sure DHCP server is available on network and is configured properly.
	NOTE When using DHCP, it is normal for the instrument to show dashes instead of the IP address when it is first powering up, because it does not obtain the IP address from the server until later in the start up sequence.

Table 3-5
Model 2701 Ethernet troubleshooting

Problem	Possible causes
Not able to open the Model 2701 web page (continued).	Bad cable connection. Make sure that either the Link/Act or 100bt LED near the Ethernet connector is on and/or blinking (see Table 1-1).
Problems with advanced display adapter driver.	A common software glitch exists between some network support software and advanced display adapter software. If the network software does not operate properly, try selecting the standard VGA driver in Windows Setup (under the control panel). If this solves the problem, try obtaining the latest version of the drivers.
Unable to connect to 2701 (connected through corporate LAN).	IP addresses that are assigned by the IS/IT department may take a period of time before they are active. Check with them as to when the IP address will become active.
	Network IDs may be different in different parts of the corporate network (network design dependent). Make sure you specifically tell the IS/IT where you are going to connect the 2701 to the network as location may determine the 2701's correct subnet.
	If you have an instrument connected to a router or a switch, the MAC address is usually cached with the IP address for a period of time. The router or switch will not recognize the instrument if the IP address is changed or if the cached IP address is assigned to a different instrument. Contact your IS/IT department for additional details about how the router/switch is configured.

4
Software and Drivers

Keithley Integra Series Software Architecture

Figure 4-1 illustrates how Keithley's powerful software tools integrate to provide a full range of application solutions. The individual components are described later in this section. Installation and configuration details are provided at the end of this section.

Figure 4-1
Software overview
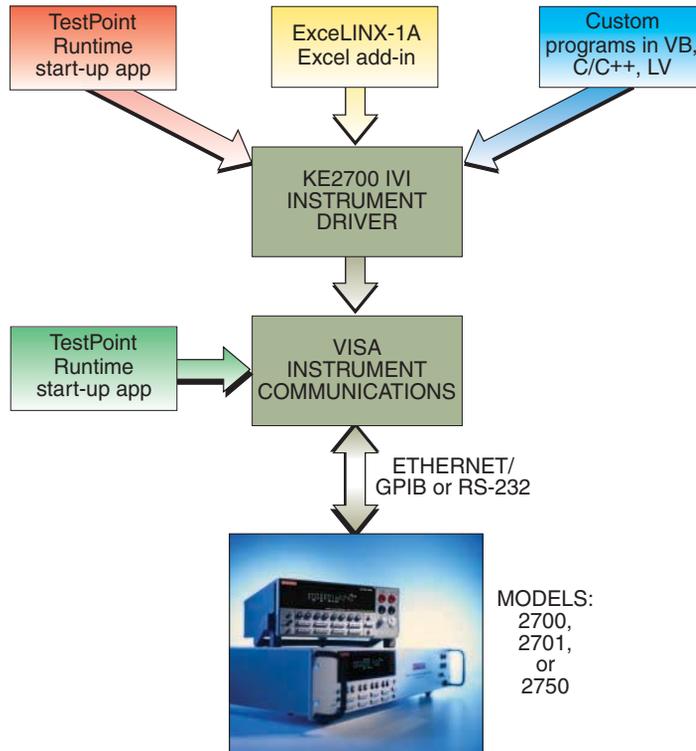
Built-in web diagnostic tool (free)

To start communicating with a properly connected and configured Model 2701, simply start Microsoft[®] Internet Explorer[®] on a PC and type the instrument's IP address into the URL line (for a screen shot of the web page, see Figure 3-2). The built-in web diagnostic interface allows for easy communication and debugging, without the need to install external software.

This interface makes it easy to read and set network parameters such as IP address, subnet mask, gateway, MAC address (read only), calibration dates, and other data stored in the Model 2701. It also takes readings from the instrument and allows the user to send command strings and receive data. (Refer to the Model 2701 User's Manual for additional information on the web page.)

Provided software

The Model 2701 includes the following software (supplied on a CD):

- TestPoint runtime start-up software package
- VISA-based IVI style instrument driver

TestPoint runtime start-up software package

The free TestPoint runtime start-up software package (Figure 4-2) provides basic data logging capabilities, so a system can be up and running almost immediately. A few clicks of the mouse are all it takes to confirm that the system's hardware, wiring, communications, and software drivers are installed and operating correctly. Data from multiple channels of a single 2701's can be saved to disk; up to eight channels of data can be graphed automatically and multiple configurations can be saved to disk.

Refer to Table 4-1 for a description of the TestPoint runtime start-up software packages features. If the application demands greater functionality, this free runtime software can be modified with the TestPoint application development package (described later).

Figure 4-2
TestPoint runtime start-up software
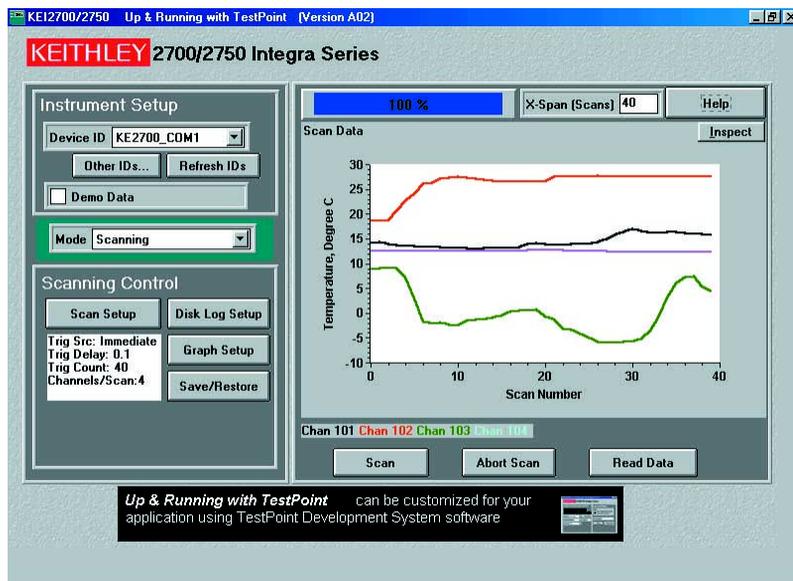
Table 4-1
TestPoint runtime start-up software—supported features

Feature	Description
Supported Instrument	2700, 2701, 2750
Supported Measurement Types	DC volts and current AC volts and current Resistance (2-wire and 4-wire) Frequency and period Temperature (Thermocouple, RTD, Thermistor)
Supported Plug-in Switch Modules	7700, 7702, 7708
Not supported	Digital I/O, Analog outputs, on/off control of switches, custom control sequences, math, filtering, limits, and scaling.
System Requirements	Pentium class PC with Windows 98 (SE), Windows NT4 (SR6), Windows ME, Windows 2000, or Windows XP Professional. Model 2700 (Firmware B04 or later) Model 2701 (Firmware A01 or later) Model 2750 (Firmware A02 or later)
Communications	TestPoint runtime uses the KE2700 Instrument Driver for instrument communications. See KE2700 Instrument Driver features and specifications below.

KE2700 VISA Based IVI Instrument Driver

The KE2700 Instrument Driver is provided free with the 2700, 2701, and 2750 instruments. All of Keithley's Integra Series software uses the KE2700 Instrument driver to communicate with the instrument. For experienced programmers who prefer to build fully custom systems from scratch, the KE2700 driver can be used with Application Development environments such as LabView, LabWindows CVI, Visual Basic, C/C++, and TestPoint. The KE2700 driver uses VISA (supplied) to manage communications with the instrument.

The following describes the benefits of using VISA and IVI drivers. Refer to Table 4-2 for descriptions of the KE2700 VISA Based IVI Instrument Driver features.

Benefits of VISA (Virtual Instrument Software Architecture)

- Provides transparent software compatibility with Ethernet, GPIB, and RS-232. No software changes are required when changing communication bus type.
- Hides the complexity of the communications bus using a common programming model for greater ease of use.
- Protects your investment in software development by making programs easily scalable for later reuse.

Benefits of IVI (Interchangeable Virtual Instruments) Drivers

- Protects software development investments by ensuring software compatibility and interchangeability from instrument to instrument within the same family (such as Model 2700, 2701, and 2750).
- Supports a wide range of Application Development Environments such as LabView, LabWindows CVI, Visual Basic, C/C++, and TestPoint.
- Supplies a common programming interface based on the ANSI-C standard.
- Hides the complexity of instrument dependent commands (SCPI).
- Provides online, built-in, context sensitive help.

Table 4-2
KE2700 VISA Based IVI Instrument Driver—supported features

Feature	Description
Supported Instruments	2700, 2701, 2750
Supported Measurement Types	All types and ranges supported by the instrument.
Supported Plug-in Switch Modules	All modules supported by the instrument.
System Requirements	Pentium class PC with Windows 98 (SE), Windows NT4 (SR6), Windows ME, Windows 2000, or Windows XP Professional. Model 2700 (Firmware B04 or later) Model 2701 (Firmware A01 or later) Model 2750 (Firmware A02 or later)
Communications Interface Support	Ethernet Keithley GPIB cards (ISA, PCI, PCMCIA) CEC GPIB cards (ISA, PCI) National Instruments GPIB cards (ISA, PCI, PCMCIA) INES GPIB cards (PCMCIA) RS-232 Serial

Additional software applications

Keithley has the software needed to get the most performance from a Model 2700 or 2750 Multimeter/Switch System. Our broad range of software solutions makes it easy to get R&D, quality assurance, and production applications "Up & Running" quickly and economically. The following programs for the Model 2700/2701/2750 are available separately.

ExceLINX-1A

ExceLINX-1A (Figure 4-3) is an economical, easy-to-use, add-in utility for Microsoft Excel and Keithley Integra Series Multimeter/Switch systems. No programming is required—configure your measurements quickly using pop-up menus and eliminate time-consuming and error prone programming. Acquire data into a spreadsheet on the fly during a scan or transfer data into a spreadsheet after a scan is completed. A few mouse clicks are all it takes to configure channels, set parameters, triggers, and scan lists. There is no need to launch a separate data logging or data-crunching application; live data streams automatically into an Excel workbook, ready for analysis or charting using all of Excel's powerful built-in tools.

Within minutes of installing ExceLINX-1A on a PC, users can acquire data directly from the Model 2700/2701/2750 instruments. Then employ Excel's graphics, charting, and analysis capabilities to turn that data into useful information, channels of data, or the tools to create a fully custom acquisition and analysis solution. Refer to Table 4-3 for descriptions of the ExceLINX-1A features.

Figure 4-3
ExceLINX-1A
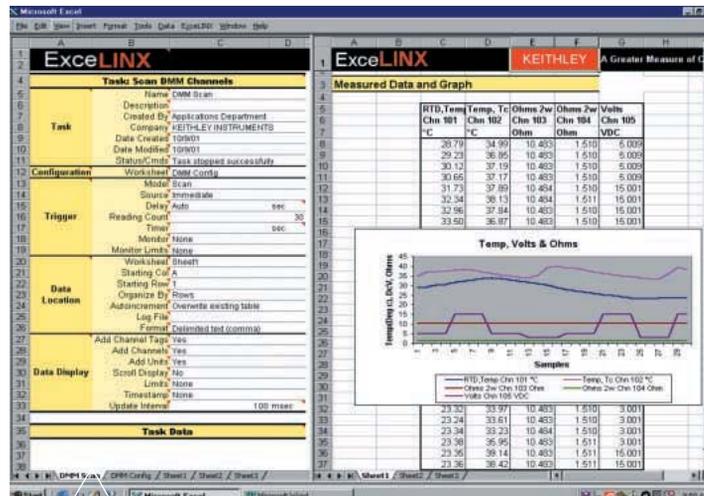
Table 4-3
ExceLINX—supported features

Feature	Description
Supported Instrument Types	2700, 2701, 2750
Supported Measurement Types	All types and ranges supported by the instrument.
Supported Plug-in Switch Modules	7700, 7701, 7702, 7703, 7705, 7706, 7707, 7708, 7709, 7710, 7711, 7712.
Other Features	Full support for all trigger types, monitor scan support, limits can control chassis digital outputs, Visual Basic for Applications interface.
Not supported	Digital I/O on a module, Analog outputs, on/off control of switches, custom control sequences.
System Requirements	Pentium class PC with Windows 98 (SE), Windows NT4 (SR6), Windows ME, Windows 2000, or Windows XP Professional. Excel 97 (SR1) or newer version. Firmware: -Model 2700 (B04 or later) -Model 2701 (A01 or later) -Model 2750 (A02 or later)
Communications	ExceLINX-1A uses the KE2700 Instrument Driver for instrument communications. See KE2700 Instrument Driver features and specifications.

TestPoint Application Development Package

The TestPoint start-up software can be modified, enhanced, and extended using the full TestPoint Application Development Package, available separately. By using the start-up runtime as a foundation, TestPoint offers the flexibility needed to build basic systems quickly, without extensive programming. TestPoint uses object-oriented, drag-and-drop technology to bring both power and simplicity to data acquisition and test and measurement applications. TestWizards and pre-written application templates in a choice of graphical styles make it simple to create a complete application. Additional objects can be added and modified to create custom enhancements.

Three optional toolkits provide even more capability for TestPoint applications:

- Internet toolkit provides Web-based remote measurements and control.
- Database toolkit provides access to popular database packages like Access, SQL, Oracle, and others.
- Statistical process control (SPC) toolkit adds charts, statistics, and analysis capabilities.

Provided software and driver installation

> *NOTE   Make sure the instrument is properly connected and configured to a controlling PC before installation of the software or drivers. Installation of the software or the drivers will not correct an improperly configured Ethernet.*

Installation and configuration

Before installing the software provided with your Model 2701 instrument, make sure the instrument is properly connected and configured to a controlling PC as described in previous sections of this manual. Installation of the software and driver will not correct an improperly configured Ethernet. It is recommended that you use the built-in web page to verify your system set-up and configuration before installing the start-up software and/or instrument driver (if the web page displays and is able to control the Model 2701, the Ethernet is functioning correctly).

Installing the start-up software and driver

To install the start-up software and the instrument driver, insert the software CD provided with your instrument. The installation utility should run automatically. If it does not start automatically, navigate and run the **install.exe** program in the root directory of the CD. Follow the on-screen prompts to install both the start-up software (TestPoint runtime) and the KE2700 instrument driver.

Although the software provided on the CD is the current version at time of shipment, it is recommended that you visit the Keithley Web site (www.keithley.com) to check for available updates.

Configuring instrument communications

Before you run the start-up software or use the instrument driver, you must configure the communications with your instrument. Make sure your instrument is properly connected to your computer and then run the Keithley Configuration Utility to configure communications.

When the configuration utility opens, the configuration wizard will also open. The wizard allows you to add, modify, and delete instruments from your configuration. It is recommended that you use the wizard for all routine configuration tasks. The configuration panel provides extra capability for advance configuration tasks.

Use the following steps to configure communications. The example screen captures shown illustrate the steps required to configure the software to communicate to a Model 2701 using Ethernet. Before using this utility, you must have already configured your PC's network communications and chosen your instrument's network address as described earlier in this manual.

> *NOTE   Close all applications that use the KE2700 Instrument Driver before using the configuration utility to make changes.*

Procedure to start Keithley configuration wizard

1. To start the configuration utility and wizard, open the "Keithley Configuration Panel". From the Start Menu, select:
   Programs>>Keithley Instruments>>Keithley Configuration Panel
2. Follow the wizard's prompts. Figure 4-4 through Figure 4-10 contains an example session of using the wizard.
3. Exit the utility. To access the utility again, select "Show Wizard" from the Help menu.

Figure 4-4
Keithley configuration wizard window
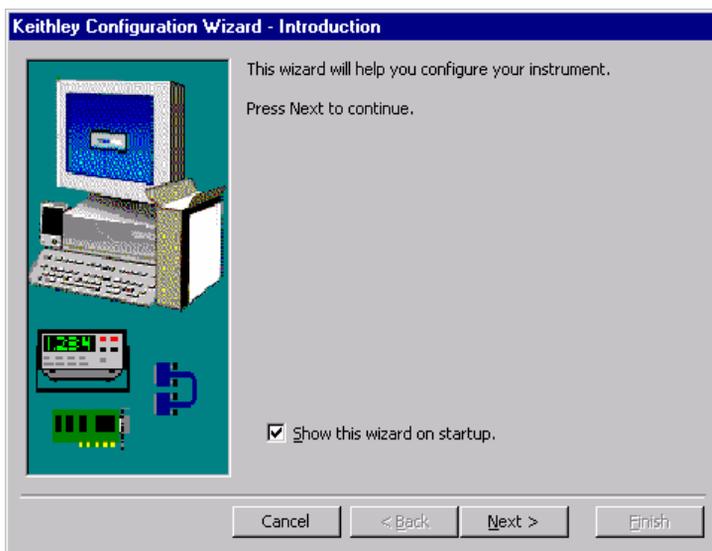
Figure 4-5
Select operation window
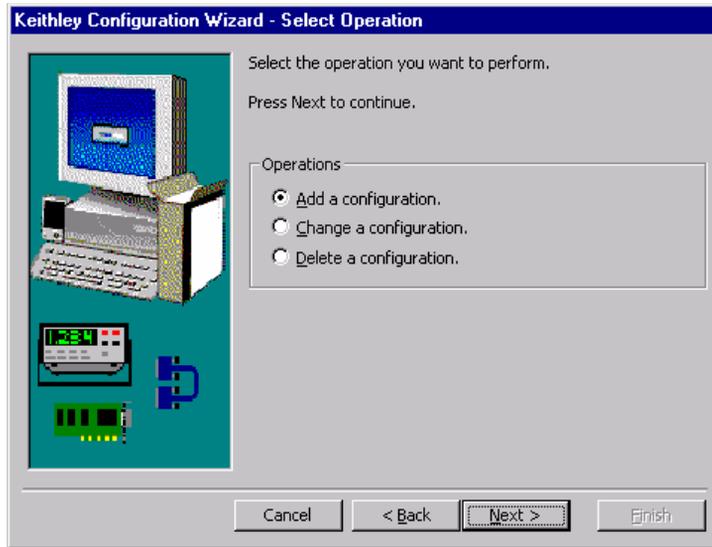
Figure 4-6
Select communication bus type window
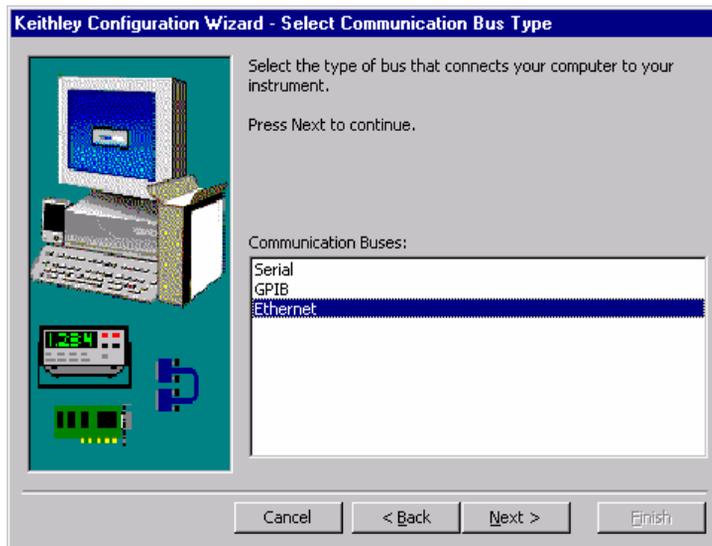
Figure 4-7
Select IP address window

Figure 4-8
Select instrument driver window

Figure 4-9
Assign instrument name window

NOTE   Change the name to anything that will help you identify your instrument.
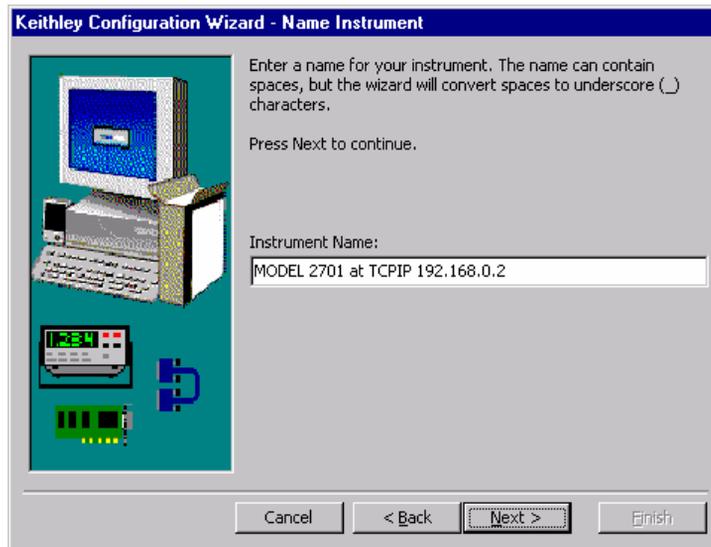
Figure 4-10
Summary window
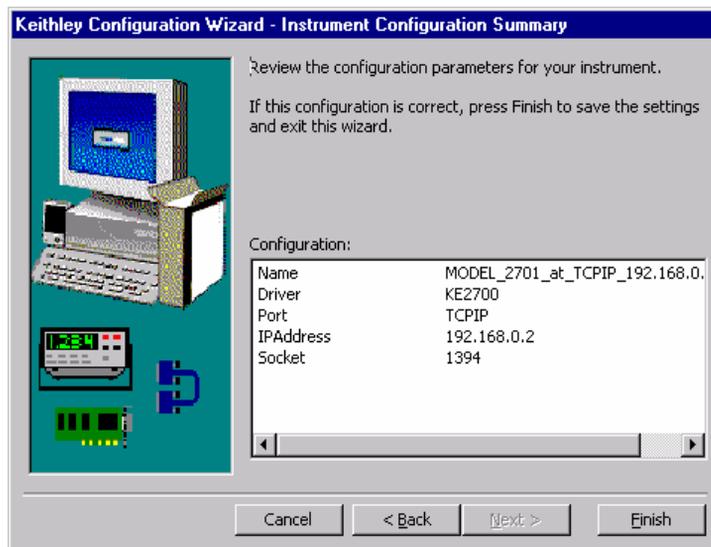
> ***NOTE***   *Specify the IP address of your instrument as determined earlier in this guide. Leave the IP Port set to 1394 for use with the Model 2701.*

Once you have completed configuring your instrument, you may exit the configuration utility. If you want to run the wizard again, you may select Help>>Show Wizard to reopen the wizard.

Advanced configuration

The configuration panel may be used to adjust advanced configuration settings by those familiar with VISA and IVI Instrument configuration. We recommend you not adjust advanced settings unless you are completely familiar with their purpose and effects.

One advanced setting that many advanced users may wish to adjust is the QueryInstrStatus attribute setting. By default, the KE2700 Instrument Driver checks the instrument for errors after every command. While this provides the safest operation and provides the most useful information in the event of a program or instrument fault, disabling this feature considerably speeds up instrument communications. Advanced users may wish to modify the setting of this attribute as described below. We recommend that you leave this function enabled until you are satisfied your application is operating correctly. Then, turn off the error checking to improve performance.

To change the attributes of QueryInstrStatus, use the following procedure.

Procedure to set QueryInstrStatus attribute to False

1. If not already running, access the configuration utility (See "Procedure to start Keithley configuration wizard" on page 4-11.).

2. Close the wizard and use the configuration panel as shown Figure 4-11.

3. Select the instrument whose configuration setting you wish to modify.

4. Then double click on the QueryInstrStatus attribute in the right-hand pane of the utility. A pop-up edit box will appear (Figure 4-12).

5. In the edit box, change the attribute setting to False and press OK.

6. Figure 4-13 will appear. Close the configuration panel (save changes when prompted).

Figure 4-11
Advanced configuration window—select instrument
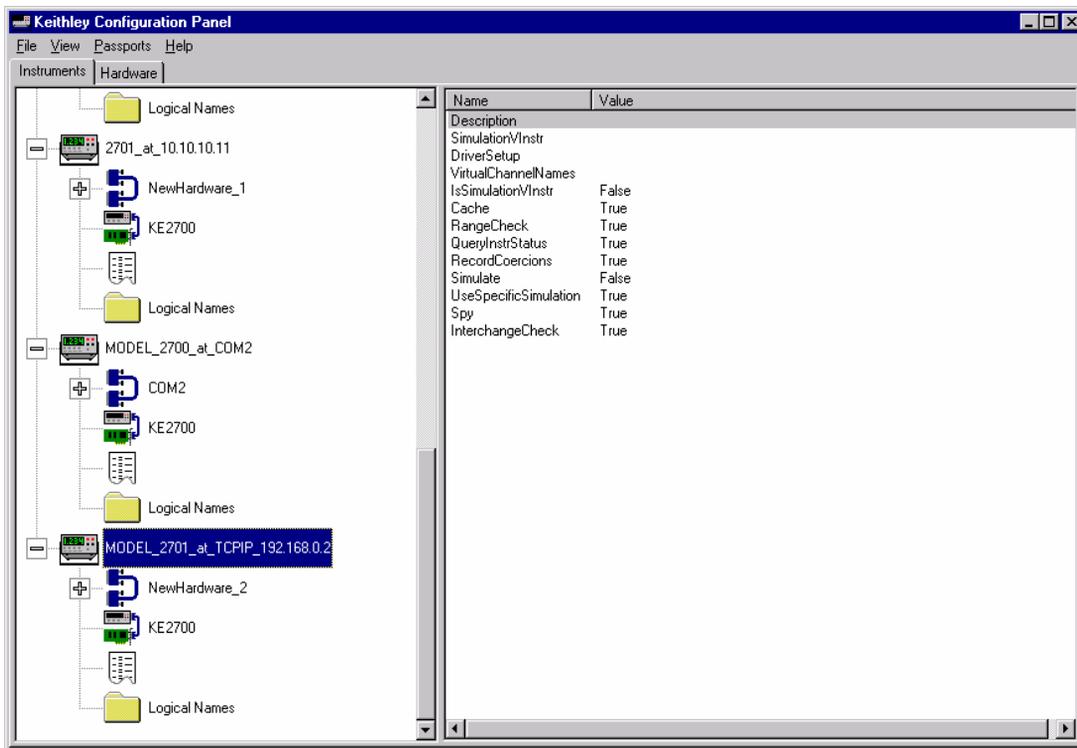
Figure 4-12
Attribute setting
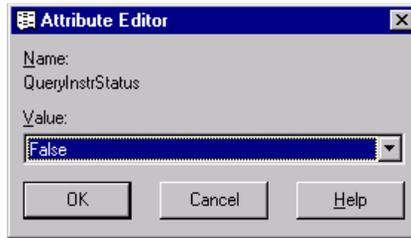
Figure 4-13
Advanced configuration window—view changed attribute
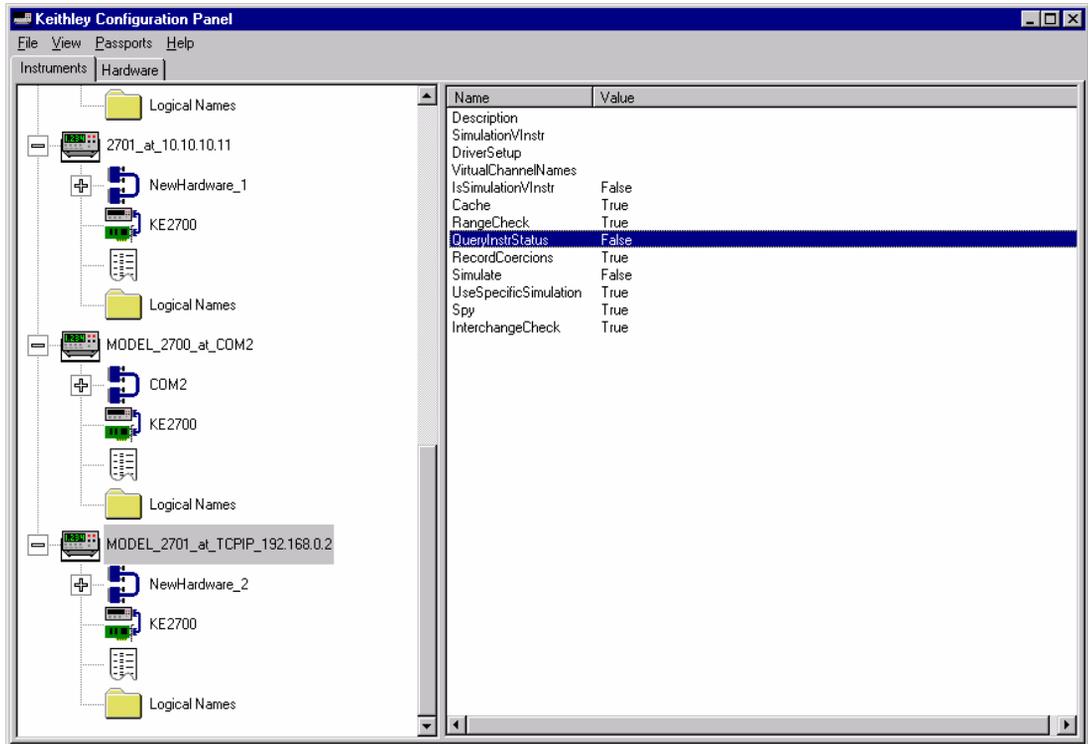
A
Cable diagrams

Ethernet cables

For 10BaseT and 100BaseTX Ethernet connections, use standard category five (CAT 5) twisted pair patch cables with RJ-45 connectors, not to exceed the standard maximum segment length of 100 meters. The equipment that the device is being attached to will determine whether a straight-thru or cross over cable configuration is required.

Straight through cables

Standard Ethernet straight through cables are required when connecting the device to a standard network hub or switch.

NOTE   Straight through cables are also referred to as patch cables.

Figure A-1
Straight through cables

Ethernet Straight Through Cables

1 – Orange/White
2 – Orange
3 – Green/White
4 – Blue (not used)
5 – Blue/White (not used)
6 – Green
7 – Brown/ White (not used)
8 – Brown (not used)

1 – Orange/White
2 – Orange
3 – Green/White
4 – Blue (not used)
5 – Blue/White (not used)
6 – Green
7 – Brown/ White (not used)
8 – Brown (not used)

Pin Assignments

1 ——————— 1

2 ——————— 2

3 ——————— 3

6 ——————— 6
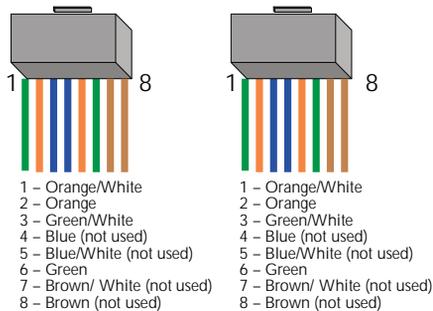
Cross over cables

Standard Ethernet cross over cables are required when connecting the device directly to the Ethernet port of a PC.

NOTE   *Cross over cables are typically labeled (cross over or XO) at one or both ends.*

Figure A-2
Cross over cables

Ethernet Cross Over Cables

1 – Orange/White
2 – Orange
3 – Green/White
4 – Blue (not used)
5 – Blue/White (not used)
6 – Green
7 – Brown/ White (not used)
8 – Brown (not used)

1 – Green/White
2 – Green
3 – Orange/White
4 – Blue (not used)
5 – Blue/White (not used)
6 – Orange
7 – Brown/ White (not used)
8 – Brown (not used)

Pin Assignments

1
2
3
6

1
2
3
6
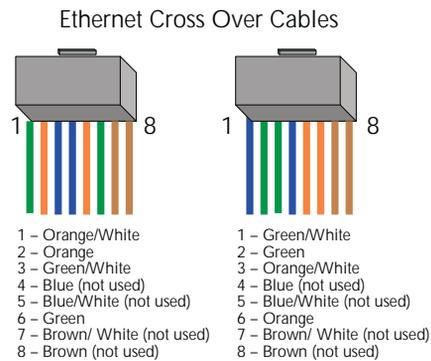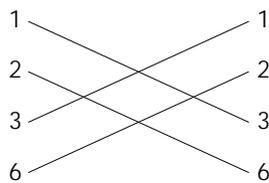
B
Glossary

ActiveX — A version of Microsoft's OLE (object linking and embedding) which can directly modify files. Usually digitally signed.

API (Application Programming Interface) — A set of callable software functions that applications use to make requests to the operating systems.

Blue Screen of Death (or Blue Screen) — A euphemism for the screen that appears when the Windows operating system halts due to a critical error.

Default Gateway — The IP address of computer that is attached to the network running TCP/IP that knows how to route data to other networks.

DNS — The Domain Name System (DNS) is a database used by TCP/IP applications to map between host names and IP addresses. Each company maintains its own database of information and runs a server program that other systems across the Internet can query. The DNS provides the protocol that allows clients and servers to communicate with each other.

Dynamic Host Configuration Protocol (DHCP) — A feature of Windows NT server that automatically assigns IP addresses to hosts on a TCP/IP network whenever the hosts starts up.

Bridge — A device that passes network data between two segments of network.

Ethernet — A network technology invented by Xerox Corporation and developed jointly by Xerox, DNEC, and Intel.

Firewall — A hardware or software component in the data path between the internet and an internal network. The firewall filters packets by examining them on one side and deciding what to pass along to the other side.

Gateway — A computer that acts as a translator on the network or as a router between two network technologies. It can also act as a translator between two different network protocols.

Host — Defined as anything on the network that can transmit and receive IP packets on a network. This would include workstations, servers, and the Model 2701.

Hub — A passive hub is a device that splits the received signals among other connected nodes. An active hub amplifies or repeats incoming signals before distributing them.

INterNIC (Internet Network Information Center) — The organization responsible for assigning Internet network addresses and domain names to hosts that are connected to the Internet.

IP Address — A unique 32-bit address assigned to each host attached to the network. An IP address specifies both the network and the host address.

MAC Address — Media access control is the hosts unique identity. It is a 6 Byte hexadecimal number that can be represented in HEX or decimal. The Model 2701 uses a decimal number, much like an IP address structure to represent the MAC address. The MAC address is usually assigned to the HOST at the factory. The host transmits its address with each packet of data. It may also be referred to as a hardware address, Ethernet address, node ID, or adapter address. This is not required to be known when using an isolated network. A systems administrator may require this when connecting to a corporate network.

Network — Two or more computers connected together enabling them to communicate.

Network Topology — Geometric organization of nodes and cable links in a LAN (local area network).

NIC — Network interface card is a computer card that is installed in a computer that allows the computer to communicate with a network.

Packet — A chunk of information that contains both the original data to be transmitted along with additional addressing information. If the packet is to large to be transmitted by the data link layer, the network layer breaks it into multiple pieces, transmits them, then reassembles the packet at the receiving end.

Peer-to-Peer Network — A type of network that no two computers have more control over the network than another. Each can act as both a server and a client. This means that each can supply resources to the other peer computers.

Protocol — A formal set of communication conventions used by two network nodes to communicate properly with each other.

Repeater — A device that amplifies incoming transmission signals before regenerating them on its output. This will maintain signal integrity along a longer media run than is normally possible.

Router — A device that forwards data packets from one network to another.

Server — See web server.

Socket — A virtual port enabling client applications to connect to the applicable server.

Subnet — A segment of LAN that is differentiated from other segments through use of an operation called a Subnet mask. This operation is performed on the networks IP address.

Subnet Mask — A transformation applied on an IP address enabling creation of subnets.

TCP/IP — Transmission Control Protocol/Internet Protocol. A set of network protocols and associated tools that originated in the UNIX and internet environments. It has become the standard protocol used when configuring networks.

Topology — See network topology.

Web Server — A program accepting requests for information framed conforming to HTTP (HyperText Transfer Protocol). The web server processes the requests and provides the requested information.

Winsock — An open standard specifying how a dynamic link library (DLL) should be written to provide TCP/IP support.

l0Base2 — Coaxial cable running a l0Mbit/sec with a distance limit of 185 meters per segment.

10Base5 — Thick coaxial cable running at l0Mbit/sec with a distance limit or 500 meters per segment.

l0BaseT/l00BaseTX — Unshielded twisted pair running 10/100 Mbit/sec. Maximum cable length l00m.

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