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8003/8003H
LAN TO PARALLEL DIGITAL INTERFACE

A flexible interface between any computer and devices with digital signals.

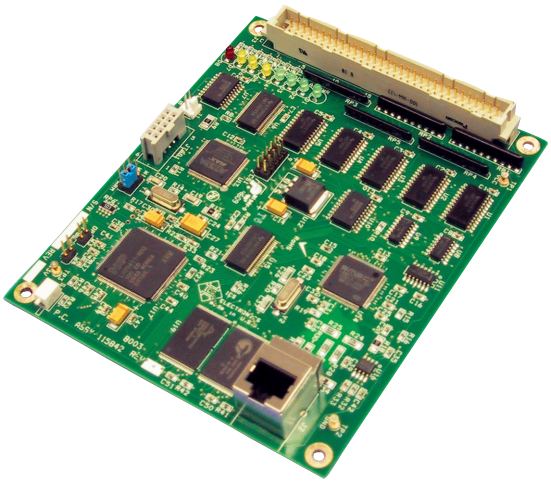
- Provides a user-definable, 40-line parallel interface with bit, byte, string and binary data transfer capabilities. *Fully configurable to the user's needs.*
- Signal monitor feature detects signal changes on 15 inputs. *Relieves controller of time consuming polling task.*
- High-current drivers and input pullup resistors. *Drives more devices, longer lines and inputs CMOS signals or switch contacts.*
- Optional Switch Control Program with SCPI commands. *Easy control of multi-line switches and attenuators.*
- Ethernet interface is VXI-11.3 Compliant and supports Raw Socket connections. *Works with virtually any computer or test language.*
- Network settings configurable with a web browser or RPC. *Easy network configuration from any computer.*
- Interchangeable with ICS's 4803 GPIB, 2303 Serial and 2003 USB boards. *Chose a Serial, GPIB, Ethernet, or USB Interface.*

☑ RoHS Compliant

Description

ICS's Model 8003 Ethernet <-> Parallel Interface is a small, 40 line digital interface that can be used to interface devices with digital signals to the computer via an 10 or 100 Mb Ethernet network. The 8003's high-power TTL level signals can easily drive small relays or other logic elements. In a typical application, the 8003 is located inside the device chassis and is powered by the device's +5 volt power. All digital signal connections are on an upright 96-pin DIN connector at one end of the card. The 8003 has vertical RJ-45 connector for the Ethernet signals. A right-angle RJ-45 connector is available on the 8003H board. Versions of both boards are available with the DIN connector mounted on the circuit-side for piggybacking on another PC board.

Applications include controlling switching logic, operating displays or passing data to/from other devices. An optional Generic Switch Control Program adds additional SCPI commands that make it easy to control multi-line switches and attenuators.



8003 Interface Board

Versatile Digital Interface

The 8003's digital interface lets the user designate the 40 data lines as inputs and/or outputs in 8-bit byte increments, connect bytes into strings, set data polarity, data format, and handshake modes. When the bytes are used as inputs, the input signals are tristated and are pulled up by 33 kohm resistors to 5 Vdc. The inputs are ideal for reading switches, TTL and CMOS signals.

The user can set the output lines to his desired values and save the output values and configuration in the 8003's Flash memory. The saved values becomes the power-on configuration. At power turn-on, the Digital I/O lines are initially tristated and then set to the saved configuration. A Stable signal is asserted after the digital I/O lines are configured to enable external logic or relays.

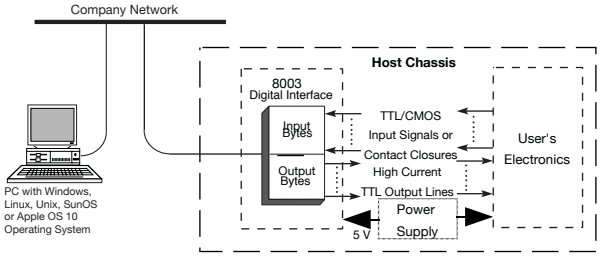


Figure 1 A typical 8003 Application

Data Transfer Methods

Data transfer capabilities between the computer and the 8003's digital interface depends upon the link to the 8003. When linked to *inst0* the user can access all setup commands and control the digital interface by individual bits, by bytes, or as strings of data values to multiple bytes as shown in Figure 2. When linked to *inst1* data is transparently transferred to the digital interface.

• Bit commands set or reset specific bits in a byte or query a bit's status. New pulse commands let the user pulse single or multiple output lines at the same time.

• Byte commands set all 8 bits in a specific byte or read data from a byte.

• String transfer commands send strings of data characters to one or more output bytes to make a multi-byte output word or read a string of data from one or more input bytes. The user designates these bytes as inputs or outputs when configuring the board.

When linked to *inst1*, the user can send or receive strings of data without commands. The 8003 transparently passes strings of data to user configured output bytes or reads data from user configured input bytes. The data is output or read without having to parse any commands, eliminating the parsing time and speeding up the data transfer. When the binary data format is used, the 8003 can output data at its maximum output rate.

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Configuring the 8003's Digital Interface

The 8003's digital interface is configured with commands from the host computer. The configuration commands permit the user to set multiple bytes as inputs or as outputs to make a wide date word, to set data polarity, data format, and handshake modes. The Bit and byte commands automatically set their bytes as outputs. String accessed bytes are preset as input or output bytes by the CONFigure command.

Formatting options let the user select a decimal value, hex or binary characters for each byte. An input translation table lets the user create his own input set with special characters when inputting data. When done, the user sets the outputs to their power-on values and saves the current configuration in the 8003's Flash memory as the new power-on configuration.

At power turn-on, the Digital I/O lines are initially tristated and then configured and set to the saved levels after the 8003 passes its self test. The 8003 provides a Stable output signal, which turns on after the 8003's digital lines are configured for controlling power to external devices or to enable external logic. The time from power turn-on to the Stable signal depends on the network settings and network's response to the 8003.

Outputting Data

The 8003 has three ways to control the digital interface and output data as shown in Figure 2:

- Bit commands set, reset or pulse bits in a specific byte.
- Output byte commands set all bits in a byte and latch an output value (0 to 255) into a specific byte. Data Strobes can be manually generated if needed.
- Strings of data can be outputted to multiple bytes with a command or transferred transparently. The 8003 converts the data string characters into packed HEX bytes, latches the data in the configured output bytes and generates a data strobe pulse to update the external device. The data strings can be a series of decimal values, ACSII HEX characters, or the 30-3F HEX characters used in ICS's earlier interfaces.

Reading The Input Signals

The 8003 has three ways to read the digital interface lines and input digital data as shown in Figure 2:

- Bit queries read the status of an individual bit from a specific byte.
- Input byte commands read 8 bits of data from a specific byte.
- Strings of data can be read from multiple bytes with a data transfer command or inputted transparently. These bytes are preset as string input bytes by the CONFigure command. For input strings, the 8003 reads the configured input bytes, converts the data to the selected output format, and outputs it as a string of characters. Data can be inputted with or without handshaking. The input data can be formatted as decimal numbers, as ASCII HEX characters, or into a user selected character set.

Transparent Data Transfer

The user can input and output data without using a string command by linking to the 8003 at *inst1* Data is read from the configured input bytes each time the 8003 receives a *device_read* rpc. The data is input and formatted just as it would be for reading strings of data.

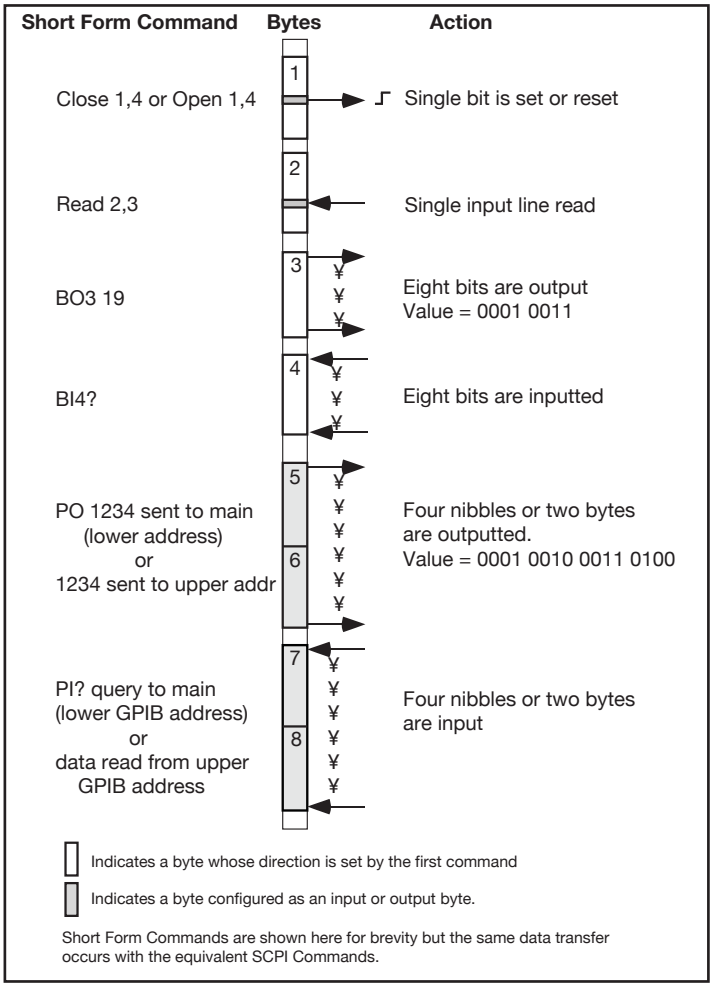


Figure 2 8003 Digital Transfer Methods
(Figure shows 8 bytes for illustrative purposes. Actual 8003 has 5 bytes)

When outputting data sent to *inst1*, the 8003 converts the data and outputs it to the bytes that the user has previously configured as outputs. Data can be outputted with or without handshaking. The 8003 automatically generates a data strobe each time it loads all of the configured output data bytes. Multiple data words can be transmitted by inserting a comma between data words.

Input Signal Monitoring

The 8003 can monitor up to fifteen lines for signal changes and generate the VXI-11 equivalent of an SRQ to notify the Application program when changes occur. Monitoring is done by setting the 8003's Questionable Transition register to detect positive and/or negative signal transitions and enabling bits in the Questionable Event register. When the enabled bit(s) are detected, the 8003 generates a *device_intr_srq* message (SRQ) to alert the Application to the event. The user's Application program can query the 8003's Questionable Condition Register to determine the input signal states and the Event Register to learn which signal changed state. Application Bulletin AB80-4 describes how to use a Reverse Channel for SRQ notification.

SCPI and Short Form Commands

Figure 3 shows the 8003's SCPI Command Tree which contains the configuration and data transfer commands. SCPI commands branch out from a root command. e.g. 'CONF:INP:POL 1' starts with the CONF root word and branches down to INPut and then to POLarity. Most functions can also be queried to verify the command setting. SCPI commands have an advantage in that they are self-documenting and make it easy to maintain your code. Most 8003 SCPI commands also have a corresponding Short Form command for quick programming.

The CONFigure branch assigns the input-output bytes for string data transfer and sets their data polarity and handshaking rules. The CONFigure branch also sets the control signal polarities.

The FORMat branch sets the data conversion method and the characters in the user's Talk conversion table.

The SENSe branch gives the user a way to read digital data from a single byte or from the configured input bytes. When reading data from a specific byte, input data polarity can be assigned on a bit-by-bit basis.

The SOURce branch provides a way to write values to a byte or to the configured output bytes. When data is outputted to a specific byte, output data polarity can be assigned on a bit-by-bit basis.

The STATus branch (not shown) is used to setup and query the Operational and Questionable registers so that changes in the digital inputs or status inputs can be used to generate 488 Service Requests (SRQs). The Questionable registers can be used to monitor and query the first 15 digital I/O lines. The Operational registers can be used to examine or monitor the two external Status inputs.

The CALibrate branch provides a way to customize the 8003 with the user's own IDN message and to lockout the configuration parameters from being changed by the end user. The DEFault command restores the 8003 to ICS's factory defaults.

User Customization

The 8003's firmware allows the user to store a custom IDN message and other parameters in the 8003's Flash memory which makes the 8003 appear as part of the OEM's product. The IDN message can be changed to show the OEM's company and product identification including serial number and product revision. A lock function hides the setup variables from the end user and prevents accidental changes to the setup.

The 8003 has an internal WebServer with HTML web pages that the user can customize so that the HTML pages match your company's colors and theme. ICS supplies a utility for uploading your HTML pages and graphics to the 8003. These changes let the end user see your company's logo, name, color and control labels which further personalizes the 8003 as part of your product.

Application Bulletin AB80-5 provides guidelines and detailed directions for how the OEM can customize the 8003's web pages.

8003 SCPI COMMAND TREE

SCPI Commands		Short Form Cmds
SYSTem	**System**	
:ERRor?		
:VERSion?		
CONFigure	**Configure I/O**	
[:DIGital]		
:INPut	<channel list>	N
:POLarity	0 I 1	TPn
:HANDshake	<boolean>	TBn
:OUTput	<channel list>	LN
:POLarity	0 I 1	LPn
:HANDshake	<boolean>	LH
:CLEar	0 I 1	C
:EDR	0 I 1	E
:INHibit	0 I 1	I
:REMote	0 I 1	R
:RESet	0 I 1	
:STRobe	0 I 1	S
:TRIGger	0 I 1	TR
:ASTATus	0 I 1	A
:BSTATus	0 I 1	B
FORmat	**Data Format**	
:TALK	<ASCii I Hex I HEXL I Table>	
:TRANSlation	<16 char string>	V
:LISTen	ASCii I Hex I HEXL I BIN I 4833	
ROUTe	**Bit Commands**	
:CLOSe	byte, bit	CLOSE
:OPEN	byte, bit	OPEN
:RESET	byte	BRESET
:PULSe	byte,bit	PL
:CHANnel	number or channel list	P
:WIDTh	10-30000 [50]	PW
SENSe	**Input Data**	
[:DIGital		
:DATA		
[:VALue]?		PI?
:PORT?	number or <channel list>	BI?
:PORTn?		BIn?
:POLarity?		Pn
:RESet:EDR		ER
:BIT?	0-1	READ?
:BYTe?	0-255	BREAD?
[SOURce]	**Output Data**	
[:DIGital]		
:DATA		
[:VALue]	<string>	PO
:PORTn	0-255	BOn
:POLarity	0-255	OPn
:STRobe		SP
CALibrate	**Calibrate Configuration**	
:IDN	string (72 char max	
:DATe	mm/dd/yy	
:DEFault		
:LOCK	1(On)I 0(Off) [0]	

Figure 3 8003 SCPI Command Tree

Ethernet Protocols

The 8003 is controlled by commands received over its Ethernet interface. The 8003 supports the VXI-11 and Raw socket protocols. The VXI-11 protocol makes it easy to control from a PC or over the company network. VXI-11 operates over Sun RPC and is a more secure protocol that mimics GPIB control of an instrument and provides secure communication over a company network or over the Internet. Raw socket lets you telnet to the unit and is best used with direct PC to instrument connections.

VXI-11 Programming

The 8003 can be easily controlled by several programming techniques and languages because it is a VXI-11.3 instrument. VXI-11 is a communication standard developed in conjunction with the VISA Specification to give GPIB like capability to LAN instruments. A VXI-11.3 interface like the 8003 will operate in an LXI system and it supports LXI's 'VXI Discovery Method'.

If you program with LabVIEW, National Instruments' VISA supports VXI-11.3 instruments like the 8003. NI's Measurement and Automation Explorer treats the 8003 as a TCP/IP compliant device.

Keysight's (Agilent) VISA library supports VXI-11.3 instruments and the Connection Manager sees the 8003 as a TCP/IP instrument.

If you are a Visual Basic, VB.Net or C/C++ programmer, you can write your program to call Agilent's or National Instruments' VISA or Agilent's SICL library in the Windows environment.

If you use LINUX or any other flavor of UNIX like SunOS, IBM-AIX, HP-UX, or Apple's OS X, you can communicate with the 8003 through RPC over TCP/IP. RPC (or Remote Procedure Calls) provides an invisible communication medium for the developer. The VXI-11 specification provides an RPCL (Remote Procedure Call Library) that can be used by virtually any operating system to control the 8003.

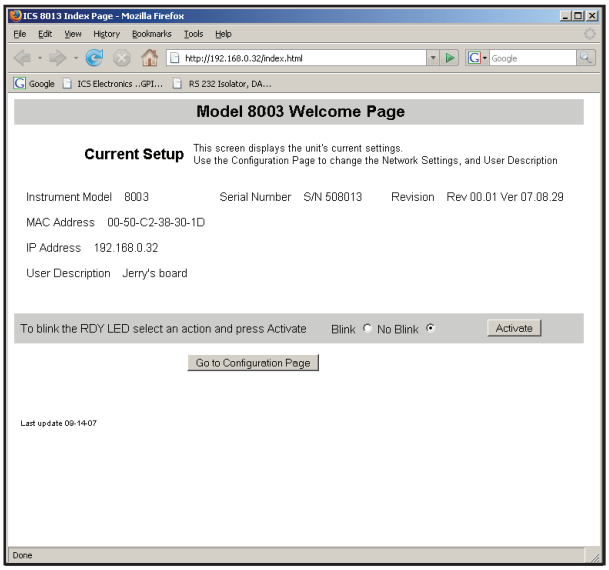
If you program with Java then you can write a 8003 control program that can be easily moved to many different operating systems. The Java jGpibEnet project on SourceForge was developed using an ICS 8065 Controller.

ICS has several Application Notes that describe how to program VXI-11 devices. These Application Notes are available at http://www.icselect.com/ab_note.html.

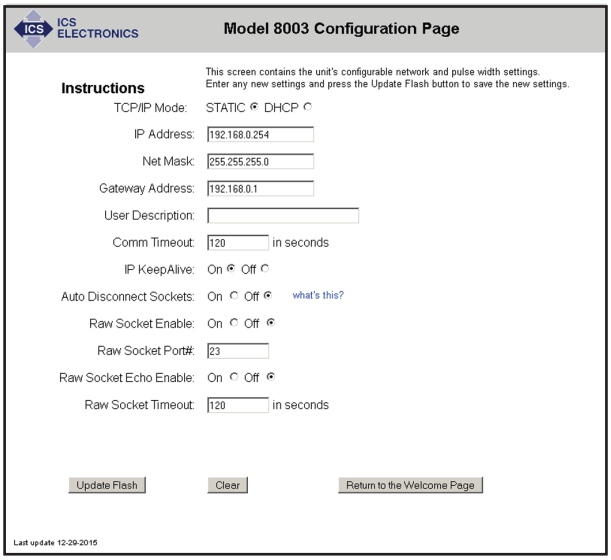
Raw Socket Operation

The 8003's “Raw Socket” connection enables sending commands to the instrument over the LAN connection using TCP/IP. Raw Socket commands can completely control the 8003's digital I/O lines with SCPI and the related Short Form commands. Raw Socket does not support *inst1* data transfers, Service Requests or other VXI-11.3 functions.

The 8003 is always ready for a telnet connection when Raw Socket is enabled. When connected, the 8003 outputs its IDN message to confirm the connection. All raw socket messages are terminated with a linefeed. Carriage returns and ignored. A backspace character causes the prior character to be deleted. Communication timeout is two minutes and it is recommended that the client issue a Space-BS sequence on an occasional basis, less than the timeout, to reset the timeout counter.



8003 Welcome Page



8003 Configuration Page

Easy Network Setup

There are three ways to set the 8003's network settings. The 8003 includes an internal WebServer with HTML web pages that can be accessed by a web browser from any computer. The web pages let the user quickly change the 8003's network settings. Secondly, ICS supplies a windows based configuration utility that walks a user through the network setup process. The third method is to use ICS's defined RPC calls to change the 8003's network settings.

VXI-11 Keyboard Control Program

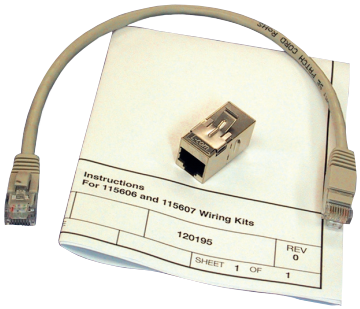
The 8003 includes ICS's VXI-11 Keyboard program for Windows which provides interactive control of VXI-11 instruments from the computer keyboard without having to write a program. The VXI-11 Keyboard program is the ideal utility program for configuring and testing the 8003 or any VXI-11 compatible instrument. Use the VXI-11kybd program to exercise the interface or to try out commands before using them in a program.

8003 Signal Connections

The 8003 has two connectors, an RJ-45 connector for the Ethernet connection and a 96-pin DIN connector with male pins for the digital signals and power. Mating DIN connectors are available with solder eyelet and solder pins or for flat-ribbon cables. The 8003 boards are also available with a DIN connector mounted on the circuit side so the board can be piggybacked on a larger PCB assembly.

Standard 8003 boards have a vertical RJ-45 connector to reduce the internal footprint. The 8003H has a horizontal RJ-45 connector so that the 8003 can be mounted against the rear panel of the chassis with the Ethernet connector protruding though the rear panel. The LAN Reset button is then accessible from the rear panel. The rear panel maching drawing is shown in the 8003 manual.

When mounting the 8003 inside a chassis, use an ICS Wiring Kit to extend the Ethernet connection to the rear panel of the host chassis. ICS's Wiring Kits provide a short 1 or 2 foot long Cat 5 cable and a shielded bulkhead connector for mounting an Ethernet connector on the rear panel of the host chassis.



ICS Wiring Kit with 1 foot cable

Available accessories include mating connectors, Ethernet to rear panel wiring kits, flat-ribbon cable assemblies and the 4803 Relay Driver Board. See the Part Selection Tree on the next page.

Mounting

The 8003 has four mounting holes and is designed to be mounted inside the host chassis, against a metal plate or on a larger PC board. Use an ICS Wiring Kit to extend the 8003's Ethernet signal to the rear panel. Each Wiring Kit includes a 1 foot (30 cm) or 2 foot (60 cm) long extension cable and a shielded RJ-45 bulkhead connector for the rear panel.

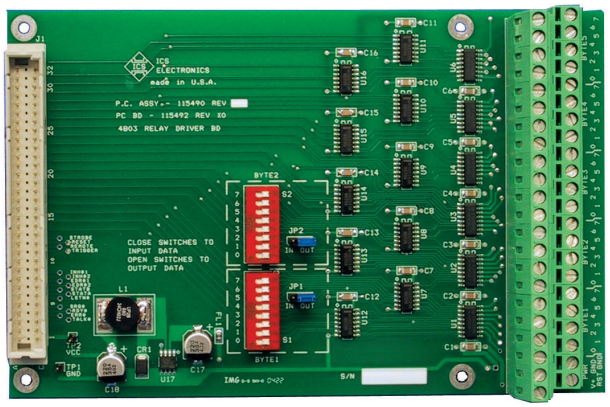
The 8003 can be ordered with the digital connector mounted underneath, on the circuit side, so the 8003 can be easily piggy back mounted on a larger PC board. Mounting dimensions for standard and piggy-back mounting are shown in the 8003 Outline and Mounting Dimensions drawing on the right. Refer to the 8003 Ordering Guide for the circuit side 8003 part numbers.

Relay Driver Board

The xx03DVR Board expands the 8003's drive outputs by providing up to forty 500 mA relay drivers with convenient screw terminals. A 8003 board with the Digital I/O connector mounted on the circuit side, P/N 115848, piggybacks on the xx03DVR board to make a compact assembly. An alternate mounding arrangement puts the xx03DVR board on top of a 8003H board. Refer to the xx03DVR board data sheet for more details about the xx03DVR board and its mounting dimensions.

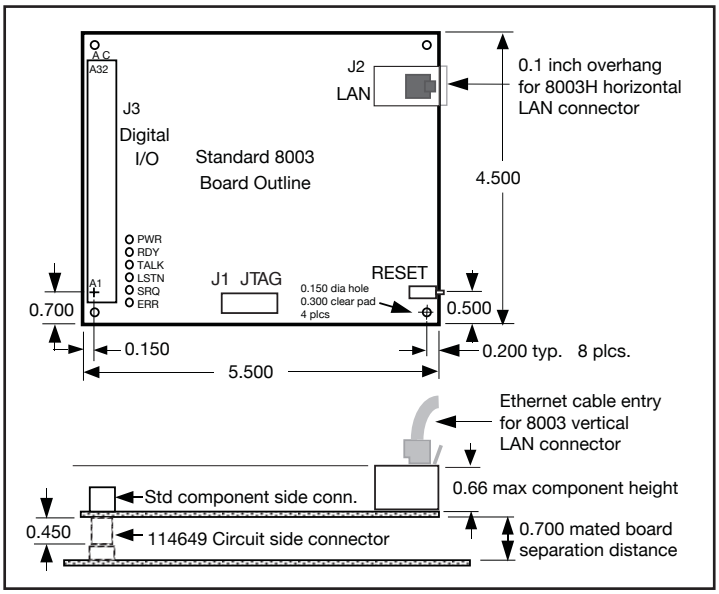
The xx03DVR board can be configured to be all relay driver outputs or to have 8 or 16 lines connect directly to ports 1 and 2 of the 8003 for use as standard TTL I/O signals.

Power for the xx03DVR Board is taken from the relay power supply which can be 7 to 32 Vdc. The xx03DVR board has a 5 V switching regulator that uses about 2.5 VA of relay power to supply 5 Vdc power to the its internal logic and to the 8003. The xx03DVR Board eliminates the need for a separate power supply for the 8003 board.



xx03DVR Relay Driver Board, P/N 115490

IMPORTANT: Order a 115848 or 115849 '8003' board to mate with the 115490 xx03DVR Board



8003 Outline and Mounting Dimensions

Select from one of the two 8003 board styles and then pick your accessory items.

Part Selection Tree		Qty	Part Number
Standard 8003 or 8003H board with the digital IO connector on the component side		(1)	8003 or 115842
		(1)	8003H or 115839
Select one mating digital IO connector -	solder eyelet	(1)	902023
	solder pins	(1)	902067
or	flat-ribbon cable	(1)	902124
Select an Open end, flat ribbon cable assembly, 5 feet long		(1)	112343
or			
Select the xx03DVR Relay Driver Board (For 8003H or 115839 boards only)		(1)	115522 (Note 2)
Select a Chassis Wiring Kit - 1 foot long cable		(1)	115606
2 foot long cable		(1)	115607
8003 or 8003H board with the digital IO connector on the circuit side (facing down)		(1)	115848 or 115849
for mounting on another PC board		(1)	115836 or 115837 (8003H)
Select the digital IO connector with solder pins for the mating PC board		(1)	902257
or			
Select the xx03DVR Relay Driver Board (Note 1)		(1)	115490 (Note 1)
Select a Chassis Wiring Kit - 1 foot long cable		(1)	115606
2 foot long cable		(1)	115607

Notes: 1. Only use 115490 xx03DVR Relay Driver Board with 115848 or 115849 boards to avoid connector interference.
2. The 115522 mounts on top of 8003H or 115839 boards.

ORDERING INFORMATION

	Part Number
Ethernet to Parallel Digital Interface Board (Includes Instruction Manual and Support CD)	8003
Ethernet to Parallel Digital Interface Board with standard connector (Board only)	115842
Ethernet to Parallel Digital Interface Board with horizontal RJ-45 connector (Includes Instruction Manual and Support CD)	8003H
Ethernet to Parallel Digital Interface Board with horizontal RJ-45 connector (Board only)	115839
8003 with connector on circuit side (Includes Instruction Manual and Configuration Disk)	115848
8003 with connector on circuit side (Board only)	115849
8003H with connector on circuit side (Includes Instruction Manual and Configuration Disk)	115836
8003H with connector on circuit side (Board only)	115837
Open-end Rainbow colored flat ribbon cable, 5 feet long	112343
xx03DVR Relay Driver Board for 115848, 115849, 115836 or 115837 boards	115490
xx03DVR Relay Driver Board for 8003H or 115839 boards	115522
Chassis Wiring Kit with 1 foot long cable	115606
Chassis Wiring Kit with 2 foot long cable	115607

Supported Standards

VXI-11 Capabilities
Fully VXI-11.3 compliant

VXI-11.3	Device Interface
Sockets	15 + 1 for UDP
Channel types	Data, Abort and Interrupt
Links	64
Interface Names	inst0 for general use inst1 for transparent data

VXI-11.3 Functions
All VXI-11.3 functions including device read, write, local, remote, clear, trigger, readstb, lock and unlock.

RPC Protocol
Conforms to ONC RPC Version 2, VXI-11

Raw Socket Protocol

Port	23
Echo	None
ICS Prompt	None
Sockets	4
Timeout	120 sec
Terminator	Linefeed
Logon Message	8003 IDN message

Ethernet Interface

Type	IEEE 802.3 compliant
Speeds	10BaseT (10 Mb/s) 100BaseT (100 Mb/s)
IP Address	Static or DHCP
Factory setting	192.168.0.254 static
Interface name	any [inst0], [inst1]

WebServer Capabilities
Provides the following HTML 4.01 compatible web pages:
- Welcome
- Configuration
- Confirmation
- Reboot

IEEE 488.2 Capabilities:
Runs all required 488.2 Common Commands, incorporates an extended IEEE-488.2 Status Reporting Structure and the Message Exchange Protocol.

SCPI Capabilities:
Incorporates the SCPI Command Tree shown in Figure 2. Complies with SCPI version 1994.0

Signal Characteristics

The 8003's parallel I/O signals have the following electrical characteristics. All time delays listed here are maximums, all pulse widths are minimums.

Inputs	40 Digital I/O , 2 Status and Reset Inputs
Input Logic Levels	High = > +2.0 V @ ±10 µA Low = <0.8 V @ 250 µA with 33 Kohm pullup to +5 Vdc for sensing contacts. Max High = 5.5 V
Input Timing	External Data Inhibit line sets within 1 µs of the active edge of the EDR Input signal and resets after data is loaded. Data loading time for 6 BCD/HEX characters is 350 µsec after the 8003 has received a *device_read* rpc.
Output Logic Levels	High = >3 V with 3 mA source High =>2 V with 24 mA source Low = 0.0 to +0.55 Vdc, 48 mA sink
Output Timing	Data is transferred to the output 2 to 24 ms after receipt of a message depending upon data transfer mode and command. Pulse width 10 to 30000 ms [50]
Data Stb	Output pulse width, 5 µs.
Trigger	Output pulse width, 5 µs
Remote	Output level asserted when in the remote state
Reset	Output pulse width, 30 µs when 8003 reset or sent *RST command.

Table 2 Digital IO Functions

Input Bytes
Input Signal polarity
Input Handshaking
Talk data format
Talk data conversion table
Output Bytes
Output Polarity
Output Handshaking
Listen data format
Control line polarities
SENSe input polarities
STATus register configurations
SOURce output polarities

Controls and Indicators

CONTROLS
LAN Rst Board edge push button

LEDs

PWR	Indicates power on
LAN	Unit good and connected to an active network
ACT	Transferring messages to/from the network
RDY	Unit has passed self test
TALK	Unit is addressed to talk
LSTN	Unit is addressed to listen
SRQ	SRQ asserted on GPIB bus
ERR	Blinks for a detected soft error or solid On for a command error

Physical

Size, L x W x H
139.7 x 114.3 x 18.4 mm
(5.5 x 4.5 x 0.725 inches)

Material

PCB	FR406 Fiberglass
Components	RoHS compatible
Construction	Lead Free

Connector and Headers

Digital I/O:	96-pin, 3 row female connector with male pins.
Ethernet:	RJ-45

Temperature

Operation	-10° C to +70° C
Storage	-40° C to +85° C

Humidity
0-90% RH without condensation

Power +5 ± 0.2 Vdc @ 350 mA

Included Accessories

Instruction Manual
Support CD with sample programs
LAN Crossover Cable

Available Accessories

See Ordering Guide on page 5 for a complete list of accessory items.
Mating Solder Eyelet Conn, P/N 902023
Mating Dip Solder Conn, P/N 902067
Mating Flat ribbon Cable Conn, P/N 902124
Wiring Kit w/1 ft cable, P/N 115606
Wiring Kit w/2 ft cable, P/N 115607
Shielded Bulkhead Adapter, P/N 902329
xx03DVR Relay Driver Board, P/N 115490

See Ordering Guide on Page 6

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