



VX4372
Slave Scanner Module
Operating Manual

Tektronix

WARRANTY

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Operators Safety Summary

The general safety information in this summary is for both operating and servicing personnel. Additional specific warnings and cautions are found throughout the manual where they apply, and may not appear in this summary.

TERMS

In This Manual

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

CAUTION statements identify conditions or practices that could result in damage to the module or other property.

Marked on the Module

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property, including the module itself.

SYMBOLS

In This Manual



This symbol indicates where applicable cautionary or other information is to be found.



This symbol indicates where special explanatory information is included in the manual. There is no caution or danger associated with the information.

Marked on the Module



DANGER — High Voltage.



Protective ground (earth) terminal.



ATTENTION — Refer to the manual.



Refer to manual before using.

Power Source

This module is intended to operate in a mainframe whose power source does not apply more than 250V rms between the supply conductors or between either supply conductor and ground. A protective ground connection through the grounding conductor in the power cord(s) is essential for safe operation.

Grounding the Module

This module is grounded through the grounding conductor of the mainframe power cord(s). To avoid electrical shock, plug the mainframe power cord(s) into a properly wired receptacle before connecting to the module connectors. A protective ground connection through the mainframe is essential for safe operation.

Danger Arising from Loss of Ground

Upon loss of the protective-ground connection, all accessible conductive parts can render an electric shock.

Use the Proper Fuse

To avoid fire hazard, use only fuses specified in the module parts list. A replacement fuse must meet the type, voltage rating, and current rating specifications required for the fuse that it replaces.

Do Not Operate in Explosive Atmosphere

To avoid explosion, do not operate the module in an explosive atmosphere.

Do Not Remove Covers or Panels

To avoid personal injury, the module covers should be removed only by qualified service personnel. Do not operate the module without covers and panels properly installed.

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VX4372

Slave Scanner Module

Section 1

General Information and Specifications

Introduction

The VX4372 Module is a printed circuit board assembly for use in a mainframe conforming to the VXIbus Specification, such as the VX1400 C size mainframe used in the Tektronix/CDS IAC System. The VX4372 is a VXIbus "C" size, 48-channel, 2-wire, slave scanner. It is designed to be used in a system with up to 11 slave scanners controlled by a master scanner, such as the VX4332, via the VXIbus local bus.

The VX4372 may be used as a 48 channel scanner, selecting one of 48 2-wire inputs, or as two 24-channel scanners, each independently selecting one of 24 2-wire inputs. The VX4372 can also be part of a scanning system in multiple mainframes with up to three masters, each master with up to 11 slaves.

Only the digital control signals of the slave modules connect to the VXIbus backplane, using the VXIbus local bus. Since all analog signals are completely isolated from the VXIbus backplane, both master and slave scanners can route signals up to ± 200 volts in amplitude. The slave module's control signal access to the Local Bus is controlled by a series of Local Bus Out Enable switches on the slave module.

Using a scan master such as the VX4332, scan sequence tables, delays, and interrupts may be programmed for the system. Symbolic names may also be defined for channels or scan sequences. Built in Test Equipment (BITE) is also provided by the scan master. See the specific scan master's manual for details.

The VX4372 is one of a series of 2- and 4-wire master and slave scanners. Any of the slaves may be used with any of the masters. The slaves may be used to expand the number of channels of the master or as separate scanning systems controlled by the master.

When used with master scanners in this series, the VX4372 and the other slaves may be used as a 1-of-N scanner, where N is the total number of relays on all the modules, or split into smaller scanners of varying size. For instance, a system with one VX4332 and two VX4372 Modules could be used in any of the following configurations (as well as others):

1 of 136 or
1 of 64 and 1 of 72 or
1 of 40 and 1 of 48 and 1 of 48 or
1 of 40 and 1 of 48 and 1 of 24 and 1 of 24 or
1 of 40 and 1 of 24 and 1 of 24 and 1 of 24 and 1 of 24 or
1 of 20 and 1 of 20 and 1 of 24 and 1 of 24 and 1 of 24 and 1 of 24

Each group is independent, and one relay may be closed in each group. Within any group, there is hardware and software protection against closing more than one relay at a time.

The basic function of a scanning system is to connect one of many analog inputs to an analog bus. To do this, the system uses the following sequence of signals and timing (unless the "Fast" command is used by the master):

1. A program command is given to close a particular relay.
2. A scan clear signal is issued to open any relay that is currently closed.
3. A programmable open delay occurs to allow the closed relay time to open.
4. The new relay is energized.
5. A programmable close delay occurs to allow the new relay time to close.
6. The module with a closed relay is read to verify that the correct relay is closed.
7. An encode signal is generated to signal a device to make a measurement.
8. The system is ready to accept a new command.

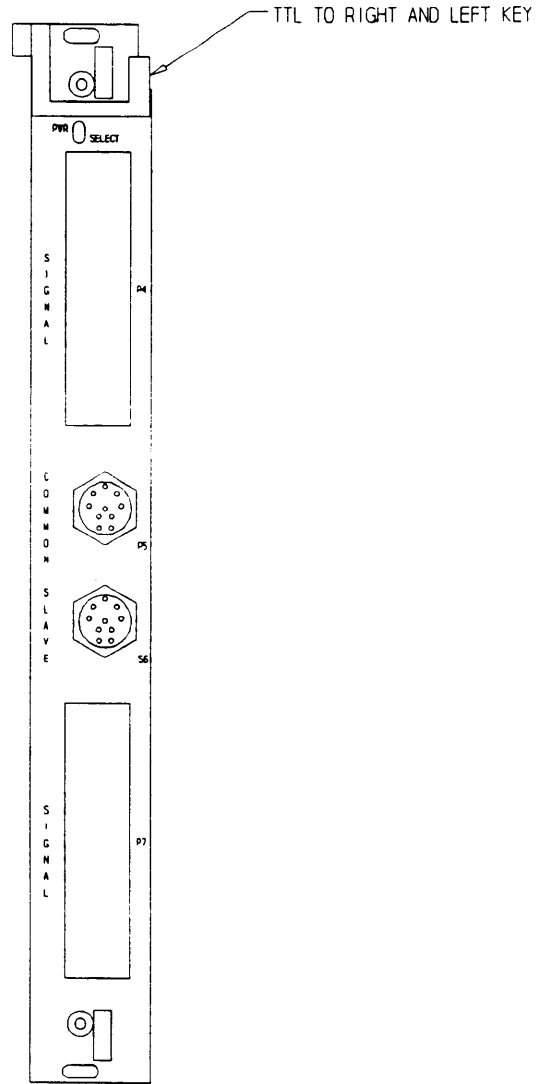


Figure 1: VX4372 Front Panel

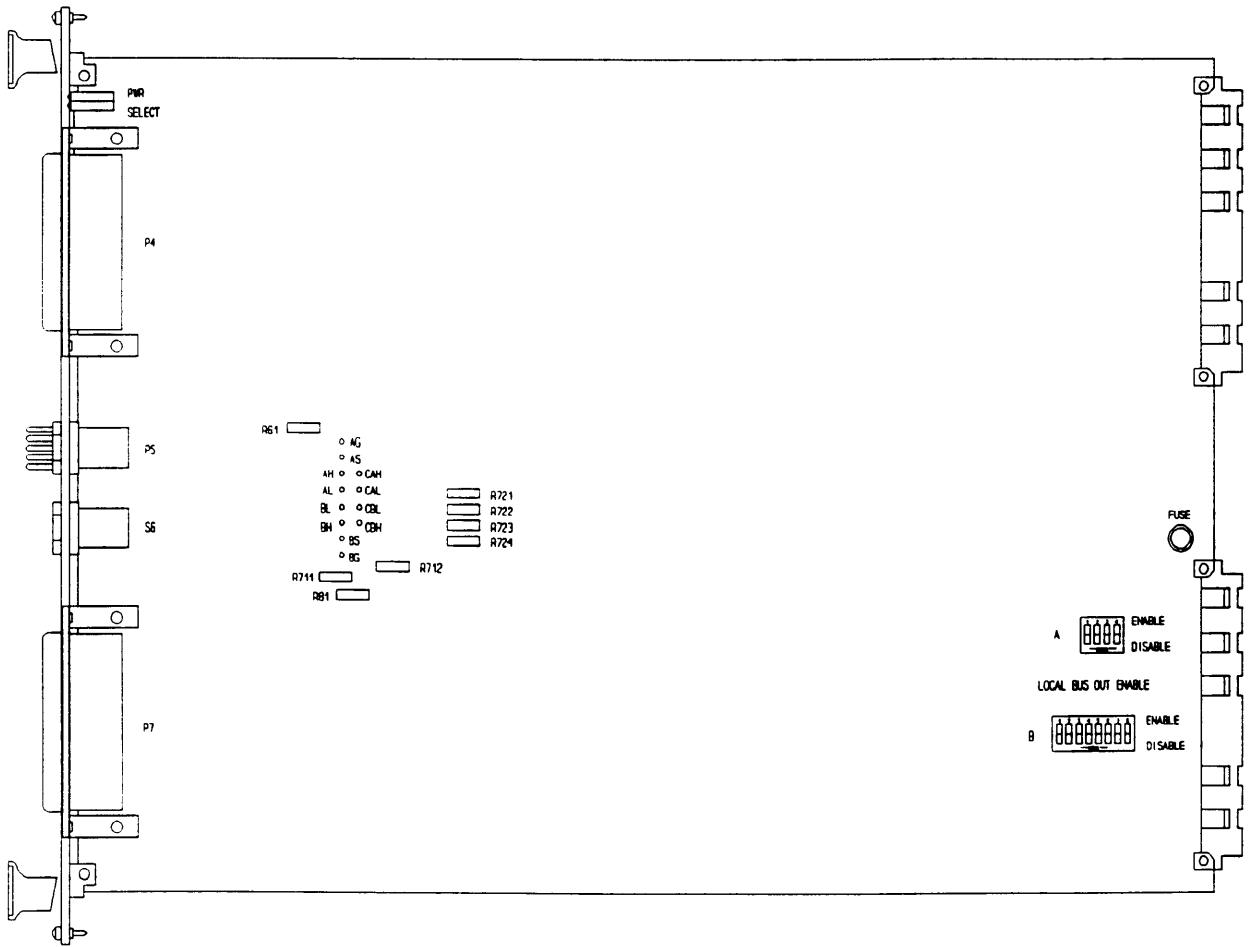


Figure 2: VX4372 Controls and Indicators

Controls And Indicators

The following controls and indicators are provided to select and display the functions of the VX4372 Module's operating environment. See Figures 1 and 2 for their physical locations.

Switches

Local Bus Out Enable Switches

The Local Bus Out Enable switches consist of two blocks of DIP switches, one block of four and one block of eight.

If the VX4372 is being used with another slave module on its right, the Local Bus Out Enable switches should all be set to ENABLE (closed).

If the VX4372 is used without another slave to the right, the Local Bus Out Enable switches should all be set to DISABLE (open) to avoid any possible damage from a module in the next slot to the right.

Fuse

The VX4372 Module has a single 5V fuse. The fuse protects the module in case of an accidental shorting of the power bus or any other situation where excessive current might be drawn.

If the +5V fuse opens, remove the fault before replacing the fuse. Replacement fuse information is given in the Specifications section of this manual.

LEDs

The following LEDs are visible at the top of the VX4372 Module's front panel to indicate the status of the module's operation:

PWR LED

This green LED is normally lit and is extinguished if the +5V power supplies fail, or if the +5V fuse blows.

SELECT LED

This normally off green LED is lit when a relay is closed on this module.

Front Panel Connectors

The VX4372 has the following connectors on its front panel:

- ▶ a 10-pin male connector with the 4-wire analog bus and digital control signals to daisy chain to a measurement device or another scanner system. The digital signals are scan clear, encode, relay closed, and chain.

- ▶ a 10-pin female connector with the 4-wire analog bus and digital control signals to daisy chain to another slave module controlled by the same master or to another scanner system. The digital signals are scan clear, encode, relay closed, and chain sense.
- ▶ two DD-50P connectors for signal inputs to this module's relays.

VXIbus Compatibility

The VX4372 Module by itself is not a VXIbus device, since it does not contain VXIbus Configuration registers. However, when it is used with a scanner master, such as the VX4332, it becomes part of a message based VXIbus multiple card instrument, and as such, is part of a VXIbus device.

Both P1 and P2 connectors are provided with the VX4372. P1 is provided only to daisy chain the VMEbus Bus Grant and Interrupt Acknowledge signals. The daisy chain could also easily be installed in the mainframe. Tektronix/CDS provides the daisy chain on the VX4372 Module primarily as a convenience to the user, since a user would not expect to have to daisy chain an occupied slot.

P2 is used for 5V power and signal ground, and for the VXIbus local bus only. No other P2 signals are used.

Specifications

Configuration:	Two 24-channel 2-wire scanners, each with a common 4-wire output bus. Software programmable to a 48-channel 2-wire scanner with a 4-wire output bus.
Relay Type:	Model: Coto 3400-0092 or equivalent, dry reed, 3 pole, form A, third pole for readback.
Contacts:	
Maximum Switching Power Resistive:	10W.
Maximum Switching Voltage:	200V DC. 120V AC RMS, balanced input. 240V AC RMS, balanced input with 1 megohm bleeder resistors. 60V AC RMS, one side grounded. 120V AC RMS, one side grounded with 1 megohm bleeder resistors.
Maximum Switching Current:	0.5A.
Reed Life:	At least 10^7 operations per channel at rated load of 10W. Less as channel and common capacitance increase at higher voltages.
Duty:	Continuous.
Scanning rate:	Random channel selection up to 280 channels per second, depending on the master's capabilities.
Signal Path Specifications:	
Differential Thermal Offset:	Less than 10 μ V.
Initial Signal Path Resistance:	Less than 700 milliohms. Signal path resistance increases by the value of the current limit series resistors if used.
Signal Path Resistance at End of Reed life:	Less than 1.5 ohms. Signal path resistance increases by the value of the current limit series resistors, if used.
Insulation Resistance:	Greater than 10 gigohms between all insulated parts.
Crosstalk Between Channels:	Measured at scanner common output, with closed channel terminated with 600 ohms and signal applied to unselected channels. 1 KHz - Less than -105 dB. 10 KHz - Less than -85 dB. 100 KHz - Less than -65 dB. 1 MHz - Less than -45 dB.

Crosstalk Between Sections:	1 KHz - Less than -115 dB. 10 KHz - Less than -95 dB. 100 KHz - Less than -75 dB. 1 MHz - Less than -55 dB.
Isolation:	
Without Bleeder Resistors:	Greater than 10 gigohms signal to ground or signal to signal.
With 1 Mohm Bleeder Resistors:	Scanner commons to ground, 1 Mohm. Open input to ground, greater than 10 gigohms.
VXIbus Compatibility:	Uses P2 power and local bus only, keyed for TTL left and right.
VXI Device Type:	When used with a VXIbus message based instrument such as the VX4332, it is part of a VXIbus message based multiple card device.
VXI Card Size:	C size, one slot wide.
Power Requirements:	All required dc power is provided by the Power Supply in the VXIbus mainframe.
Voltage:	5 Volt Supply: 4.75 V dc to 5.25 V dc.
Current (Peak Module, I_{PM}):	5 volt supply: 1.0 A.
Current (Dynamic Module, I_{DM}):	5 volt supply: 0.1 A.
Fuses:	Replacement fuse: Littlefuse P/N 273002; CDS P/N 42202-73020.
Cooling:	Provided by the fan in the VXIbus mainframe. Less than 10°C temperature rise with 0.5 liters/sec of air at a pressure drop of 0.01 mm of H ₂ O.
Temperature:	0°C to +50°C, operating. -40°C to +85°C, storage.
Humidity:	Less than 95% R.H. non-condensing, 0°C to +30°C. Less than 75% R.H. non-condensing, +31°C to +40°C. Less than 45% R.H. non-condensing, +41°C to +50°C.
Radiated Emissions:	Complies with VXIbus Specification.
Conducted Emissions:	Complies with VXIbus Specification.

Section 1

Module Envelope

Dimensions: VXI C size. 262 mm x 353 mm x 30.5 mm (10.3 in x 13.9 in x 1.2 in)

Dimensions, Shipping: When ordered with a CDS mainframe, this module will be installed and secured in one of the instrument module slots (slots 1 - 12).

When ordered alone, the module's shipping dimensions are:
406 mm x 305 mm x 102 mm.
(16 in x 12 in x 4 in).

Weight: 2.0 kg. (4.3 lbs.)

Weight, Shipping: When ordered with a CDS mainframe, this module will be installed and secured in one of the instrument module slots (slots 1-12).

When ordered alone, the module's shipping weight is:
2.5 kg. (5.3 lb).

Mounting Position: Any orientation.

Mounting Location: Installs in an instrument module slot (slots 1-12) of a C or D size VXIbus mainframe. (Refer to D size mainframe manual for information on required adapters.)

Front Panel Signal

Connectors:
2 - DD 50P pin connectors.
1 - 10-pin circular connector, pin.
1 - 10-pin circular connector, socket.
Refer to Appendix A for connector pinouts.

Recommended Cable or Connector:

VX1638S Data cable.

Equipment Supplied:

1 - VX4372 Module.
1 - Operating Manual (Part # 00000-34372).
1 - Service Manual (Part # 00000-44372).

Optional Equipment:

2 - VX1638S Cable, or VX1780S Hooded Connector.
1 - VX1632S Cable, or VX1786S Hooded Connector.
1 - VX1632P Cable, or VX1786P Hooded Connector.
1 - VX1635 Cable, or VX1786S and VX1786P Hooded Connectors.

Section 1

Section 2

Preparation For Use

Installation Requirements And Cautions

The VX4372 Module is a C size VXIbus instrument module and therefore may be installed in any C or D size VXIbus mainframe slot other than slot 0. If the module is being installed in a D size mainframe, consult the operating manual for the mainframe to determine how to install the module in that particular mainframe. Setting the module's Logical Address switch defines the module's programming address. Refer to the Controls and Indicators subsection for information on selecting and setting the module's logical address. To avoid confusion, it is recommended that the slot number and the logical address be the same.

Tools Required

The following tools are required for proper installation:

Slotted screwdriver set.



Note that there are two printed ejector handles on the card. To avoid installing the card incorrectly, make sure the ejector marked "VX4372" is at the top.

In order to maintain proper mainframe cooling, unused mainframe slots must be covered with the blank front panels supplied with the mainframe.

Based on the number of instrument modules ordered with a Tektronix/CDS mainframe, blank front panels are supplied to cover all unused slots. Additional VXIbus C size single-slot and C size double-slot blank front panels can be ordered from your Tektronix supplier.



Verify that the mainframe is able to provide adequate cooling and power with this module installed. Refer to the mainframe Operating Manual for instructions.

If the VX4372 is used in a VX1X Series Mainframe, all VX4372 cooling requirements will be met.

Installation Procedure



The VX4374 Module must be in a slot immediately to the right of a compatible master or slave scanner. An empty slot between modules would disrupt the VXibus local bus daisy chain.

The VX4372 Module is a piece of electronic equipment and therefore has some susceptibility to electrostatic damage (ESD). ESD precautions must be taken whenever the module is handled.

- 1) Record the revision level, serial number (located on the label on the top shield of the VX4372), and switch settings on the Installation Checklist. Only qualified personnel should perform this installation.
- 2) Set the Local Bus Out Enable switches (see Figure 2). If the VX4372 is being used with another slave module on its right, the Local Bus Out Enable switches should all be set to ENABLE (closed).

If the VX4372 is used without another slave to the right, the Local Bus Out Enable switches should all be set to DISABLE (open) to avoid any possible damage from a module in the next slot to the right.

- 3) The module can now be inserted into any slot immediately to the right of a compatible master or slave scanner.

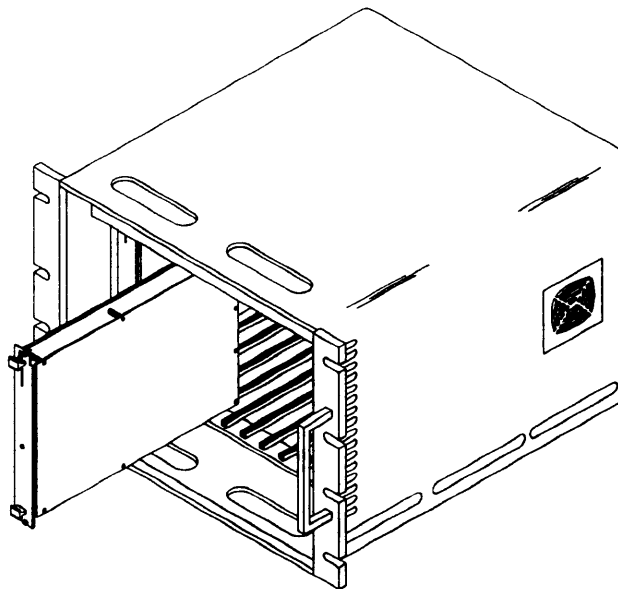


Figure 3: Module Installation

4) **Installation of Cables -**

Use a VX1638S Cable to interface between the module I/O connector and the Unit Under Test (UUT).

If a special cable is needed, a VX1780S Hooded Connector may be used to cable between the module's output connector and the UUT.

Master/slave to slave interface cables:

To chain the VX4372 to a master or slave module, use a VX1635 cable.

Master/slave to measurement device cables:

Use a VX1632S Cable to interface between Section A connector P5 and a measurement device. Use a VX1632P Cable to interface between Section B connector S6 and a measurement device. If the module sections are joined, only one cable is necessary.

See Figure 4 for cabling examples.

Board Options

Analog Bus:

The VX4372 has a 4-wire common or analog bus. These four lines are labeled High, Low, Guard and Shield. The factory configuration connects the Section A and Section B 2-wire common lines to the High and Low lines via traces on the PC board. Provisions are made on the board to allow the user to jumper the Section common lines to any combination of the 4-wire analog bus. To change the connections, cut the traces for the standard configuration before adding jumpers. Refer to points marked CAH, CAL, AH, AL, AS, AG, CBH, CBL, BH, BL, BS and BG in Figure 2 and to Figure 5.

Bleeder and Current Limit Resistors:

Switching high voltages can cause excessive relay contact wear, and lead to reduced relay performance and life. The stray capacitance of the module and cabling, coupled with a large voltage difference between the signal line and common line, creates brief but high current pulses. The VX4372 Module provides two ways of limiting this current: bleeder resistors and current limit resistors.

Bleeder resistors are useful when switching large voltage signals that are both positive and negative. They provide a high resistance path to ground from the common bus to bleed off high voltage of one polarity before closing a relay of a signal of the opposite polarity. A typical value for these resistors is 1 megohm. Holes are provided on the VX4372 to install bleeder resistors on all four analog lines of both the A and B Section. Refer to Figure 2 and Figure 5.

Current limit resistors limit the current to the relay contacts by adding a series resistance between the common lines of a section and its relays. A typical value for

these resistors is 100 ohms. If this added resistance will not adversely affect measurements, it will extend the life of the relay contacts in high voltage applications, particularly those with a significant amount of capacitance (for example, many modules chained together, or long cables).

The module is factory installed with 0 ohm current limit resistors, which can be replaced by the user. Refer to Figure 2 and Figure 5.

Section 2

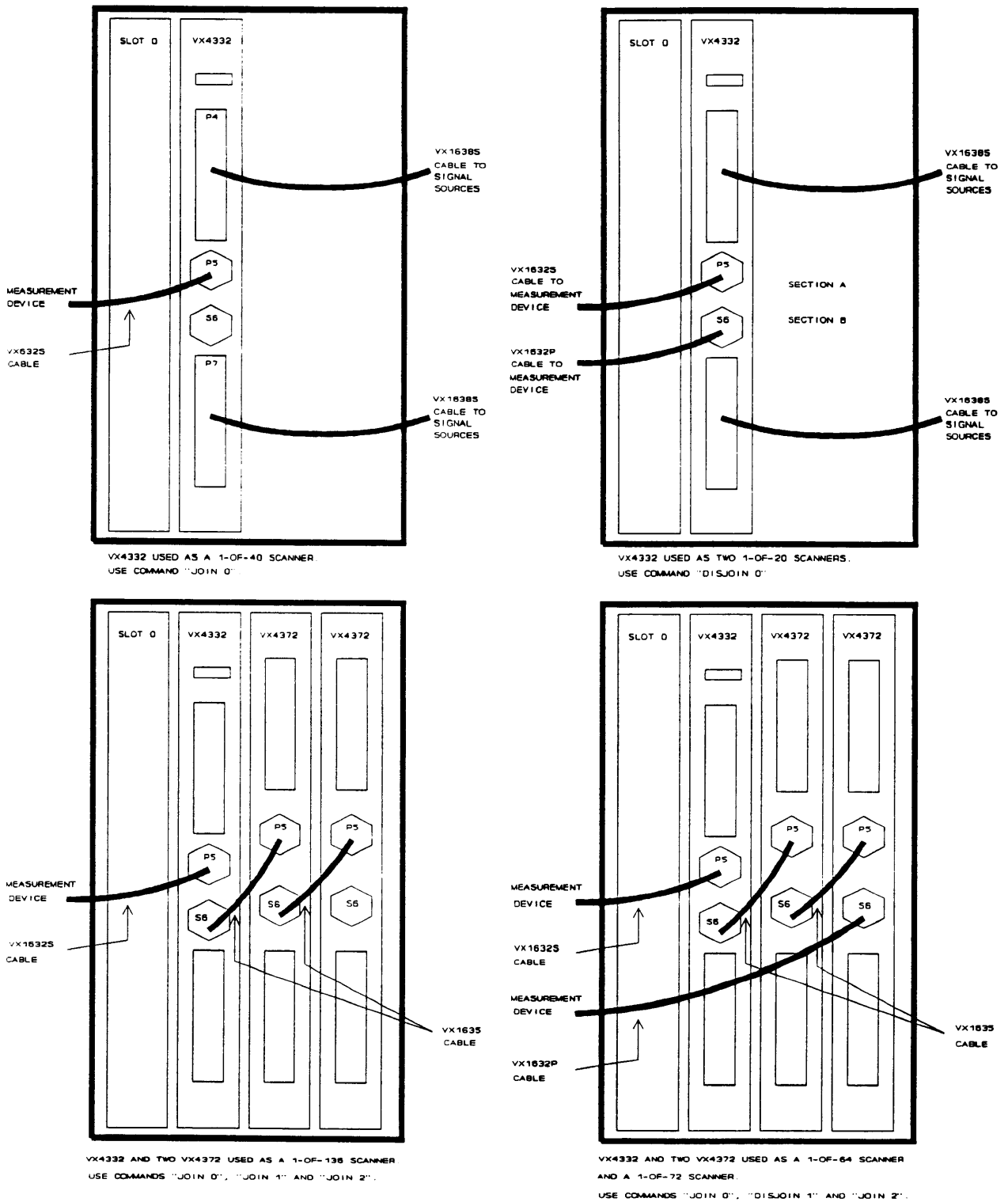


Figure 4: Cabling Examples

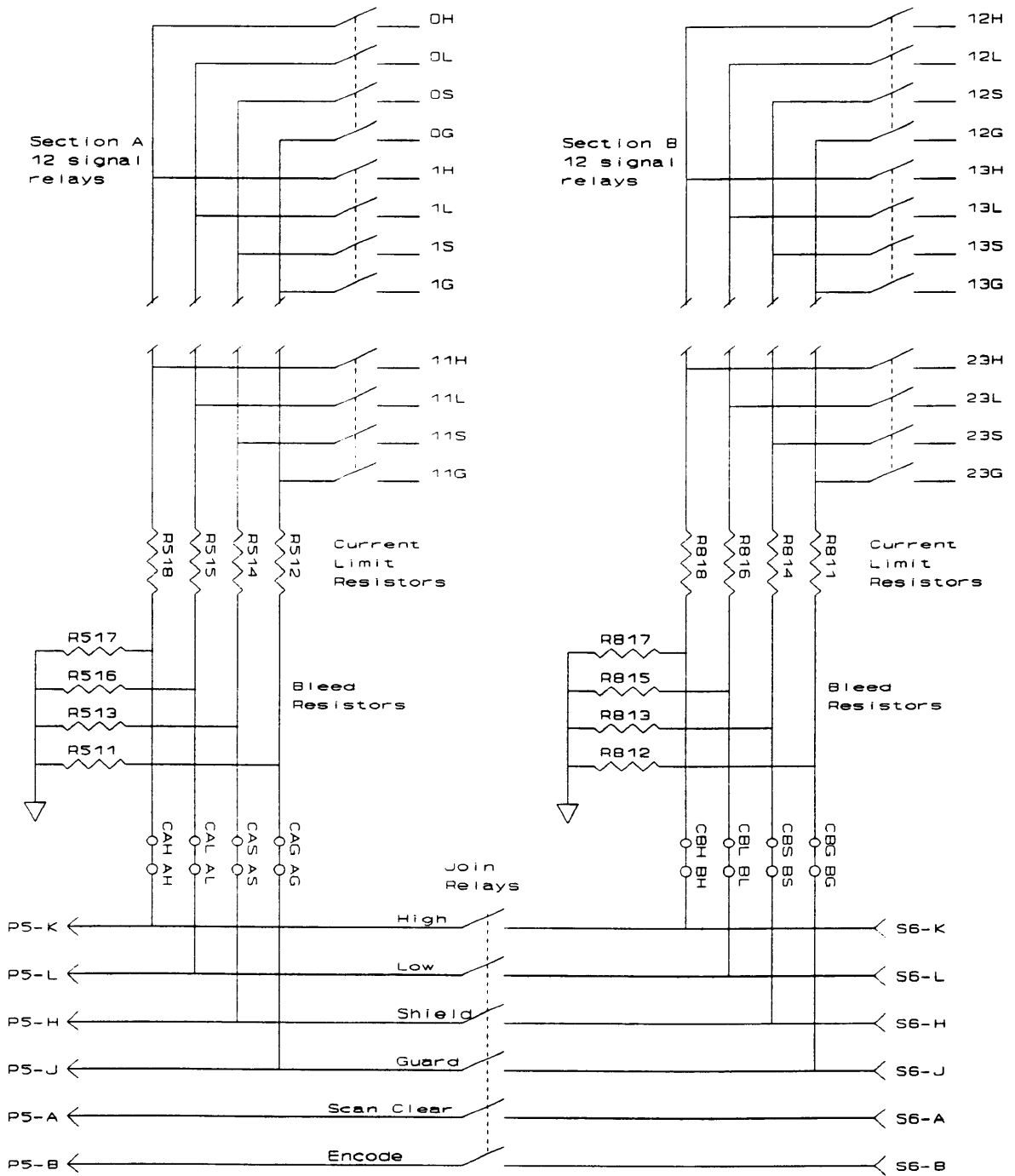


Figure 5: Jumpers and Optional Resistors

Installation Checklist

Installation parameters may vary depending on the mainframe being used. Be sure to consult the mainframe Operating Manual before installing and operating the VX4372 Module.

Revision Level: _____

Serial No.: _____

Mainframe Slot Number: _____

Switch Settings:

Local Bus Out Enable Switches: _____

Cable/Hooded Connector Installed:

VX1638S Cable: ___

VX1780S Hooded Connector: ___

VX1635 Cable: ___

VX1632S Cable: ___

VX1632P Cable: ___

Cuts and Jumpers:

Performed by: _____ Date: _____

Section 2

Section 3

Operation

Overview

The VX4372 is controlled by a master scanner (such as the VX4332) via the VXIbus local bus, and becomes an extension of the master, and part of a message based VXIbus multiple card instrument. Under the master's program control, it may be used as a 48-channel scanner, selecting one of 48 2-wire inputs, or as two 24-channel scanners, each independently selecting one of 24 2-wire inputs. Refer to the Operation section of the master scanner's manual for operation instructions.

This module has two sets of 24 relays with a default open and close delay time of one millisecond. On power-up, all relays, including the relays joining the two 24-channel sections, are open.

If the VX4372 loses power or its fuse blows, its front panel PWR LED will go out and the VX4372 will signal its master via the local bus. The master scanner will then cause the VXIbus signal SYSFAIL* to become active.

Section 3

Section 4

Programming Examples

Since the VX4372 is controlled by a master scanner (such as the VX4332) via the VXibus local bus, and becomes an extension of the master, and part of a message based VXibus multiple card instrument, no separate programming is required. Refer to the master scanner's Operating Manual for information on programming the system.

Appendix A

Input/output Connections

Signal Connectors

P4 and P7 are DD-50P connectors.

Channel 0	High	P4-1	Low	P4-18	Channel 24	High	P7-1	Low	P7-18
Channel 1	High	P4-2	Low	P4-19	Channel 25	High	P7-2	Low	P7-19
Channel 2	High	P4-3	Low	P4-20	Channel 26	High	P7-3	Low	P7-20
Channel 3	High	P4-4	Low	P4-21	Channel 27	High	P7-4	Low	P7-21
Channel 4	High	P4-5	Low	P4-22	Channel 28	High	P7-5	Low	P7-22
Channel 5	High	P4-6	Low	P4-23	Channel 29	High	P7-6	Low	P7-23
Channel 6	High	P4-7	Low	P4-24	Channel 30	High	P7-7	Low	P7-24
Channel 7	High	P4-8	Low	P4-25	Channel 31	High	P7-8	Low	P7-25
Channel 8	High	P4-9	Low	P4-26	Channel 32	High	P7-9	Low	P7-26
Channel 9	High	P4-10	Low	P4-27	Channel 33	High	P7-10	Low	P7-27
Channel 10	High	P4-11	Low	P4-28	Channel 34	High	P7-11	Low	P7-28
Channel 11	High	P4-12	Low	P4-29	Channel 35	High	P7-12	Low	P7-29
Channel 12	High	P4-13	Low	P4-30	Channel 36	High	P7-13	Low	P7-30
Channel 13	High	P4-14	Low	P4-31	Channel 37	High	P7-14	Low	P7-31
Channel 14	High	P4-15	Low	P4-32	Channel 38	High	P7-15	Low	P7-32
Channel 15	High	P4-16	Low	P4-33	Channel 39	High	P7-16	Low	P7-33
Channel 16	High	P4-34	Low	P4-35	Channel 40	High	P7-34	Low	P7-35
Channel 17	High	P4-36	Low	P4-37	Channel 41	High	P7-36	Low	P7-37
Channel 18	High	P4-38	Low	P4-39	Channel 42	High	P7-38	Low	P7-39
Channel 19	High	P4-40	Low	P4-41	Channel 43	High	P7-40	Low	P7-41
Channel 20	High	P4-42	Low	P4-43	Channel 44	High	P7-42	Low	P7-43
Channel 21	High	P4-44	Low	P4-45	Channel 45	High	P7-44	Low	P7-45
Channel 22	High	P4-46	Low	P4-47	Channel 46	High	P7-46	Low	P7-47
Channel 23	High	P4-48	Low	P4-49	Channel 47	High	P7-48	Low	P7-49
Ground		P4-17							
		P4-50							
		P7-17							
		P7-50							

Common Connectors

Section A or Common - P5.
P5 is a 10-pin male circular connector.

<u>Pin</u>	<u>Signal</u>
P5-A	Scan Clear*
P5-B	Encode*
P5-C	Join*
P5-D	Relay Closed Out*
P5-E	No Connection
P5-F	Ground
P5-H	Analog Bus Shield
P5-J	Analog Bus Guard
P5-K	Analog Bus High
P5-L	Analog Bus Low

Section B or Slave - S6.
S6 is a 10-pin female circular connector.

<u>Pin</u>	<u>Signal</u>
S6-A	Scan Clear*
S6-B	Encode*
S6-C	Join Sense*
S6-D	Relay Closed In*
S6-E	No Connection
S6-F	Ground
S6-H	Analog Bus Shield
S6-J	Analog Bus Guard
S6-K	Analog Bus High
S6-L	Analog Bus Low

* indicates Low True signal.