# 4864

## GPIB TO RELAY INTERFACE

## DESCRIPTION

The Model 4864 is an IEEE 488.2/GPIB/HP-IB to Relay Interface that provides 16 form 'A' contacts or 16 relay drivers for switching signals or for driving external relays. The 4864's versatile commands let the user control the relays individually, step them as a single or multi-pole scanner, or step in a programmed sequence. The 4864 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 4864 can also monitor the digital inputs and generate an SRQ and when the signals change state.

The Model 4864 is a member of ICS's Mini-Box family of IEEE 488.2 interfaces which provide many new features while using less than one third the space of earlier designs. All Mini-Box interfaces are IEEE 488.2 compatible and use SCPI and short-form commands for ease of programming. All Mini-Box interfaces are packaged in a CE compliant metal case that is less than 1.6 inches (39 mm) high and 7.3 inches (186 mm) wide and can be rack mounted in a 1U high space.

### 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 4864-11 are for switching low level signals up to 0.5 amperes. The relay contacts in the 4864-12 are rated for switching currents up to 1.0 amperes. The 4864-14 has 16 relay driver outputs that sink 300 mA to activate external relays or solenoids. The relays and drivers are on a plug-in relay PCB which simplifies relay maintenance and contact type changes.



**4864 GPIB Relay Interface**

### Digital Inputs

Each 4864 also provides eight isolated digital inputs for TTL/CMOS signals or contact closures. Each input has a pullup resistor to a common line that can be connected to the 4864's internal 5 Vdc power or to an external voltage source. The signals have >500 volts of isolation from the 4864 when driven by an external source.

### Programmability

The 4864 includes commands for direct relay actuation, for signal scanning and for random relay sequences. The user has his choice of using SCPI commands for easy program documentation or short-form commands for reduced typing when controlling the unit from a keyboard. The 4864 also responds to all of the IEEE-488.2 required common commands.

All of the relay setup values, digital input enabling, operating mode and GPIB Bus address are programmable from the GPIB Bus. These configuration values can be saved in the 4864's Flash memory and are automatically recalled as the default settings at power turn-on time.
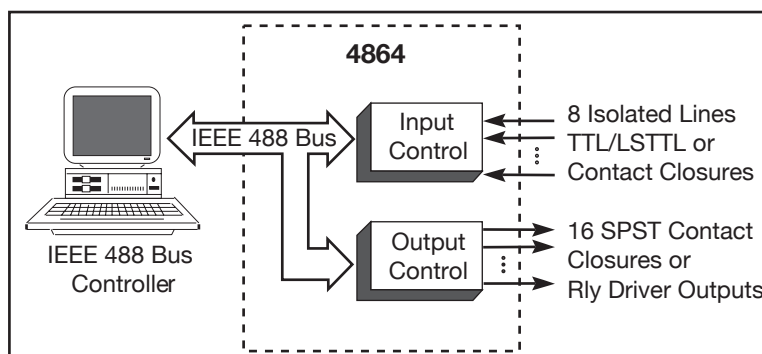
### GPIB Controlled relays and isolated digital inputs

- Multiple relay configurations:
  - 16 low-level SPST relays
  - 16 hi-power SPST relays
  - 16 relay drivers
  *Choose the right contact or relay driver for your application.*

- Multiple relay programming modes:
  - individual relays
  - single or multipole scanning or pulsed
  *Flexible relay programming.*

- Isolated digital inputs accept contact closures and CMOS/TTL logic levels.
  *Eliminates ground loops.*

- IEEE-488.2 compatible unit uses SCPI commands.
  *Meets the latest GPIB specifications.*

- Includes a menu-driven configuration program.
  *Steps user through configuration choices.*

- Metal case provides full EMI/RFI protection
  *Proven EMI/RFI Compliance.*

CE Approved

☑ RoHS



**Figure 1    4864 Block Diagram**

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## 4864 SCPI Command Advantages

Table 1 shows the 4864'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 document-ing and make program maintenance easier. An example of a SCPI command is one which sets a relay:

ROUT:CLOSE 4          'Closes relay 4

Many of the 4864 SCPI commands have short-form equivalents that minimize typing and GPIB bus traffic. The short-form relay command is:

C 4                        'Closes relay 4

## Controlling the Relays

The simplest way to control the 4864'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. Multiple relays can be opened, closed or plused 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:CLOS (@1,3,4)       'Closes relays 1,3 and 4
ROUT:OPEN (@11:13)       'Opens relays 11 through 13

## Scanning Options

For data acquisition applications, groups of the relays can be configured to operate as a single or multi-pole scan-ner. 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 4864'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.

```
ROUT:SCAN (@1,3,5), (@2,4,6)   'Defines scanner relays
INIT:IMM                'Closes initial pole (Relays 1 and 2)
*TRG or a GET           'Steps the scanner to the next
                         position.  Relays 1 and 2 open;
                         relays 3 and 5 close)
*TRG or a GET           'Steps the scanner to the third
                         position.
*TRG or a GET           'Steps the scanner to the home
                         position.
```

**Figure 2    4864 Scanner Command Example**

### TABLE 1    4864 SCPI Command Tree

| SCPI Tree | Short-Form Commands | |
|---|---|---|
| **SYSTem** | **System Setup and Query** | |
| :COMM | | |
| :GPIB | | |
| :ADDRess | <numeric> | |
| :ERRor? | | |
| :VERSion? | | |
| | | |
| **STATus** | | |
| :OPERation | not used in 4864 | |
| [:EVENt]? | | |
| :CONDition? | | |
| :ENABle | <numeric> | |
| :ENABle? | | |
| | | |
| :QUEStionable | **Digital Inputs** | |
| [:EVENt]? | | E? |
| :CONDition? | | D? |
| :ENABle | <numeric> | M |
| :ENABle? | | M? |
| :PTRansistion | <numeric> | P |
| :PTRansistion? | | P? |
| :NTRansistion | <numeric> | N |
| :NTRansistion? | | N? |
| | | |
| **ROUTe** | **Relay Control** | |
| :CLOSe | channel list | C |
| :STATe? | | Q? |
| :OPEN | channel list | O |
| :ALL | | A |
| :SCAN | | Sn |
| :PULSe | channel list | PL |
| :WIDTh | 1-30000 [25] | PW |
| | | |
| **INITiate** | **Scan Control** | |
| [:IMMeditate] | | I |
| :CONTinuous | 1(On)\| 0(Off) [0] | N |
| | | |
| **CALibrate** | **Calibrate** | |
| :IDN | <string> | |
| :DATe | mm/dd/yy | |
| :DEFault | | |
| :LOCK | 1(On)\| 0(Off) [0] | |

## Reading and Monitoring the Digital Inputs

The 4864's eight digital inputs are read by querying the Questionable Condition register in the 4864's Status Reporting Structure. The Questionable Event register reports the bits that have changed since its last reading. Positive and nega-tive 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 4864's Status Byte Register and to generate a Service Request message (SRQ) to alert the Application to the event. The user's Application program can query the 4864's Questionable Condition Register to determine the input signal states and/or the Event Register to learn which signal changed state.

## Signal Connections

All 4864 relay and digital connections are brought out on a 50-pin blue-ribbon connector on the 4864's rear panel. Table 2 lists the signals. The relay outputs are floating form 'A' (normally open) contacts. Relay driver signals are brought out on the NO contact pins. The 4864'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 4864 is performing its power-on selftest. A Relay Enable signal is provided to control external devices that may need to be held off.
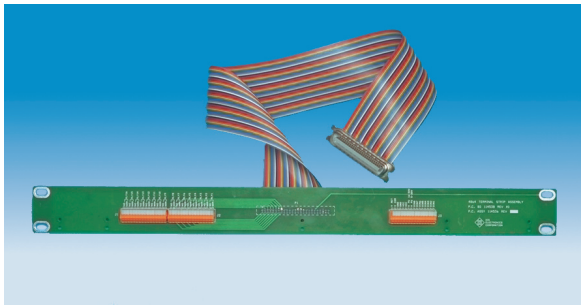
## 4864 Terminal Board

The 4864 Terminal Board is a small board with screw terminals that plugs into the 4864'a 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 4864.
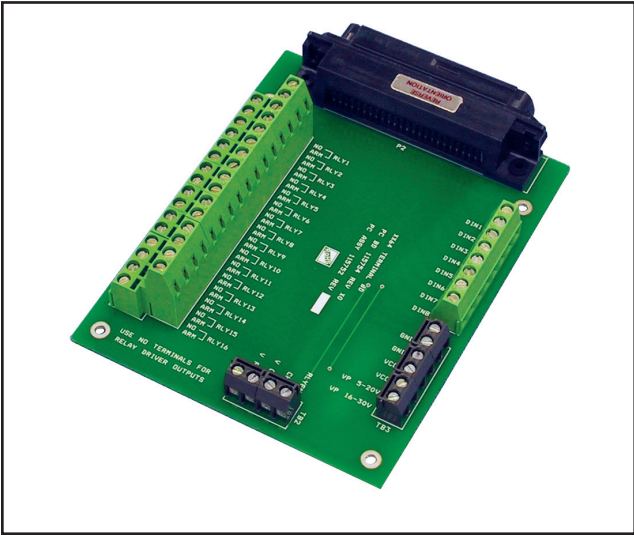


**4864 Terminal Board**

## Rack Mounted Terminal Strip

A rack mounted Terminal Board is available for the 4864. 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 4864 signals. A 60 cm (24 inch) long flat-ribbon cable connects the Terminal Board to the 4864.



**Rack Mounted 4864 Terminal Strip**

**TABLE 2      4864 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 | Relay Enable and 5 V Ground |
| Logic Gnd | 43 | |
| + 5 Vdc | 19 | 5 V power output |
| + 5 Vdc | 44 | |
| Shield Gnd | 20 | |
| Relay Enable | 45 | Output Signal |
| 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 | |

The rack mounting kits are available for mounting one or two 4864s in a 1 'U' high space. Order P/N 114212 for mounting one unit, P/N 114213 for mounting two units.
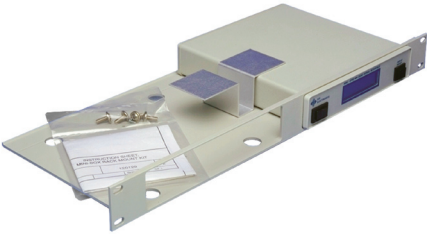


**114213 Dual Rack Mount Kit**

## OEM Board Versions

The Relay Interfaces are available in board versions for OEMs or for any user who wants to mount the 4864 or 2364 Board Assembly in a chassis. Power can be supplied from the host's 12 V to 24 V power supply. The boards are available with GPIB and Serial interface configurations listed in Table 3. On the OEM boards, the interface headers are mounted vertically to minimize the board footprint. The relay I/O connector is the same right angle 50-pin connector with lock bails.

## External GPIB Address Capability

Standard 4864's store their GPIB address in Flash memory and use a SCPI command to change it. On 4864 OEM boards, extra digital input lines are provided in the GPIB header to read the GPIB address from an external address switch at power turn-on. The external address function is enabled with a SCPI command.

## GPIB Header

On 4864 OEM boards, the 4864's GPIB connector is replaced with a 26-pin vertical header for remoting the GPIB bus and address switch signals to the rear panel. The 26 pin header mates with a flat ribbon cable from one of ICS's GPIB Connector / Address switch assemblies. These compact, business card size assemblies provide a convenient way to mount a GPIB Connector and an address switch on the rear panel.

## RS-232/RS-485 Interfaces

On 2364 OEM boards, the RS-232 / RS-485 serial interface is on a 10-pin header at the front of the board. The serial interface operates at rates up to 115,200 baud and provides all of the functionality of the GPIB interface but over an RS-232 link or over an RS-485 network. Up to sixteen 2364s can be placed on a single RS-485 network. The 2364s are addressed by a two character address sequence prefixed to the normal 4864 command. The unit address and network capability are controlled by SCPI commands.

Boards with both GPIB and serial interfaces, default to using the serial interface at power turn-on time until the GPIB interface enters the Remote state. Refer to the 2364 data sheet for more information about the serial interface.

## LED Header

An 8-pin header on the OEM boards allows easy extension of the LED drive signals to the user's front panel.

## OEM Firmware Customization

The 4864 and 2364's firmware allows the user to store a custom IDN message and other setup parameters in Flash memory. This effectively integrates the board into the user's system and makes the OEM board appear as part of the end product. A lock function hides the setup variables from the end user and prevents accidental changes to the setup.

**TABLE 3    OEM BOARD CONFIGURATIONS**

| Part Number | Same As | Interfaces | | |
|---|---|---|---|---|
| | | GPIB | RS-232 | RS-485 |
| 114521-11 | 4864-11 | Yes | Yes | Yes |
| 114521-12 | 4864-12 | Yes | Yes | Yes |
| 114521-14 | 4864-14 | Yes | Yes | Yes |
| 114681-11 | 2364-11 | No | Yes | Yes |
| 114681-12 | 2364-12 | No | Yes | Yes |
| 114681-14 | 2364-14 | No | Yes | Yes |

OEM Boards have the same specifications as the 'same as' model number. OEM boards include the Instruction Manual, Configuration disk and Mating connector. GPIB Connector/Switch Assemblies, serial cables or serial cable kits must be ordered separately.
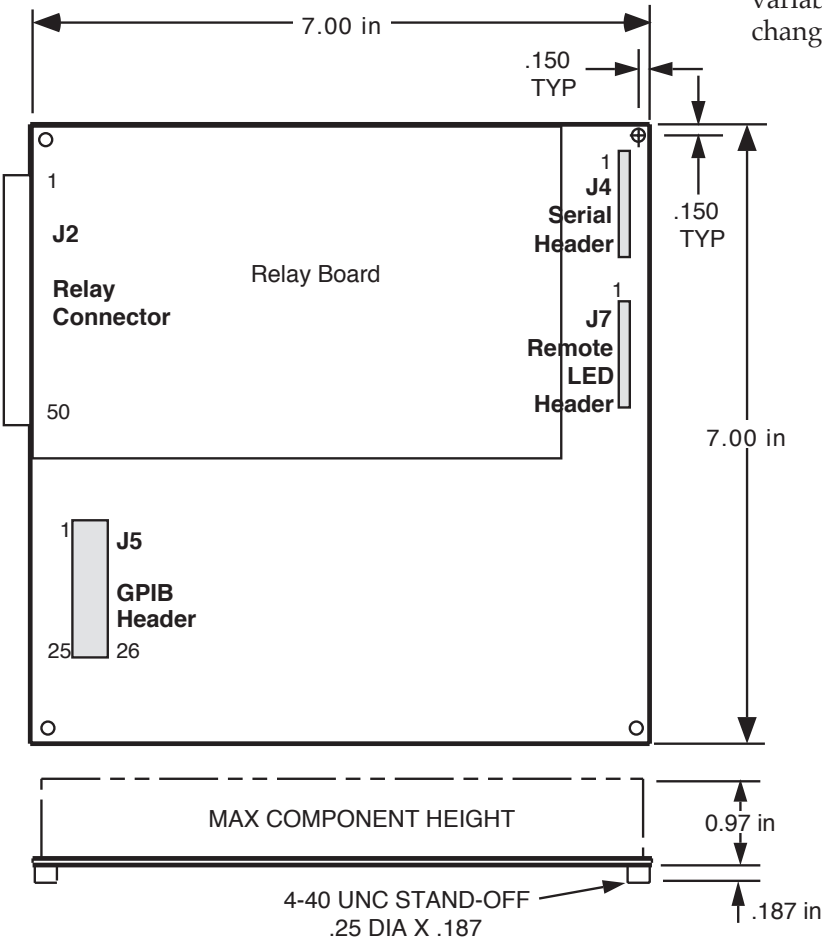


**4864 OEM Board Dimensions**

Select the 4864 version and then pick your accessory items.

| **Part Selection** | **Qty** | **Part Number** |
|---|---|---|

Standard 4864 Relay Inerface Minibox.  Includes a 50-pin mating connector and hood -

|  | | |
|---|---|---|
| with 16 form 'A' low level contacts | (1) | 4864-11 |
| with 16 form 'A' heavy duty contacts | (1) | 4864-12 |
| with 16 sink type relay drivers | (1) | 4864-14 |
| 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) |

4864 OEM Relay Inerface Board.  Includes a 50-pin mating connector and hood -

| | | | | |
|---|---|---|---|---|
| with 16 form 'A' low level contacts | | (1) | 114521-11 | |
| with 16 form 'A' heavy duty contacts | | (1) | 114521-12 | |
| with 16 sink type relay drivers | | (1) | 114521-14 | |
| Select a GPIB Connector/Address Switch Assembly - | Horizontal style | (1) | 113640-L (Note 2) | |
| | Vertical style | (1) | 113642-L (Note 2) | |
| 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.
2. -L is the cable length in cm.  You can order any length from 10 to 90 cm.
   Standard stocked lengths are: 30, 45, 60 and 90 cm.  Select an appropriate length as it is best to not
   have extra cable coiled up in the chassis to minimize EMI pickup.  See the GPIB Connector/Address
   Switch Assembly data sheet for more details.

## IEEE 488 Bus Interface

The 4864's 488 Bus interface meets IEEE STD 488.1-1987 and has the following capabilities.
SH1, AH1, T6, L4, SR1, PP0, DC1, RL0, DT1, C0 and E2 drivers.

Address Capability
Primary addresses 0-30

SRQ Generation
SRQs are generated if the unit is not a talker, if SRQs are enabled and if an Enabled Event Status Register bit or an monitored digital input change occurs. Digital inputs are monitored by the Questionable register.

488.2 Common Commands
*CLS, *ESE, *ESE?, *ESR?, *IDN?, *OPC, *OPC?, *PSC, *RCL, *RST, *SAV, *SRE, *SRE?, *STB, TST? and *WAI

SCPI Commands
Used to set and query all programmable functions. The 4864 conforms to the SCPI 1994.0 Specification.

## Digital Inputs

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 | 1,000 samples/sec |

## Relay Contacts

All relay contacts are brought out to individual pins on the relay connector. Guard lines are provided between adjacent relay contacts

| | | |
|---|---|---|
| Model No. | 4864-11 | 4864-12 |
| Usage | Lo level | Hi Power |
| No. of Relays | 16 | 16 |
| Contact form | Form A (SPST) | Form A (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 Ω | 0.2 Ω |
| Life at 100$\mu$A | 20 x10$^6$ cycles | |
| at 500mA | 2 x 10$^6$ cycles | |

## Relay/Solenoid Driver Outputs

In -14 version, the relays are omitted and the relay drivers are brought directly out to the connector. Drivers are open collector type with an internal snubber diode. User supplies the external voltage for the diodes.

| | |
|---|---|
| Model No. | 4864-14 |
| Usage | External relays |
| No. of Drivers | 16 |
| Current | 300 mA sink max |
| Switching V | 48 Vdc max |
| Pulse width | 1-30000 ms [25] |

## Scanner-Sequence Memory

16 relays x 32 steps

## Front Panel Indicators

| | |
|---|---|
| PWR | Indicates power on |
| RDY | Unit has passed self test |
| TALK | Unit is addressed to talk |
| LSTN | Unit is addressed to listen |
| SRQ | Unit is asserting SRQ |
| ERR | Unit sensed a command error |

## Physical

| | |
|---|---|
| Size | W x H x D 7.29 x 7.45 x 1.52 inches (1185.2 x 189.2 x 38.6 mm) |
| Weight | 3 lbs (1.4 kg) |
| Temperature | -10°C to +55°C Operating -40°C to +70°C Storage |

Humidity 0-90% RH, no condensation

Construction  All metal case

| | |
|---|---|
| Connectors | IEEE bus-Std 24 pin w/metric studs I/O-Amphenol 57-30500 50-pin connector w/spring locks |
| Power | 12 to 24 Vdc @ 100 mA plus 10 mA per closed relay |

## Included Accessories

Instruction Manual
Mating Connector
Support CD ROMwith Configuration and
 example programs
UL/CSA/VDE approved AC power adapters
provided for:
 US - 115±10% Vac, 60 Hz (std)
 Europe - 230±10% Vac, 50/60 Hz
 UK - 230±10% Vac, 60 Hz
 Japan - 100±10% Vac, 50/60 Hz
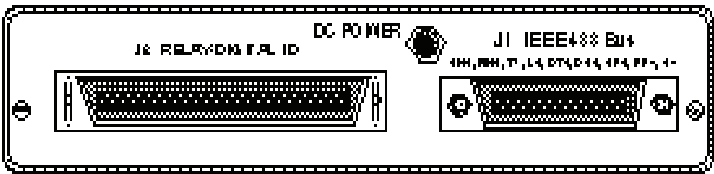


**4864 Rear Panel**

## ORDERING INFORMATION

| | Part Number |
|---|---|
| Relay Interface with 16 SPST low-level relays | 4864-11 |
| Relay Interface with 16 SPST high-power relays | 4864-12 |
| Relay Interface with 16 relay/solenoid drivers | 4864-14 |
| 4864 Terminal Board | 115750 |
| RackMounted Terminal Strip Assembly with 60 cm cable (See separate data sheet) | 114534-60 |