

# NETWORK INTERFACES

## 8064 LAN to RELAY Interface



### DESCRIPTION

The Model 8064 is an Ethernet to Relay Interface that provides 16 form 'A' contacts or 16 relay drivers for switching signals or for driving external relays. The 8064's versatile commands let the user control the relays individually, step them as a single or multi-pole scanner, or step in any programmed sequence. The 8064 also includes eight isolated digital inputs that can be used to read external signals or contact closures. In control applications, these signals can be used to verify the response of the external system to the control outputs. The 8064 can also monitor the digital inputs and generate a Service Request when the signals change state.

### VXI-11 Advantages

The 8064 is a VXI-11.3 compliant instrument and fits in with today's new test equipment architectures that use TCP/IP networks. Because the 8064 is VXI-11.3 compliant it can be controlled by a very wide range of applications and programming languages. VXI-11 is a communication standard developed in conjunction with the VISA Specification. An VXI-11.3 instrument like the 8064 can operate in Windows systems with VISA or SICL libraries and in any UNIX/LINUX or similar operating system without special drivers. The VXI-11 specification provides an RPCL (Remote Procedure Call Library) that can be used by virtually any operating system to control your instrument. While the 8064 will operate in an LXI system, if IVI drivers are provided, LXI devices are limited to Windows operating systems with VISA libraries.



8064 Relay Interface

### Relays and Driver Outputs

Models with relays contain 16 floating form 'A' (SPST) relays with both sides of each relay contact brought out to the rear panel connector. The connector pin assignments are arranged to minimize signal cross talk. The relay contacts in the Model 8064-11 are for switching low level signals up to 0.5 amperes. The relay contacts in the 8064-12 are rated for switching currents up to 1.0 amperes. The 8064-14 has relay driver outputs that sink 300 mA to activate external relays or solenoids. A Relay Enable output signal is provided to control external devices that need to wait while the 8064 initializes at power turn-on time. The 8064 relays and relay drivers are glitch free and do not generate false outputs at power turn-on.

The relays and drivers are on a plug-in relay PCB which simplifies relay maintenance and contact type changes.

### Ethernet controlled relays and isolated digital inputs

- VXI-11.3 Compatible  
*Works with virtually any computer or test language.*
- Multiple configurations:
  - 16 low-level SPST relays
  - 16 hi-power SPST relays
  - 16 relay drivers*Choose the correct contact or driver for your application.*
- Multiple relay programming modes:
  - individual relays
  - single or multi-pole scanning*Flexible relay programming.*
- Isolated digital inputs accept contact closures, CMOS/TTL, and up to 32 V inputs.  
*Eliminates ground loops.*
- IEEE-488.2 compatible unit uses SCPI commands.  
*Meets the latest test system specifications.*
- Configurable with a web browser, with a windows configuration program or RPC.  
*Easy network configuration from any computer.*
- Includes ICS's VXI-11 keyboard program.  
*The easy way to test relay connections before writing a test program.*

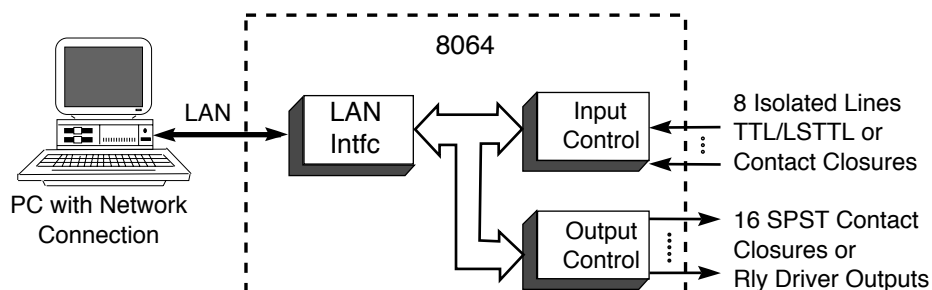


Figure 1 8064 Block Diagram

CE Approved

RoHS

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## 8064: Application

### Digital Inputs

The 8064 provides eight isolated digital inputs for TTL/CMOS signals, contact closures or levels up to 32 Vdc. Each input has a pullup resistor to a common line that can be connected to the 8064's internal 5 Vdc power or connected to an external voltage source for 500 volts of isolation.

### Data Transfer Methods

The 8064 has a single VXI-11 Interface personality or name *intr0*. *intr0* is used for communicating with the 8064, for configuration, to control the relays and to read the digital inputs using the SCPI or short form commands.

### SCPI and Short Form Commands

Table 1 shows the 8064's SCPI Commands and their short-form command equivalents. SCPI commands are a tree and branch structure that start from the main command and work out to a value, action or query at the end of the branch. Because SCPI commands are so easy to read, they are self documenting and make program maintenance easier. An example of a SCPI command is one which sets a relay:

ROUTE:CLOSe 1      Activates relay #1

Some SCPI commands have short-form versions which minimize typing. An example is:

C 1      Activates relay #1

### Controlling the Relays

The simplest way to control the 8064's relays (or relay driver outputs) is individually using the relay's CLOSE or OPEN commands. Unspecified relays remain in their current state. This satisfies most users who are controlling other device(s) or are switching signals. An example is:

ROUT:CLOS 5      'Closes relay number 5

Multiple relays can be opened and closed at the same time by entering the relay numbers in the list form. List are in parenthesis and are identified with the ASCII AT '@' character. Examples are:

ROUT:OPEN (@11:13)      'Opens relays 11 through 13  
ROUT:CLOS (@1,3,4)      'Closes relays 1,3 and 4

### Scanning Options

For data acquisition applications, groups of the relays can be configured to operate as a single or multi-pole scanner. The relays are selected as a list with the ROUT:SCAN command. The INIT:IMMEDIATE command sets the relays to the first position and enables the scanner. The INIT:CONT command enables or disables the scanner. The scanner can be advanced with either the IEEE-488.1 GET command or with a 488.2 \*TRG command. The scanner operates as a break-before-make scanner. Unused relays can be controlled individually and used for other non-scanning applications. The scan relay list is stored in the 8064's Flash memory with the \*SAV 0 command. The maximum list size is 16 relays x 32 steps. Figure 2 shows the commands to setup a 2 pole, 3 position scanner.

TABLE 1 8064 SCPI COMMAND TREE

SCPI Commands	Short Form Cmds
SYSTem :ERRor? :VERSion?	<b>System Setup and Query</b>
STATus :OPERation [:EVENT]? :CONDition? :ENABLE :ENABLE?	<numeric>
:QUESTionable [:EVENT]? :CONDition? :ENABLE :ENABLE? :PTRansision :PTRansision? :NTRansision :NTRansision?	<b>Digital Inputs</b>  E? D? M M? P P? N N?
ROUTe :CLOSe :STATe? :OPEN :ALL :SCAN :PULSe :WIDTH	<b>Relay Control</b> channel list  channel list  channel list 1-30000 [25]
INITiate [:IMMeditate] :CONTinuous	<b>Scan Control</b>  1(On) 0(Off) [0]
CALibrate :IDN :DATE :DEFault :LOCK	Calibrate <string> mm/dd/yy  1(On) 0(Off) [0]

ROUT:SCAN (@1,3,5), (@2,4,6) 'Defines scanner relays  
INIT:IMM 'Closes initial pole  
(Relays 1 and 2)  
INIT:IMM 'Sets scanner to initial position  
(No relays enabled)  
\*TRG or GET 'Turns relay 1 on  
\*TRG or GET 'Turns relay 1 off, relays 2 and 3 on  
\*TRG or GET 'Turns relay 2 off  
\*TRG or GET 'Turns relay 3 off, relay 4 on  
\*TRG or GET 'Turns relay 4 off  
(back to initial position)

Figure 2 Control Function Example

### Reading and Monitoring the Digital Inputs

The 8064's eight digital inputs are read by querying the Questionable register in the 8064's Status Reporting Structure. The Questionable Event register reports the bits that have changed since its

## 8064: Application

last reading. Positive and negative filter masks let the Questionable Event register capture bits that go high, go low or move in either direction with a > 1 kHz sample rate.

Enable bits allow the corresponding bits in the Questionable Event Register to be summarized in the 8064's Status Byte Register and to generate a *device\_intr\_srq* message (SRQ) over a reverse Interrupt Channel to alert the Application to the event. The user's Application program can query the 8064's Questionable Condition Register to determine the input signal states and/or the Event Register to learn which signal changed state.

### Easy Programmability

The 8064 can be easily controlled by several programming techniques and languages because it is a VXI-11.3 instrument. If you program with LabVIEW, National Instruments' VISA supports VXI-11.3 instruments like the 8064. NI's Measurement and Automation Explorer treats the 8064 as a TCP/IP compliant device.

Agilent's VISA library supports VXI-11.3 instruments and the Agilent Connection Manager sees the 8064 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 8064 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 8064. For more information about VXI-11 refer to ICS's VXI-11 Tutorial (Application Bulletin AB80-11) and RPC Programming (AB80-3) on [www.icselect.com](http://www.icselect.com).

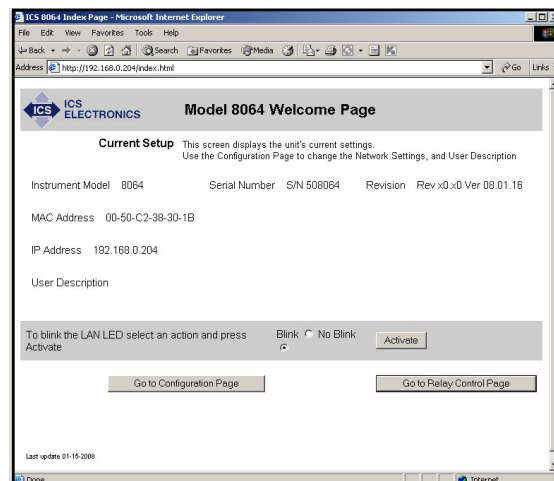
If you program with Java then you can write a 8064 control program that can be easily moved to many different operating systems. The Java jGpibEnet project on SourceForge was developed using an ICS 8065 Controller.

### Network Settings

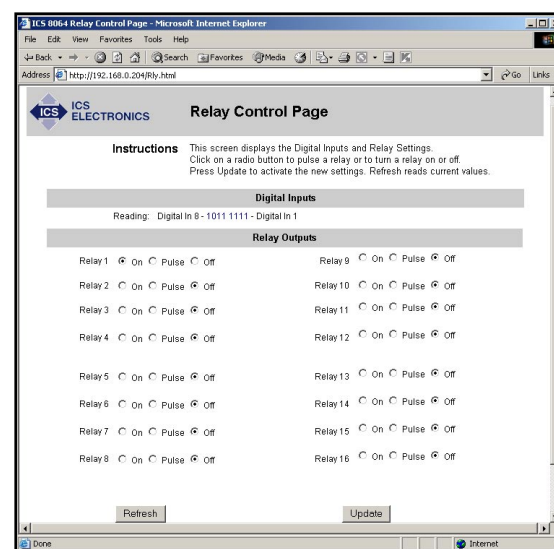
There are three ways to configure the 8064's Network settings. The simplest way is to use a standard web browser and interact with the 8064's WebServer. The Welcome and configuration pages are shown on the right. The second way is to use ICS's VXI-11 Configuration Utility which runs on any Win 98 or Win32 PC and does not require a VISA library. LINUX and UNIX programmers can use ICS's defined RPC Commands to change and set the network settings.

### Network Features

The TCP transportation layer and IP protocol used by the 8064 guarantees error free communication with the over the network or Internet as long as the connection is maintained. The 8064 has communication timeout feature to monitor the link status and Keepalive capability to maintain the communication link with the client application. When the 8064 discovers that the channel is no longer active, or when a channel is closed, the 8064 closes that channel and releases all resources that were used by the client. This unlocks any instruments links, destroys the links and returns all resources to the pool for the next user.



8064 Welcome Page



8064 Relay Control Page

### Browser Control

The 8064's webserver includes a prototype Relay Control Page which allows a user to control the relays or relay driver outputs from any web browser. The Relay Control Page also displays the digital inputs. The Relay Control Page gives a user or maintenance people an easy way to test the 8064 or the system connections with a standard web browser.

### Signal Connections

All 8064 relay and digital connections are brought out on a 50-pin blue-ribbon connector on the 8064's rear panel. A mating connector is included with each unit. The relay outputs are floating form 'A' (normally open) contacts. Relay driver signals are brought out on the NO contact pins. The 8064's relays and drivers are not enabled after a power turn-on until the user's saved configuration has been loaded into their driving latches. This prevents erroneous switching while the 8064 is performing its power-on selftest. A Relay Enable signal is provided to control external devices that may need to be held off.

## 8064: Application

### 8064 Terminal Board

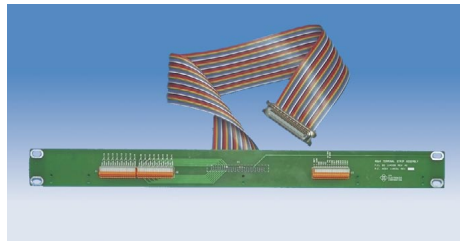
The 8064 Terminal Board is a small board with screw terminals that plugs into the 8064's rear panel connector. It has terminals for the relay contacts, the digital inputs and for the miscellaneous signals. The 115750 Terminal Board includes the hardware to fasten it to the 8064.



**8064 Terminal Board**

### Rack Mounted Terminal Strip

A rack mounted Terminal Board is available for the 8064. The 114534-60 Terminal Strip mounts across the rear rails of an DIN/RETMA equipment rack and provides the user with lever actuated terminals for the 8064 signals. A 60 cm (24 inch) long flat-ribbon cable connects the Terminal Board to the 8064.



**Rack Mounted 8064 Terminal Strip**

### OEM Board Version

The 8064 is available as a board version for OEM applications. Board versions are designed to be mounted in the host's chassis and accept 12 to 24 volt power. Optional Wiring Kits extend the LAN connection on the 8064 board to the rear panel. The Relay Contact - Digital IO connector is a right angle 50-pin connector with lock springs. A mating connector is included with each OEM board. An 8 pin header on the OEM board allows easy extension of the 8064's LEDs to the user's front panel.

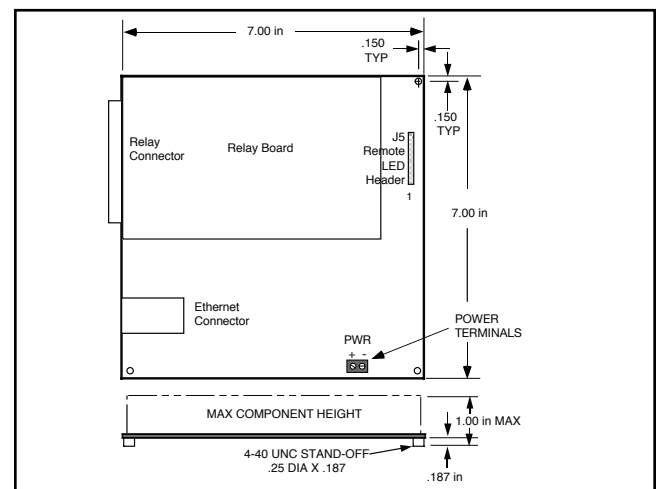
### Firmware Customization

The 8064's firmware allows the user to store a custom IDN message and other setup parameters in the 8064's Flash memory. A lock function hides the setup variables from the end user and prevents accidental changes to the setup.

The user can also customize the HTML pages used in the 8064's webserver to display his company name and logo or to match his company's web image. The Relay Control page can be modified to show what the relays control by replacing the generic 'Relay *n*' names with a more descriptive name such as 'Heat Pump 1'. All of these changes effectively integrate the 8064 into the user's system and makes the 8064 appear as part of the company's product line.

**TABLE 2 8064 Signal-Pin Assignments**

Signal	Pin	Description
Relay 1 NO	1	Relay Contact or Driver 1 Output
Relay 1 Arm	26	
Relay 2 NO	2	Relay Contact or Driver 2 Output
Relay 2 Arm	27	
Relay 3 NO	3	Relay Contact or Driver 3 Output
Relay 3 Arm	28	
Relay 4 NO	4	Relay Contact or Driver 4 Output
Relay 4 Arm	29	
Relay 5 NO	5	Relay Contact or Driver 5 Output
Relay 5 Arm	30	
Relay 6 NO	6	Relay Contact or Driver 6 Output
Relay 6 Arm	31	
Relay 7 NO	7	Relay Contact or Driver 7 Output
Relay 7 Arm	32	
Relay 8 NO	8	Relay Contact or Driver 8 Output
Relay 8 Arm	33	
Relay 9 NO	9	Relay Contact or Driver 9 Output
Relay 9 Arm	34	
Relay 10 NO	10	Relay Contact or Driver 10 Output
Relay 10 Arm	35	
Relay 11 NO	11	Relay Contact or Driver 11 Output
Relay 11 Arm	36	
Relay 12 NO	12	Relay Contact or Driver 12 Output
Relay 12 Arm	37	
Relay 13 NO	13	Relay Contact or Driver 13 Output
Relay 13 Arm	38	
Relay 14 NO	14	Relay Contact or Driver 14 Output
Relay 14 Arm	39	
Relay 15 NO	15	Relay Contact or Driver 15 Output
Relay 15 Arm	40	
Relay 16 NO	16	Relay Contact or Driver 16 Output
Relay 16 Arm	41	
V Return	17	External Relay Ground Return
V Common	42	External Relay + Voltage Input
Logic Gnd	18	
Logic Gnd	43	
+ 5 Vdc	19	
+ 5 Vdc	44	
Shield Gnd	20	
Relay Enable	45	
V Pullup High	21	External 16-30 Vdc Input
V Pullup Low	46	External 5-20 Vdc Input
Digital In 8	22	
Digital In 7	47	
Digital In 6	23	
Digital In 5	48	
Digital In 4	24	
Digital In 3	49	
Digital In 2	25	
Digital In 1	50	



**Figure 4 8064 OEM Board Layout**

8064: ORDERING GUIDE

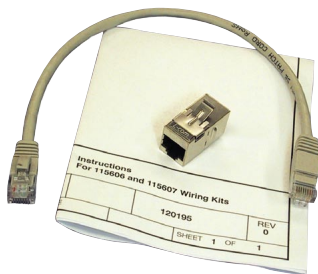
Select the 8064 version and then pick your accessory items.

Part Selection	Qty	Part Number
Standard 8064 Relay Interface Minibox. Includes a 50-pin mating connector and hood -		
with 16 form 'A' low level contacts	(1)	8064-11
with 16 form 'A' heavy duty contacts	(1)	8064-12
with 16 sink type relay drivers	(1)	8064-14
Select an extra mating digital I/O connector, 50-pin ribbon connector and hood	(1)	902002
Select an Open end, 50 conductor, 28 AWG wire cable assembly, 5 feet long	(1)	112829-01
or		
Select the 4864 Terminal Board	(1)	115750
or		
Select the 4864 I/O terminal Strip with 60 cm long flat-ribbon cable	(1)	114534-60 (Note 1)
8064 OEM Relay Interface Board. Includes a 50-pin mating connector and hood -		
with 16 form 'A' low level contacts	(1)	115631-11
with 16 form 'A' heavy duty contacts	(1)	115631-12
with 16 sink type relay drivers	(1)	115631-14
Select a Chassis Wiring Kit -		
with 1 foot long cable	(1)	115606
with 2 foot long cable	(1)	115607
Select an extra mating digital I/O connector, 50-pin ribbon connector and hood	(1)	902002
Select an Open end, 50 conductor, 28 AWG wire cable assembly, 5 feet long	(1)	112829-01
or		
Select the 4864 Terminal Board	(1)	115750
or		
Select the 4864 I/O terminal Strip with 60 cm long flat-ribbon cable	(1)	114534-60 (Note 1)

Notes: 1. The dash number is the cable length in cm.

Wiring Kits

ICS's Wiring Kits provide a short 1 or 2 foot long Cat 5 cable and a shielded bulkhead connector of extending the 8064's Ethernet connector to the rear panel of the host chassis.



115606 Wiring Kit

Rack Mounting Kits

The rack mounting kits are available for mounting one or two 8064s in a 1 'U' high space. Order P/N 114212 for mounting one unit, P/N 114213 for mounting two units.



114213 Dual Rack Mount Kit



## 8064: Specifications

Supported Standards	Relay Contacts	Indicators
<b>VXI-11 Capabilities</b> 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 intr0 for general use intr1 for transparent data	All relay contacts are brought out to individual pins on the relay connector. Guard lines are provided on the PC board between adjacent relay contacts to minimize crosstalk.  Model No. 8064-11 8064-12 Usage Lo level Hi Power No. of Relays 16 16 Contact form Form A Form A (SPST) (SPST) Contact mat'l Ruthenium - Contact ratings: (Restive load) 0.5 A 1.0 A Switching V 200 Vdc 200 Vdc Power 10 W 50 W Breakdown V 300 Vac 300 Vac Resistance 0.15 $\Omega$ 0.2 $\Omega$	PWR Indicates power on LAN Unit connected to an active LAN Blinks to identify the unit. ACT Transferring messages to/from the network RDY Unit has passed self test TALK Unit asked to send data LSTN Unit sent a command or data SRQ Device Service Request asserted ERR Blinks for a soft VXI-11 error and On for solid command errors
<b>VXI-11.3 Functions</b> All VXI-11.3 functions including device read, write, local, remote, clear, trigger, readstb, lock and unlock.		<b>Physical</b>
<b>RPC Protocol</b> Conforms to ONC RPC Version 2, VXI-11		<b>Size, L x W x H</b> 7.29 x 1.52 x 7.45 inches (1185.2 x 38.6 x 189.2 mm)
<b>Ethernet Interface</b> 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]	<b>Relay/Solenoid Driver Outputs</b>  The -14 version has the relay driver outputs. Relay drivers are open collector type with an internal snubber diode. User supplies the positive relay power for the diodes.  Model No. 8064-14 Usage External relays No. of Drivers 16 Sink Current 300 mA max Switching V 48 Vdc max	<b>Weight</b> 1.6 lbs. (0.73 kg.) plus pwr adapter  <b>Construction</b> RoHS compliant, lead free  <b>Connector and Headers</b> Digital I/O: 50-pin female, metal DC shell blue-ribbon connector with locking springs. 8-pin male header Ethernet: RJ-45  <b>Temperature</b> Operation -10° C to +70° C Storage -20° C to +85° C  <b>Humidity</b> 0-90% RH without condensation  <b>Power</b> 12 to 24 Vdc @ 7 VA + 50 mA/closed relay  <b>Approvals</b> EEC Standards EN 61000-6-4:2001, EN 61000-6-2:2001, EN 55024:2003, and EN 55022:2003.
<b>WebServer Capabilities</b> Provides the following HTML 4.01 compatible web pages: Welcome Configuration Confirmation Reboot 404, 500 and 501 Error pages Relay Control	<b>Scanner-Sequence Memory</b> 16 relays x 32 steps  <b>Digital Inputs</b>  Eight isolated inputs that can be queried and/or monitored for selected bit changes. Detected changes are saved and can be used to generate a Service Request (SRQ).  Data lines 8 Input signals TTL/CMOS or contact closure to ground Input Levels Low = 0±0.5 V @ 2 mA High=>2.4 V or open Pullups 1.5 Kohm to +5 Vdc or to user furnished external voltage External Voltage 5 to 32 Vdc Isolation 500 Vdc to internal logic with external pullup voltage. Monitoring > 1k samples/sec	<b>Included Accessories</b> Instruction Manual Mating Connector LAN Crossover Cable. CD-ROM with VXI-11 Keyboard Controller program and Configuration Utility. UL/CSA/VDE approved AC power Adapters: US - 115±10% Vac, 60 Hz (std.) -E Europe - 230±10% Vac, 50/60 Hz -B UK - 230±10% Vac, 60 Hz -U Japan - 100±10% Vac, 50/60 Hz -A Australia/China - 230±10% Vac, 60 Hz
<b>IEEE 488.2 Capabilities:</b> Runs all required 488.2 Common Commands, incorporates an extended IEEE-488.2 Status Reporting Structure and the Message Exchange Protocol.		
<b>SCPI Capabilities:</b> Incorporates the SCPI Command Tree shown in Table 1. Complies with SCPI version 1994.0.		
<b>LXI Conformance:</b> The 8064 generally conforms to the LXI 1.1 Specification for Class C instruments except the 8064 does not self generate IP addresses. The 8064's VXI-11.3 and IEEE-488.2 conformance exceeds LXI requirements.		
<b>Controls</b> Power Front panel switch LAN Rst Rear panel push-button that resets the network settings		

## ORDERING INFORMATION

	Part Number
Ethernet to Relay Interface with low level contacts	8064-11
Ethernet to Relay Interface with heavy duty contacts	8064-12
Ethernet to Relay Interface with relay drivers	8064-14
4864 Terminal Board	115750
4864 Rack Mount Terminal Strip with 60-cm long cable	114534-60
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