8113
LAN TO PARALLEL DIGITAL INTERFACE

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

DESCRIPTION

ICS's Model 8113 Ethernet <> Parallel Interface Board provides a 128 line digital interface that can be used to interface devices with a large number of digital signals to the computer via an Ethernet network. The 8113 can also be controlled via a RS-232 port and has an options I2C interface for driving a HMI interface. In a typical application, the 8113 is located inside the device chassis and is powered by DC power from the device's power supply. All digital signal connections are on a 150-pin connector at one end of the card. An RJ-45 header on the other end of the 8113 accepts the Ethernet signals. Applications include controlling switching matrices, operating relays, driving digital logic or displays in a test chassis.

Rugged Ethernet Interface

The 8113 uses a proven hard wired stack for handing TCPIP communication. The stack has been designed to prevent flooding, spoofing and injection attacks. The 8113 can be used with fixed, static IP addresses or it can obtain its address from a DHCP server. A UDP broadcast feature can be used to discover the 8113 on DHCP networks.

Versatile Digital Interface

The 8113's digital interface is user configured with SCPI commands over its network or serial interface. The configuration commands permit the user to designate the 128
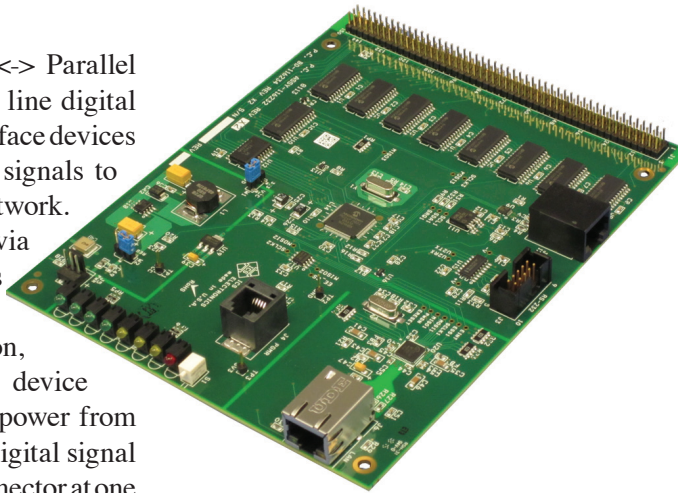
**8113 Interface Card
shown with optional I2C port**

data lines as inputs and/or outputs in 8-bit byte increments, connect bytes to create larger parallel words, set data polarity, data format, and handshake modes. Handshake signals allow for many different data transfer modes.

When configured as inputs the signals are tristated and are pulled up by 100 kohm resistors to Vdd. The inputs are ideal for reading switches, TTL and CMOS signals.

When configured as outputs, the user sets the output polarity and power turn-on values. Output levels are user set as 3.3 or 5 Vdc.

The configuration settings can be saved and are recalled at power turn-on. At power turn-on, the Digital I/O lines are initially tristated and then set to the saved configuration. A Stable output signal can be used to keep external signals from activating until the output lines have been configured.

- 128-line parallel interface with bit, byte, pulse,and string data transfer capabilities. *Fully configurable to the user's needs.*

- 3.3 or 5 volt logic compatible. *Use with new 3.3 volt logic*

- RS-232 serial control port for non-Ethernet systems. *Works with older systems.*

- Optional I2C port for interfacing touch screen panels. *Easy way to add HMI control to your chassis.*

- Digital IO lines compatible with ICS's other xx13 boards. *Easy switch to a new interface.*

- Companion Relay Driver Boards drive 5-48 volt relays. *Boosts drive signals to control larger relays and solenoids.*

- Runs on 5 to 32 Vdc power. *Does not require a special power supply.*

☑ ROHS Compliant
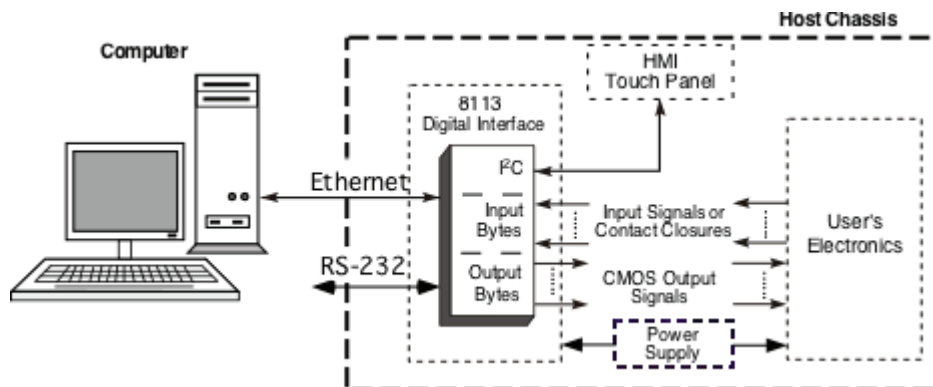
Figure 1   A typical 8113 Application

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Data Transfer Methods

The 8113 provides three ways to control the Digital IO lines.
• Bit commands set, reset or pulse specific bits in a byte or query a bit's status.

• Byte wide commands set all 8 bits in a specific byte or read data from a byte. Data Strobes can be manually generated if needed. Data can be formatted as decimal or HEX.

• 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. The 8113 converts output 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.

For input strings, the 8113 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.

Configuring the 8113's Digital Interface

The 8113'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 when the command is first invoked.. 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 8113'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 8113 passes its self test. The 8113 provides a Stable output signal, which turns on after the 8113'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 8113.

Input Signal Monitoring

The 8113 can monitor up to fifteen lines in the first two bytes for signal changes and set a bit in the Status Register when changes occur. Monitoring is done by setting the 8113's Questionable Transition register to detect positive and/or negative signal transitions and enabling bits in the Questionable
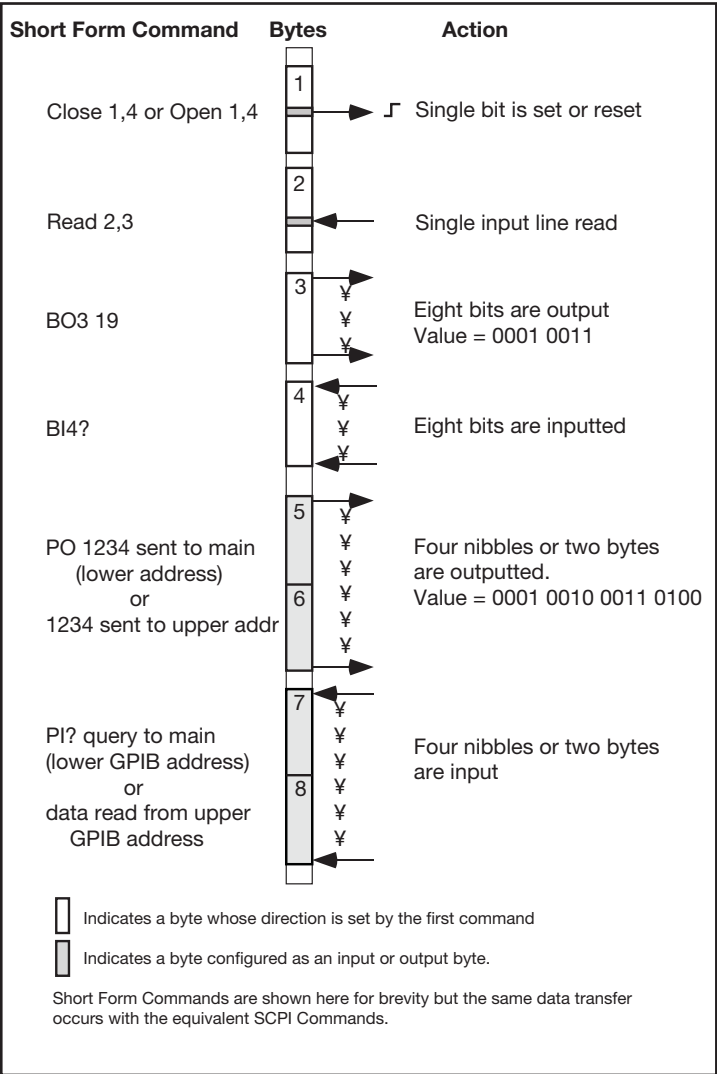

Figure 2   8113 Digital Interface Data Transfer Methods

Event register. When any enabled bit(s) are set, the summary line sets a bit in the Status Register.

SCPI and Short Form Commands

Figure 3 shows the 8113'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 8113 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 for the user to customize the 8113 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 8113 to ICS's factory defaults.

Internal Webserver

The 8113 internal WebServer has two HTML web pages that can be customized by ICS so that the HTML pages match your company's colors and theme. These changes let the end user see your company's logo, name, color and control labels which further personalizes the 8113 as part of your product. Page one is the Welcome page that displays product identification and status information. Page two is a password protected Configuration page where the end user can change the network settings, port number, and host name.

Ethernet Protocol

The 8113 is controlled by commands received over its Ethernet interface. The 8113 supports TCPIP (Raw socket) communication. Raw socket lets you telnet to the unit and is best used with direct PC to instrument connections.

Ethernet Programming

The 8113 can be easily controlled by several programming techniques and languages. You can also make VISA calls If you program with LabVIEW, National Instruments' VISA supports TCPIP communication. Keysight's (Agilent) Connection Manager also sees the 8113 as a TCP/IP instrument.

Examples abound for doing socket coding with Visual Basic, C or C#. Or you can write your program to make VISA calls to Keysight's or National Instruments' VISA library

Interactive Keyboard Control Program

The 8113 includes ICS's VISA Keyboard program for Windows which provides interactive control of VXI-11 and TCPIP

8113 SCPI COMMAND TREE

SCPI Commands		Short Form Cmds
SYSTem	**System Settings**	
:ERRor?		
:VERSion?		
CONFigure	**Configure I/O**	
[:DIGital]		
:INPut	<channel list>	N
:POLarity	0	1	TPn
:HANDshake	<boolean>	TBn
:OUTput	<channel list>	LN
:POLarity	0	1	LPn
:HANDshake	<boolean>	LH
:CLEar	0	1	
:EDR	0	1	E
:INHibit	0	1	I
:REMote	0	1	R
:RESet	0	1	X
:STRobe	0	1	S
:TRIGger	0	1	TR
:ASTATus	0	1	A
:BSTATus	0	1	B
FORmat		
:TALK	<ASCii	Hex	HEXL	Table>	
:TRANSlation	<16 char string>	
:LISTen	<ASCii	Hex	HEXL	4833>	
ROUTe	**Bit Commands**	
:CLOSe	byte, bit	CLOSE
:OPEN	byte, bit	OPEN
:RESET	byte	BRESET
:PULSe	byte,bit	PL
:CHANnel	number or channel list	PC
:WIDTh	10-30000 [50]	PW
SENSe	**Input Data**	
[:DIGital]		
:DATA		
[:VALue]?		PI?
:PORT?	number or <channel list>	BI?
:PORTn?		BIn?
:POLarity?		IPn
:RESet:EDR		ER
:BIT?	0-1	READ?
:BYTe?	0-255	BREAD?
[SOURce]	**Output Data**	
[:DIGital]		
:DATA		
[:VALue]	0-255	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)| 0(Off) [0]	

Figure 3   8113 SCPI Command Tree

instruments from the computer keyboard without having to write a program. The VISAkybd program makes calls to The VISA Keyboard program is the ideal utility program for configuring and testing the 8113's connections or for trying out commands before using them in a program.

Ethernet Connections

The 8113's Ethernet connector is a shielded RJ-45 right-angle connector that allows the 8113 to be mounted against the rear panel with the Ethernet connector, LAN Reset button and LED status indicators protruding though the rear panel. The 8113 can also be ordered with a vertical Ethernet connector when mounted inside the host chassis.

When mounting the 8113 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.

RS-232 Serial IO

The 8113 can also be controlled via its RS-232C Interface. All of the SCPI and Short Form commands operate the same, regardless of the controlling interface. The Serial Interface is located on a 10 pin header. Flat ribbon connection cables with DE-9 male and female connectors are available to connect the 8113 to the host chassis' rear panel.

Optional I2C Interface

The 8113 has an optional I2C interface that can be used to control color touch screen panels or other I2C devices. Adding an inexpensive HMI device like a touchscreen panel provides the end user with a manual control of the chassis. It lets the user monitor the system status and view or change the network and serial port settings. The current firmware has functions to control a switch chassis but can be altered to control almost any kind a device. Contact factory for firmware support for your I2C device.

The I2C interface uses a right angle, RJ45 connector so the the I2C devices can be connected together with inexpensive CAT5 patch cables. The right angle RJ45 connector is omitted on standard boards since it conflicts with the standard connector and relay driver boards.

8113 Digital IO Connections

The 8113 has a 150-pin connector with 3 rows of 50 pins per row on 0.1 inch centers. The standard 8113 board has vertical male pins on the component side of the board. The 8113 is also available with the a female connector on the circuit side for piggy-backing onto a larger PC board.

Mating connectors are available for the 8113 with two lengths of solder tails. There also is a Connector Board and two Relay Driver Boards to simplify connecting to the 8113.
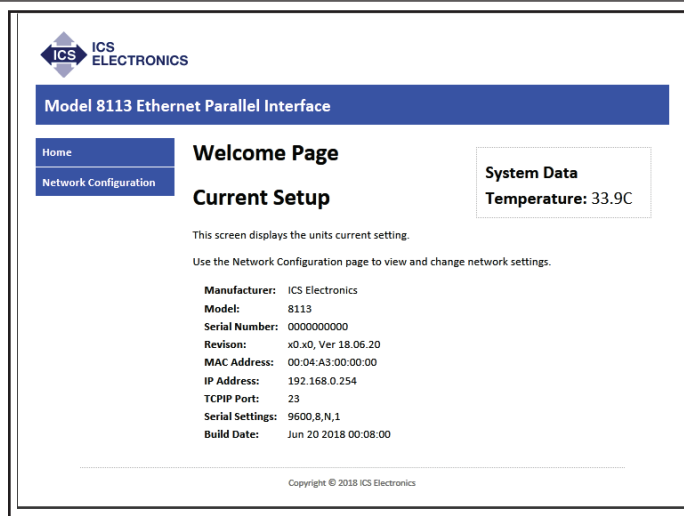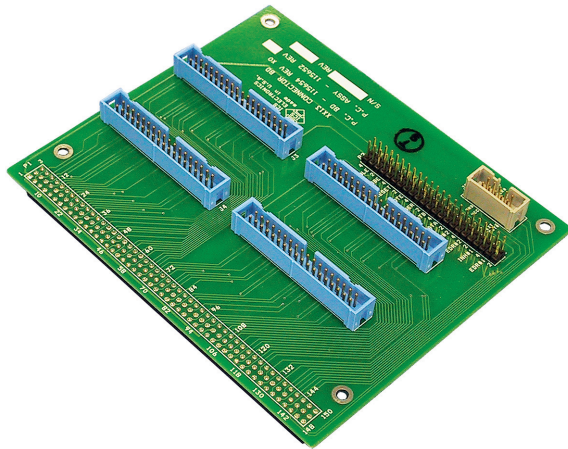

8113 Welcome Page
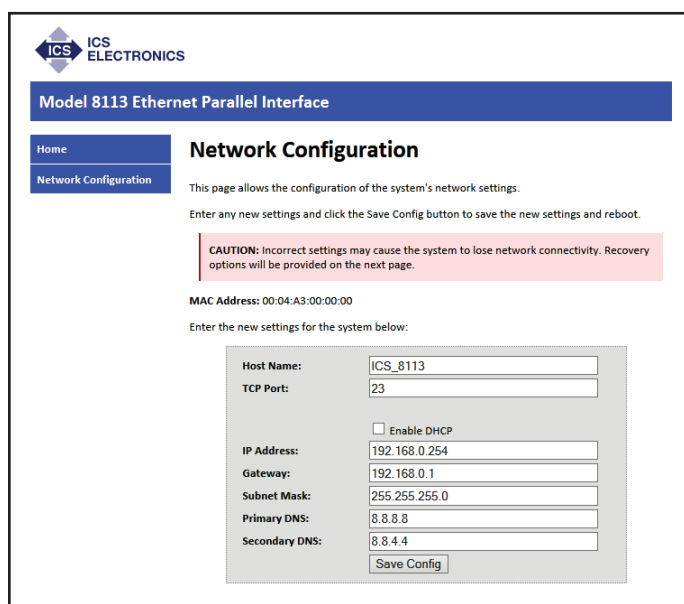
8113 Configuration Page

Connector Board

The Connector Board is a short PC assembly with four 36-pin flat-ribbon headers that breaks the 128 digital IO lines into four 32 line groups. The Connector Board also includes a 10-pin header with LED drive signals for remoting the 8113's LEDs. The 115650 Connector Board plugs into the 8113's 150-pin digital connector and sits on top of the 8113 board.

8113 with xx13DVR Relay Driver Board

xx13 Connector Board with four ribbon headers

Relay Driver Boards

Two Relay Driver Boards are available for the 8113. Both boards sit on top of the 8113 board and include an internal switching power supply that converts a 2.5 VA of the relay power supply voltage into 5 volts to power the 8113. The relay drivers on both boards are disabled at power turn-on time and are only enabled after the output signals have been configured and are stable.

The xx13DVR Relay Driver Board has 128 sink-type relay drivers that switch up to 48 volts and sink up to 500 mA of current. The board has four 36 pin headers with 32 relay driver outputs on each header. One byte or 8-bits on each header can be routed directly to the 8113 and used for standard 8113 CMOS I/O signals. 36-conductor flat-ribbon cables and mating solder-pin connectors are available for connecting to an external relay board.
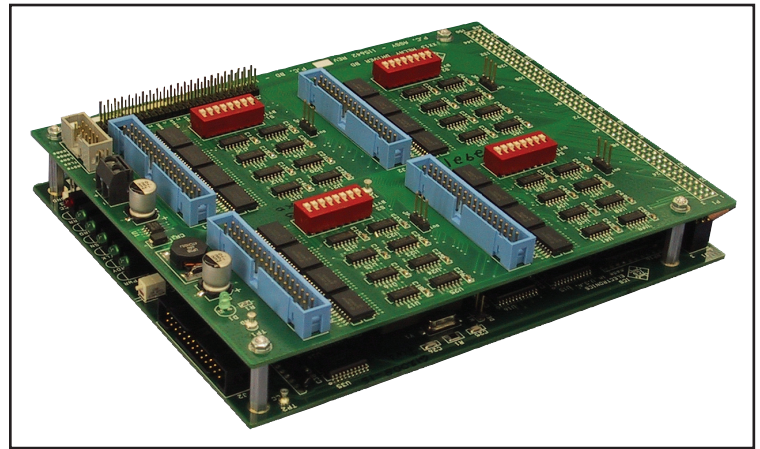
The DC-37 Relay Driver Board has 64 sink-type relay drivers and 64 direct TTL I/O lines. The DC-37 Relay Driver Board has four DC-37 male connectors with 16 relay drivers and 16 TTL I/O lines on each connector. Each DC connector has an unused signal line that a user can jumper to any 8113 handshake line.

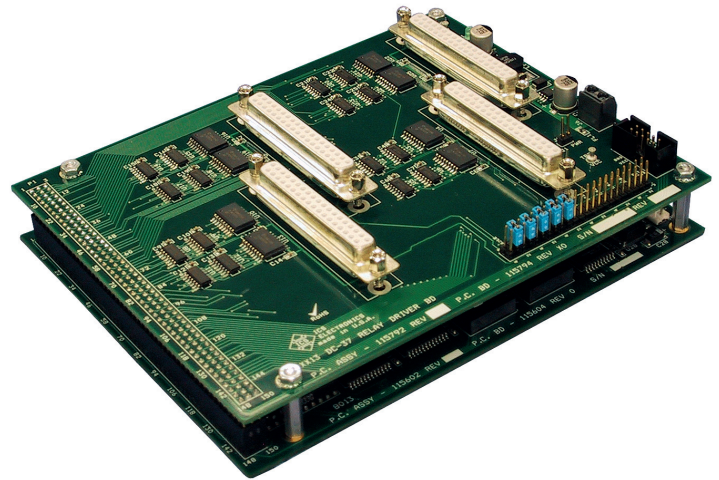See the separate data sheets for more information about either Relay Driver boards.

8113 with DC-37 Relay Driver Board

8013 Differences.

The 8113 is functionally and physically compatible with the earlier 8013 board but with the following changes.
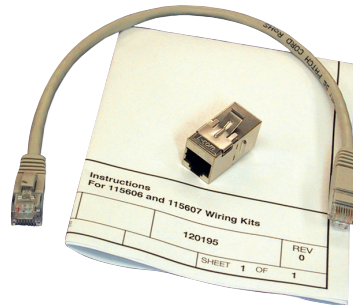
- The 8113's Ethernet interface is a more robust, faster TCP/IP connection but it does not support the VXI-11 protocol.
- The 8113's Digital IO signals are CMOS and can provide 3.3 and 5 volt outputs. They do not have the high sink and source current of the 8013's TTL signals.

ICS Wiring Kit with 1 foot cable

- The 8113 has a RS-232C interface and can be controlled by devices with RS-232 serial ports.
- [a] The 8113 has an optional I2C port for interfacing with tough screen and other HMI displays.

8113: ORDERING GUIDE

Select from one of the two 8113 board styles and then pick your accessory items.

Part Selection		Qty	Part Number
Standard 8113 board with the digital IO connector on the component side		(1)	8113 or 8113V (Note 2)
Select one mating digital IO connector -	solder pins, short connector	(1)	902308
	solder pins, tall connector	(1)	902331
or			
Select the xx13DVR Relay Driver Board with 128 drivers		(1)	115640 (See Note 1)
or			
Select the DC-37 Relay Driver Board with 64 drivers		(1)	115790
or			
Select the Connector Board with four 36-pin headers		(1)	115650 (See Note 1)
Select a chassis LAN Wiring Kit -	Bulkhead connector and 1 ft long cable	(1)	115606
	Bulkhead connector and 2 ft long cable	(1)	115607
8113 board with the digital IO connector on the circuit side (facing down) for mounting on another PC board.		(1)	TBD
Select digital IO connector with solder pins for the mating PC board		(1)	902307
Select a chassis LAN Wiring Kit -	Bulkhead connector and 1 ft long cable	(1)	115606
	Bulkhead connector and 2 ft long cable	(1)	115607

Notes:
1. Headers mate with 115656-L cable and/or 902334 female connector. PCB male header is P/N 902332.
2. Relay Driver Boards will not fit on a 8113V board.

ORDERING INFORMATION

	Part Number
Ethernet to Parallel Digital Interface Board (Includes Instruction Manual and Support CD)	8113
Ethernet to Parallel Digital Interface Board with vertical Ethernet connector (Includes Manual and Support CD)	8113V
Ethernet to Parallel Digital Interface Board (Board only)	116232
Ethernet to Parallel Digital Interface Board with digital connector on circuit side (Includes Manual and Support CD)	TBD
Ethernet to Parallel Digital Interface Board with digital connector on circuit side (Board only)	TBD
Mating digital I/O 150-pin female connector, short solder pins	902308
Mating digital I/O 150-pin female connector, long solder pins	902331
Mating digital I/O 150-pin male connector, short solder pins	902307
Wiring Kit with Shielded Bulkhead Adapter and 1 ft long Ethernet extension cable	115606
Wiring Kit with Shielded Bulkhead Adapter and 2 ft long Ethernet extension cable	115607
Shielded Bulkhead Adapter	902329
xx13DVR Relay Driver Board with 128 relay drivers	115640
DC-37 Relay Driver Board with 64 relay drivers	115790
Connector Board with four 36-pin flat ribbon headers and 10-pin LED drive signal header	115650
Mating female flat-ribbon connector for Relay Driver and Connector Board	902334
Flat-ribbon, 36 conductor cable with female connectors. L=length in cm from 10 to 90 cm	115656-L
PC Header, 36 pins with solder tails for 115656 cable	902332
Mating DC-37P Connector and hood for DC Relay Driver Board	902047 and 902105

Supported Standards

TCPIP Protocol

Port	0 to 9999
Echo	None
ICS Prompt	None
Sockets	1
Timeout	5 minutes
Terminator	Linefeed
Logon Message	8113 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
Host name	any

WebServer Capabilities

Provides the following HTM 4.01 compatible web pages:
  Welcome
  Configuration
  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 8113's parallel I/O signals are 5 V compatible and have the following electrical characteristics. User selectable 3.3 or 5 V Vdd . All time delays listed here are maximums, all pulse widths are minimums.

Inputs	128 Digital I/O , 2 Status and Reset Inputs
Input Logic Levels	High = > +2.0 V @ ±10 μA Low = <0.8 V @ 250 μA with 100 Kohm pullup to +3.3/+5 Vdd for sensing contacts. Max High = 5.5 V
Input Timing	External Data Ready Inhibit output sets within 100 ms of the active edge of the EDR Input signal and resets after data loaded.
Output Logic Levels	High = > 4.3 V with 3 mA source. High = > 2.6 V with 1 mA source. Low = <= 0.6 Vdc, 8 mA sink at 5 V 1.8 mA sink at 3.3 V
Output Timing	Data is transferred to the output 0.63 ms after receipt of a message depending upon data transfer mode and command. Pulse width 10 to 30000 ms.
Data Stb	Output pulse width, 5 μs.
Trigger	Output pulse width, 5 μs
Remote	Output level always true.
Reset	Output pulse width, 70 μs
Stable	True 4.52 sec after power on.

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

LAN Reset   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	Blink for a detected soft error or solid On for a command error

Physical

Size, L x W x H
  7.0 x 5.5 x 0.76 inches   (178 x 140 x 19 mm)

Material

PCB	FR406 Fiberglass
Components	RoHS compatible
Construction	Lead Free

Connector and Headers

Digital I/O:	150-pin, 3 row male conn
Ethernet:	RJ-45
Serial	10 pin (2x5) header
Power:	2-pin AMP connector or pins on J1 (Digital I/O)

Temperature

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

Humidity
  0-90% RH without condensation

|	
Power	+5 Vdc @ 225 mA (typ.) +7 to +32 Vdc @ 1.5 VA

Included Accessories

Instruction Manual
Support CD with sample programs
LAN Jumper Cable

Available Accessories

See Ordering Guide on page 5 for a complete list of accessory items.
  Mating short connector, P/N 902308
  Mating tall connector, P/N 902331
  Wiring Kit w/1 ft cable, P/N 115606
  Wiring Kit w/2 ft cable, P/N 115607
  Shielded Bulkhead Adapter, P/N 902329
  xx13DVR Relay Driver Board, P/N 115490
  DC-37 Relay Driver Board, P/N 115790

See Ordering Guide on page 6
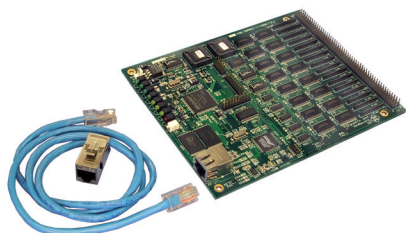
8113 shown with a short Cat 5 cable and a bulkhead connector