MODEL VXI-5534
VXI Quad Serial Interface Module
Instruction Manual

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APPLICABILITY

The programming portion of this manual applies to all units with revision 6 or later firmware. Users with earlier firmware versions should contact ICS Electronics to upgrade their units.

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Specifications

1.1 DESCRIPTION

1.1.1 VXI-5534 Quad Serial Interface Module

The VXI-5534 Quad Serial Interface Module provides four separate serial interfaces in a single wide VXI module. Each interface has its own logical address and can be independently programmed or addressed for data transfers. Each serial interface operates in a command mode or data mode. In the command mode, the serial interfaces accept configuration commands and status queries. All settings can be saved in nonvolatile memory for recall at power turn-on time. In the data mode, the serial interfaces provide transparent data transfer. Data transmission can be either direct or buffered for later output upon receipt of a VXIbus trigger. Received data is buffered in the VXI-5534's memory for transfer to the VXI controller. Each interface channel can be programmed to generate a VXIbus Interrupt upon receipt of a serial message or data. A four character LED display shows device addresses, interface status and error conditions.

Each of the VXI-5534's Serial Interfaces provides RS-232, RS-423 or RS-422/RS-485 compatible signals for asynchronous data transmission. Baud rates, character formats and transmission mode are independently programmable for each channel. An internal baud rate generator provides standard rates up to 115.2 Kbaud and custom baud rates up to 153.6 Kbaud. Internal termination networks can be switched into each channel's transmit and receive data lines for RS-422/RS-485 operation. Standard units have 10 Kbytes of buffer space for each channel which can be expanded up to 40 Kbytes per channel with the -M memory option.

Although the VXI-5534's hardware is capable of operating with asynchronous data transmission, synchronous bit oriented protocols and synchronous byte oriented protocols, the VXI-5534's standard firmware only provides for asynchronous data transmission. Extension of the VXI-5534 for operation with synchronous data transmission protocols requires additional custom firmware.

1.1.2 VXIbus Description

1.1.2.1 VXIbus Objectives

The goal of the VXIbus Consortium is to create an open industry standard for modular instruments by defining interoperability between vendors, mechanical and environmental requirements, EMC compatibility, system initialization and software communication protocols. The physical portion of the VXIbus specification was adapted from the existing VME bus specification (IEEE-STD 1014). VXI is an acronym for "**V**ME bus E**x**tensions for **I**nstrumentation."

The VXIbus specification details the technical requirements of VXIbus compatible components such as mainframes, backplanes, power supplies and modules. The specification also provides for interconnecting and operating different manufacturers' products within the same chassis. The latest revision of the specification is version 1.4. The success of the specification is evidenced by over 300 manufactures who make over 800 different VXIbus products and hundreds of users .

The IEEE Standards Committee, in its IEEE-STD 1155, has adopted the VXIbus consortium's specifications. The U. S. Air Force has also accepted the specifications as the basis for its Modular Automatic Test Equipment (MATE) Instrument on a Card (IAC) standard.

The VXIplug&play Alliance has defined several additional standards that simplifies the integration of multivendor VXI systems. The VXIplug&play Alliance has created a standard system framework concept that allows test programs in any language and operating system to be able to control VXI chassis and instrument modules through Standard Instrument Drivers. The VXIplug&play Framework identifies the operating system (OS) and applications development environment (ADE) used to generate the test software. The VXIplug&play Alliance just adopted an updated specification for a set of standard VISA Transition Library drivers that the Slot 0 Controllers and Embedded Computer vendors should adhere to assure VXIplug&play compatibility. The VISA (Virtual Instrument Software Architecture) drivers are used between the end user's test application program or general purpose test programs purchased from software vendors and the physical VXI modules or GPIB instruments. These VISA Transition Library (VTL) drivers are described in the VXIplug&play VPP-4.2 Specification Version 3.0 and are referred to as the VTL 3.0 drivers.

1.1.2.2 Advantages of VXIbus Based Systems

The VXIbus provides the user with the following advantages:

- Higher density packaging
- Increased system throughput
- More precise timing and device synchronization
- Standard protocols for instrument communication and control
- Ability to utilize existing VME modules
- Lower costs due to shared resources.

1.1.2.3 VXIbus System Configurations

VXIbus systems utilize a chassis with a backplane and a common power supply. Modules plug into the chassis from the front and communicate to each other over the backplane. The left most slot in each chassis is labeled slot 0 and it is reserved for the system or chassis controller. Modules in the other slots are servants to the system controller but can also be controllers and have their own servants. The Slot 0 controller must be capable of performing the resource manager function which initializes the other modules and assigns logical addresses for dynamically addressed devices, interrupt lines, and trigger lines. The Slot 0 controller may be an embedded computer or it may simply be a translator module driven by an external computer.

Each VXI device is addressed by its logical address. The address may be static and preset by the user or dynamic and set by the resource manager function during system initialization. The VXIbus specification allows for 256 logical addresses. Address 0 is reserved for the Slot 0 controller and address 255 is reserved for dynamic addressable devices that will have their address defined by the resource manager. A VXI system can contain a maximum of 254 logical devices.

A module may be a single logical device or contain multiple logical devices. Physically the module can also be one slot wide or occupy multiple slots. Full rack wide VXI chassis have 13 slots on a 1.2 inch centers and can hold up to 13 one slot wide modules. Chassis extenders allow multiple chassis to be interconnected together producing systems of up to 254 logical devices.

VXI based systems can also incorporate non-VXIbus devices. The most common variations are the inclusion of GPIB instruments in the system or the use of VME cards in the VXI chassis. Slot 0 controllers commonly have a GPIB interface for controlling the GPIB instruments so that their operation can be controlled from the same program as are the VXI modules. VME cards can function in a VXI chassis because the VXIbus Specification maintained compatibility with the VME bus by retaining the VME signals definitions for P1 and the center row of P2. Provisions were also made to address the registers in the VME modules just as they are currently addressed in a VME bus system.

1.1.2.4 Data Transfer Methods

VXI modules can be register or message based . Register based modules are typically controlled by direct reads or writes to registers in the module. Message based modules communicate with word serial messages that are strings of ASCII or binary bytes. Word transfer uses the VXI word serial protocol that examines bits in the modules's protocol register to maintain an orderly data transfer. Because of the word serial protocol, register based modules are typically faster than message based modules but they lack the intelligence of message based modules. A new Fast Data Channel specification provides for direct transfer of data from a module's memory to the Slot 0 Controllers at rates up to 32 Mbytes per second.

1.1.2.5 Additional information about the VXIbus

For additional information, contact the VXI Consortium for a copy of the VXI specification, the VXIplug&play Alliance for a copy of the VISA specification or ICS Electronics for Application Bulletins that describe VXI applications.

TABLE 1-1 VXIBUS GLOSSARY

Commander: A VXIbus device that has VME bus master capability and may have VXIbus servants under it in the system hierarchy. A Commander may act as a Servant to another Commander. A Commander must be message based.

Servant: A VXIbus device (with or without VME bus master capability) that is under control of a Commander in the VXIbus system hierarchy. A Servant may also be a Commander to other Servants. A Servant may be either message or register based.

Interrupt Handler: The module in the VXIbus system that generates the hardware interrupt acknowledge for a particular VME interrupt level. In VXIbus, the software interrupt handler may or may not be on the same module as the hardware interrupt handler.

Logical Address: A unique 8 bit number (0-255) which identifies each VXIbus device in a system. It defines the device's A16 register addresses

Resource Manager: A message based commander located at logical address 0 which provides configuration management services, including address map configuration, Commander/Servant mapping, self test, and diagnostic management.

VXI Message Based Instrument: An intelligent instrument that implements the defined VXIbus registers and, at a minimum, word serial protocol.

VXI Word Serial Messages: The simplest required communication protocol supported by Message Based devices in a VXIbus system. It utilizes the A16 communications registers to transfer data or commands as a series of characters on the VXIbus backplane. The end bit is asserted on the last character of the message. Uses Word Serial Commands: Byte Available and Byte Request.

VXI Word Serial Commands: Single word, 16-bit commands sent from the commander to its servants. Some Word Serial Commands have a response word. The VXI specification defines a number of standard Word Serial commands that are reserved for use by the Slot 0 Controller or the Resource Manager. The specification also allows instrument designers to define their own Word Serial Commands.

VXI Commands: These are commands passed from a Commander to a Servant within the VXIbus environment. There are three broad categories of commands: VXIbus Instrument Protocols, IEEE 488.2 Common Commands and Device specific commands. A command may or may not be stimulated by an external event. For example an IEEE-488 Group Execute Trigger will generate a trigger command to all addressed devices. However, a Begin Normal Operations command is generated by the VXIbus resource manager and has no external source.

VXI Events: VXIbus Events are passed from a Servant to a Commander. They may be generated by the Servant either in response to a command (e.g., an invalid command error), or due to an external condition (e.g., data ready or status change).

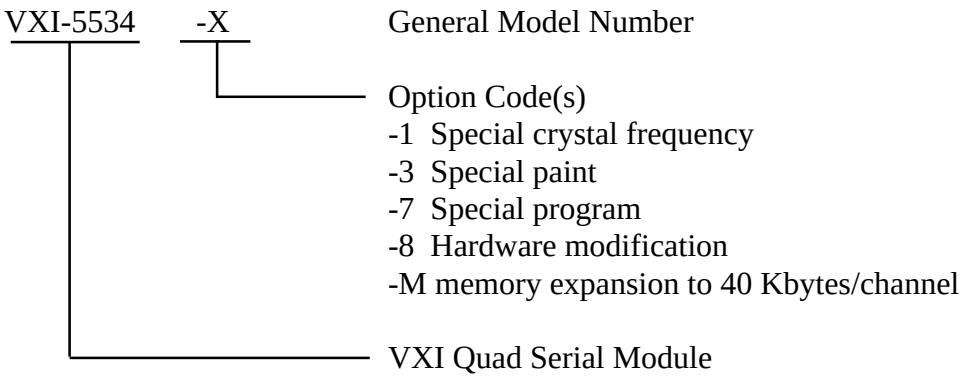
VXI Fast Data Channel: A method for exchanging data between a commander and a servant module that utilizes a minimum of handshaking to transfer data so that the data transfer rate approaches the theoretical VME bus transfer rate. May allow a commander access to portions of the device's memory or a register in the A24 or A32 address space. Data transfer is unidirectional for each channel and can be D16 or D32 bit words. Multiple channels may be opened for each device.

488-VXIbus Interface Device: An IEEE-488 to VXIbus Interface Device is a message based device which provides communication between the IEEE-488 bus and VXIbus instruments. Typically this function is included in the Slot 0 card for external control of the VXI chassis.

1.2 DETAIL SPECIFICATIONS

The following specifications apply in general to all VXI-5534 modules.

1.2.1 Model Number Designation



1.2.2 VXIbus Capabilities

The VXI-5534 has the following VXIbus capabilities:

Addressing	Static configured addresses 4-248 or dynamic configuration capability for four logical devices in one module. Address setting is for logical device #1 which is serial channel #1. Remaining devices (serial channels) use sequentially higher VXIbus addresses.
Manufacturer ID	4073 (ICS Electronics)
Device Class	Message based I4 class VXI instrument
Address Space	A16 only
Model Number	5534
Interrupter	Programmable Interrupter
Event Generator	Not implemented
VMEbus Master	Not implemented
Commander	Servant only capability
Signal Register	Not implemented
Handshake	Normal handshake only
Shared Memory	No capability
Primary Classification	I4

1.2.3 VXIbus Word Serial Commands

The VXI-5534 supports the following word serial commands:

Standard I4 Word Serial Commands

Abort Normal operation
Begin Normal operation
Byte Available
. Byte Request
Clear
End Normal operation
Trigger
Read STB
Read Protocol
Read Protocol Error

Programmable Interrupter Commands

Assign Interrupter Line
Read Interrupter Line
Read Interrupters

Event Generator Commands

Asynchronous mode control
Control Response
Control Event

ICS Defined Commands

Cmd Mode	-	Accepts Commands and responds to queries.
Data Mode	-	All Word Serial messages are considered serial data.
Arm Trigger	-	Select TTL Trigger Line and send buffer number.

1.2.4 Status Byte Response

The VXI-5534 logical devices respond to the Read STB command by sending a byte equivalent to the serial poll response in IEEE Standard 488.2. The bit assignments are:

Bit	Meaning
7	Output Done
6	Request Service (RQS)
5	Event Status Summary bit
4	Message Available bit
3	Receive Error
2	Transmit Buffer Empty
1	Receive Buffer Not Empty
0	Msg Received/Data Count Exceeded

The on condition of the corresponding bit in the RQS mask byte enables generation of a Request Service Interrupt at the next occurrence of the unmasked bit. Bits with 0's in the RQS mask byte will not generate an interrupt, but they will be reported in the STB response byte. Status bits 0 and 1 are high when their corresponding status line is in its logical true state as defined by the user.

1.2.5 VXIbus IEEE 488.2 Common Commands

The VXI-5534 supports the VXIbus IEEE 488.2 Common Commands listed in Table 1-2 to perform functions such as service request enable, event status register query and status byte query, etc. Common Commands always begin with an asterisk (*), and may include one or more parameters. Detailed descriptions of the commands can be found in IEEE Std 488.2-1987.

TABLE 1-2 VXIBUS IEEE 488.2 COMMAND LIST

Command	Title	Description
***CLS**	Clear status register	Clears all Event Registers and updates status byte register
***ESE <mask>**	Event status enable.	Sets the bits in the Event Status Enable Register
***ESE?**	Event status enable query	Queries the current contents in the Event Status Enable Register
***ESR?**	Event status register query	Queries and clears contents in the StandardEvent Status Register
***IDN?**	Identification query	Returns identification string of the VXI-5534
***OPC**	Operation complete	Sets OPC bit in the Standard Event Register when all pending operations are completed[1]
***OPC?**	Operation complete query	Returns a 1 to the output queue when all pending operations have completed[1]
***RCL 0**	Recall command	Restores the state of the device from stored parameters
***RST**	Reset	Resets the VXI-5534 logical device to a specific state[1]
***SAV 0**	Save command	Saves current state parameters for recal at power on.
***SRE <mask>**	Service request enable	Sets the enable bits in the Service Request Enable Register
***SRE?**	Service request enable query	Queries the current contents in the Service Request Enable Register
***STB?**	Read status byte query	Queries the current contents in the Status Byte Register
***TRG**	Trigger	Starts transmission of a selected buffer.
***TST?**	Self-test query	Returns 0 unless self test fails[1]
***WAI**	Wait to Continue	Halts execution of commands and queries until the current operations is completed[1]

[1] These commands have limited usefulness with the VXIbus. See Chapter 3 for more information.

1.2.6 Serial Interfaces

The VXI-5534 provides four serial interfaces for asynchronous communication with external devices. Each interface supports RS-232, RS-423 or RS-422/RS-485 serial links. The interfaces use 9-pin connectors. The RS-232 signals are pin compatible with the 9-pin COM port on any IBM AT compatible PC.

1.2.6.1 RS-232 Specifications

Signals	BA, BB, CA, CB, CC, CD, CF and CI Signal ground is AB. Shield is AA
Transmit Levels	+12 ±2 Vdc = logic '0' or on -12 ±2 Vdc = logic '1' or off
Receive Levels	±1.5 Vdc minimum ±25 Vdc Maximum
Mode	Full duplex

1.2.6.2 RS-423 Specifications

Identical to the RS-232 specifications listed in 1.2.5.1 above except for reduced transmission levels. Waveshaping is set for 115.2 Kbaud.

Transmit Levels	+5 ±1 Vdc = logic '0' or on -5 ±1 Vdc = logic '1' or off
Receive Levels	± 0.2 Vdc minimum ± 25 Vdc Maximum

1.2.6.3 RS-422/RS-485 Specifications

Signals	TX, RX, CLKO, CLKI Balanced lines Signal ground is SG. Shield is chassis ground
Transmit Levels	+2.5 Vdc differential for binary '0' or on -2.5 Vdc differential for binary '1' or off
Receive Levels	±0.2 Vdc minimum ±25 Vdc maximum differential or between any signal and SG
Mode	Full or half duplex

1.2.6.4 Data Character Formats

Data bits 5, 6, 7 or 8 bits/character

Parity Odd, even or none

Stop bits 1 or 2

1.2.6.5 Baud Rates

Internal baud rates can be selected from 150 to 115,200 baud. Standard rates are: 150, 300, 600, 1200, 2.4 K, 4.8 K, 7.2K, 9.6 K, 19.2 K, 38.4 K, 57.6 K, 76.8K and 115.2K. Baud rate accuracy is ±0.02 %. Other internal baud rates are programmable up to 153.6 Kbaud by specifying the baud rate generator time constant. Combined baud rate for a channel pair (channels 1 & 2 or channels 3 & 4) should not exceed 230.4 Kbaud.

1.2.6.6 X-On/X-Off Protocol

X-on/X-off protocol for flow control can be separately enabled for each serial channel.

1.2.6.7 Serial Buffers

Each serial interface includes the following data buffers:

Buffers	Standard Units	Extended RAM Units
Transmit	4,092 bytes	16,380 bytes
Trigger Buffers	4 @ 512 bytes	8 @ 1,024 bytes
Receive Buffer	4,092 bytes	16,380 bytes

1.2.6.8 Termination Resistor Network

For RS-422/RS-485 applications, the VXI-5534 serial interfaces can be configured to switch a termination resistor network across the Tx and Rx signal pairs by a VXIbus command. The termination resistor networks are mounted on plug-in headers. The standard termination network is a 220 ohm load with 1 Kohm pullup and pulldown resistors to hold undriven Tx/Rx lines at +2.7 and +2.2 volts. VXI-5534 channels must be configured in pairs as RS-422/RS-485 interfaces to use the resistor termination networks.

1.2.7 Configuration Commands

The VXI-5534 uses the commands listed in Table 1-3 to configure its serial interfaces. Configuration settings can be stored in the VXI-5534's nonvolatile memory for recall when the unit is powered on or reset.

TABLE 1-3 CHANNEL CONFIGURATION COMMANDS

Command	Description
BAUD n <nl>	Sets baud rate to standard values.
BAUD# n <nl>	Sets baud rate time constant for non-standard baud rates.
BITS n <nl>	Sets number of data bits per character
CONFIG? <nl>	Requests current configuration message
DEFAULT <nl>	Sets all configuration parameters to defaults
EXTRN RECV	Selects external clock input for receive
EXTRN TRANS	Selects external clock input for transmit
EXTRN OFF	Selects internal baud rate clocks
EXTRN CLK X1	Selects times 1 baud rate clock
EXTRN CLK X16	Selects times 16 baud rate clock
LOOPBACK a <nl>	Selects data loopback ON/OFF for testing
PACE a <nl>	Enables X-on/X-off flow control
PARITY a <nl>	Sets parity generation and detection
PDEFAULT a <nl>	Sets the power on default mode (command or data)
SAVE <nl>	Stores the current configuration in EEPROM
SBITS n <nl>	Sets number of stop bits per character
SETBUFINT n <nl>	Sets number of received characters which set the DIO1 bit in the Status Byte.
SET EOM hh <nl>	Sets the End-Of-Message byte
SET MASK hh <nl>	Sets the received character mask byte
STORE n, <string> <nl>	Stores data in Trigger Buffer (n)
TERMRES <bool> <nl>	Switches termination network in/out for RS-422/RS-485 operation.
TRIGGER n <nl>	Sends data from buffer (n).
TYPE a <nl>	Selects RS-232 (RS-423) or RS-422/485 interface and transmission mode

1.2.8 Front Panel Indicator

The VXI-5534 has a four character alpha numeric display on the front panel which displays status, logical device addresses and diagnostic messages. The display cycles through a series of status and information messages at power turn-on and during self test. During normal operation, the display shows the currently addressed serial channel. The display can be manually set to show diagnostic messages with the DISPLAY push-button.

Display	Meaning
SysF	SYSFAIL asserted, Self test in progress
Init	VXI-5534 passed self test and module initialized
Rdy	VXI-5534 Ready (Begin Normal Operation received)
SER1	Serial Interface #1 addressed
SER2	Serial Interface #2 addressed
SER3	Serial Interface #3 addressed
SER4	Serial Interface #4 addressed
FAIL	Failed Self Test
ERnn	Error Code Number (nn)

1.2.9 Physical

Size	C size VXI module
Dimensions	352.43 mm long x 233.35 mm high x 30.18 mm wide
Weight	1.79 Kg (3.94 lbs) including RF shields
Power	5 Vdc at 2 A max
	± 12 Vdc at 0.2 A
Temperature	0 °C to 55 °C operating
	-20 °C to 70 °C storage
Serial Connectors	9-pin, DE-9P with 4-40 lock studs

1.3 ACCESSORIES

1.3.1 Supplied Accessories

The following accessories are supplied with each VXI-5534 module.

Qty.	Part Number	Description
1	120134	VXI-5534 Instruction Manual

2

Installation

2.1 UNPACKING AND INSPECTION

If shipping carton or instrument is damaged, call carrier immediately and inspect the contents for damage (scratches, dents, etc.). Retain shipping carton and packing material for carrier's inspection. If unit is damaged or fails to meet specifications, notify ICS Electronics Corporation or your local sales representative immediately. ICS will make arrangements for unit to be repaired or replaced without waiting for claim against carrier to be settled.

2.2 SHIPMENT VERIFICATION

Take a moment to verify that you have everything you need. If you ordered a standard VXI-5534 module, we should have sent you:

(1)	VXI-5534	VXI Module
(1)	120134	VXI-5534 Instruction Manual

If anything is missing or defective, please contact ICS Electronics immediately.

2.2 INSTALLATION

The VXI-5534 Quad Serial Module is ready for RS-232 and RS-422/RS-485 operation when shipped. For RS-423 operation, set the internal jumpers as described in paragraph 2.4.2. To enable the internal termination resistor networks for RS-422 and RS-485 applications, install the Switch ICs per paragraph 2.4.3.

To install the VXI-5534 in a C size VXI chassis, select an empty slot and remove the slot cover plate. Turn off chassis power. Set the module's logical address as described in paragraph 2.3 before installing the module in a VXI chassis. Slide the VXI-5534 module into the chassis with the LEDs up (or to the left in the case of a horizontal chassis) until the connectors start to engage the backplane connectors. Press the module firmly into the backplane connectors until the front panel stops at the chassis rails.

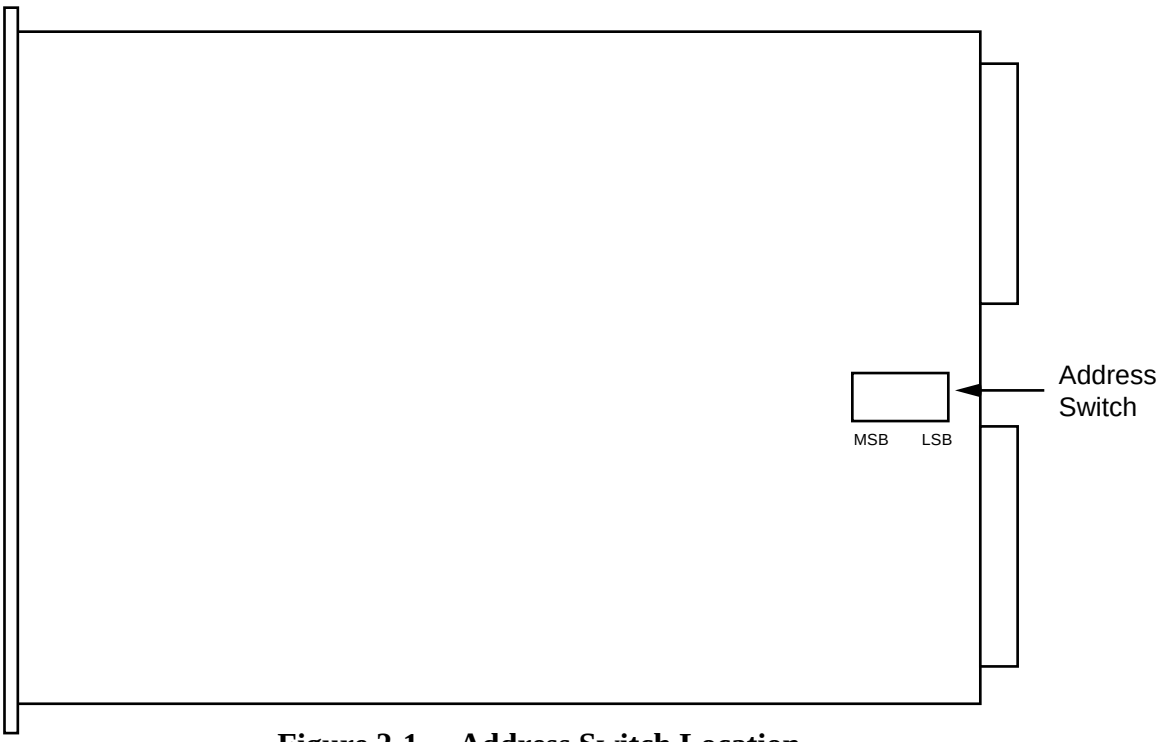
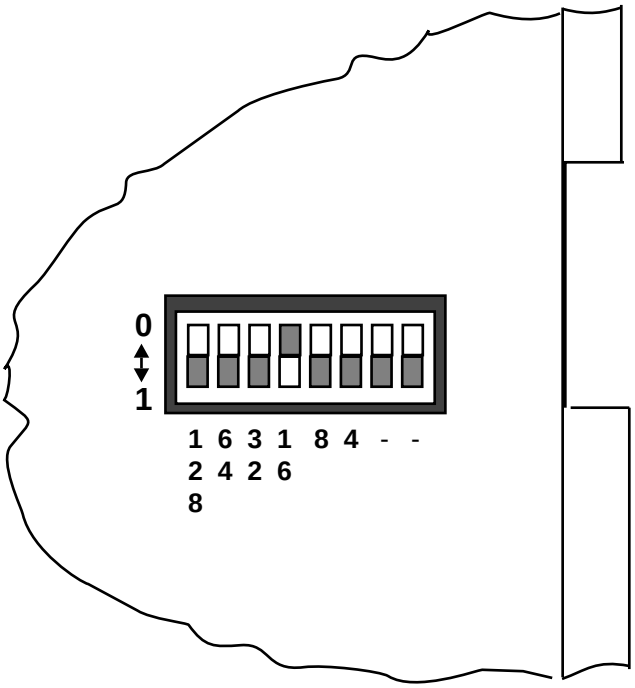


Figure 2-1 Address Switch Location



Note - White blocks show switch set to logical address 16 (10 HEX)

Figure 2-2 Address Switch Layout

2.3 ADDRESS SWITCH SETTINGS

The VXI-5534 has an internal address switch located on the rear of the module between P1 and P2 for setting the VXI-5534's logical address. The address switch is accessible through an opening in the cover of the module when the module is removed from the VXI chassis. Figure 2-1 and Figure 2-2 shows the switch layout and rocker bit weights. A rocker in the 'on' or up position is set to logic '1'. A rocker in the 'off' or down position it is set to logic '0'. When shipped, the VXI-5534 address switch is set to 16 by the factory.

> CAUTION: The VXI-5534 requires four consecutive VXI addresses starting with its address switch setting. **Do not set rockers 1 and 2 on** and do not set any other VXI module address in this address range.

The VXI-5534's four serial channels use four sequential VXIbus addresses as shown by the following figure:

1								
2	6	3	1					} Switch rocker weights
8	4	2	6	8	4	-	-	
A	A	A	A	A	A	0	0	} Channel #1
A	A	A	A	A	A	0	1	} Channel #2
A	A	A	A	A	A	1	0	} Channel #3
A	A	A	A	A	A	1	1	} Channel #4

Note-A = Logical Address Setting

2.3.1 Static Address Switch Setting

Set the logical address to any unused value from 4 to 248 in steps of 4. Address rockers 1 and 2 are not used for address setting and must be set to OFF.

1								
2	6	3	1					
8	4	2	6	8	4	-	-	← Switch rocker weights and use
8	7	6	5	4	3	2	1	← Address switch rockers
0	0	0	1	0	0	0	0	← Factory default address (logical address 16)

2.3.2 Dynamic Configuration Setting

To enable dynamic configuration of the module's logical address by the Resource Manager[1], set the address switch to 252 (all ones). Again switch rockers 1 and 2 are not part of the module's address setting and must be set to OFF.

[1] The Resource Manager is a function in the Slot 0 commander module.

2.3.3 Checking the VXI-5534's Logical Device Address

To check the address setting of the module, press the DISPLAY MODE button with a small thin object (a tooth pick will do) until **Addr** is displayed, then release the button. The display will indicate the selected address in the form **A=xx**, where xx is the VXIbus address in hexadecimal notation.

2.3.4 Resetting the VXI-5534 E^{2}PROM

Bit 1 on the VXI-5534 Address Switch enables resetting the E^{2}PROM to the factory default settings when its has become corrupted. The E^{2}PROM is tested each time the VXI-5534 performs its self-test. If the E^{2}PROM fails its test, the LEDs will display the ER03 message. To restore the E^{2}PROM to the factory defaults, set Address Rocker 1 on and reset or turn on the module. When done, reset the Address Rocker 1 to its off position to prevent accidental overwrites of the E^{2}PROM contents.

NOTE-Thisprocedureoverwritesanyusersetting.Youwillhaveto restoreandre-saveyoursettingsafterrestoringtheE ^{2}PROM.

2.4 SERIAL INTERFACE

The VXI-5534 has four 9 pin DE-9P connectors with lock studs that independently provide either RS-232, RS-423 or RS-422/RS-485 signals. Table 2-1 shows the serial signal assignments and the signal direction relative to the VXI-5534.

TABLE 2-1 SERIAL INTERFACE PIN ASSIGNMENTS

Pin Number	Signals and Direction		
	RS-232/RS-423	RS-485 FD	RS-485 HD
1	DCD ←	Rx+ ←	-
2	Rx ←	Rx- ←	-
3	Tx →	Tx- →	Tx/Rx-
4	DTR →	Tx+ →	Tx/Rx+
5	DGND	DGND	
6	DSR ←	CLKO+ →	-
7	RTS →	CLKO- →	-
8	CTS ←	CLKI+ ←	-
9	RxCLK ←	CLKI- ←	-
Shell	Chassis	Chassis	Chassis

Note: Signal direction arrows ←=into VXI-5534, →=out from VXI-5534

2.4.1 RS-232 Connections

When RS-232C signals are selected, the signal pinouts are compatible with those on the 9-pin COM port of an IBM AT or clone computer. The VXI-5534's RS-232 signals can be expanded out to a 25 pin connector with the use of a standard 9 pin-to-pin- 25 pin adapter cable. The RS-232 column in Table 2-1 shows the RS-232 signal pin assignments and their direction relative to the VXI-5534. Figure 2-3 shows the standard 9 pin to 25 pin adapter wiring. For minimum RS-232 connections, use the serial signals on pins 2, 3 and 5. Jumper the unused RS-232 control lines back to themselves as follows: RTS to CTS and DTR to DSR and DCD. Implement either the hardware or software flow control if the serial messages could overflow either devices' receive buffer.

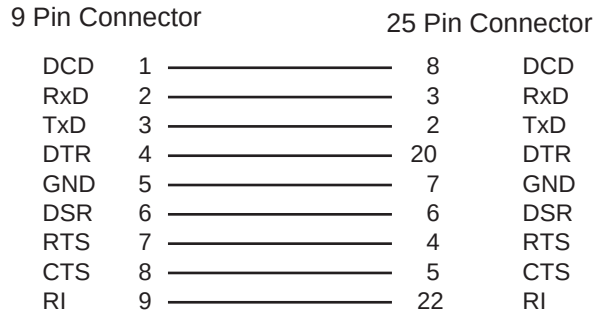


Figure 2-3 DTE 9 Pin to 25 Pin Adapter

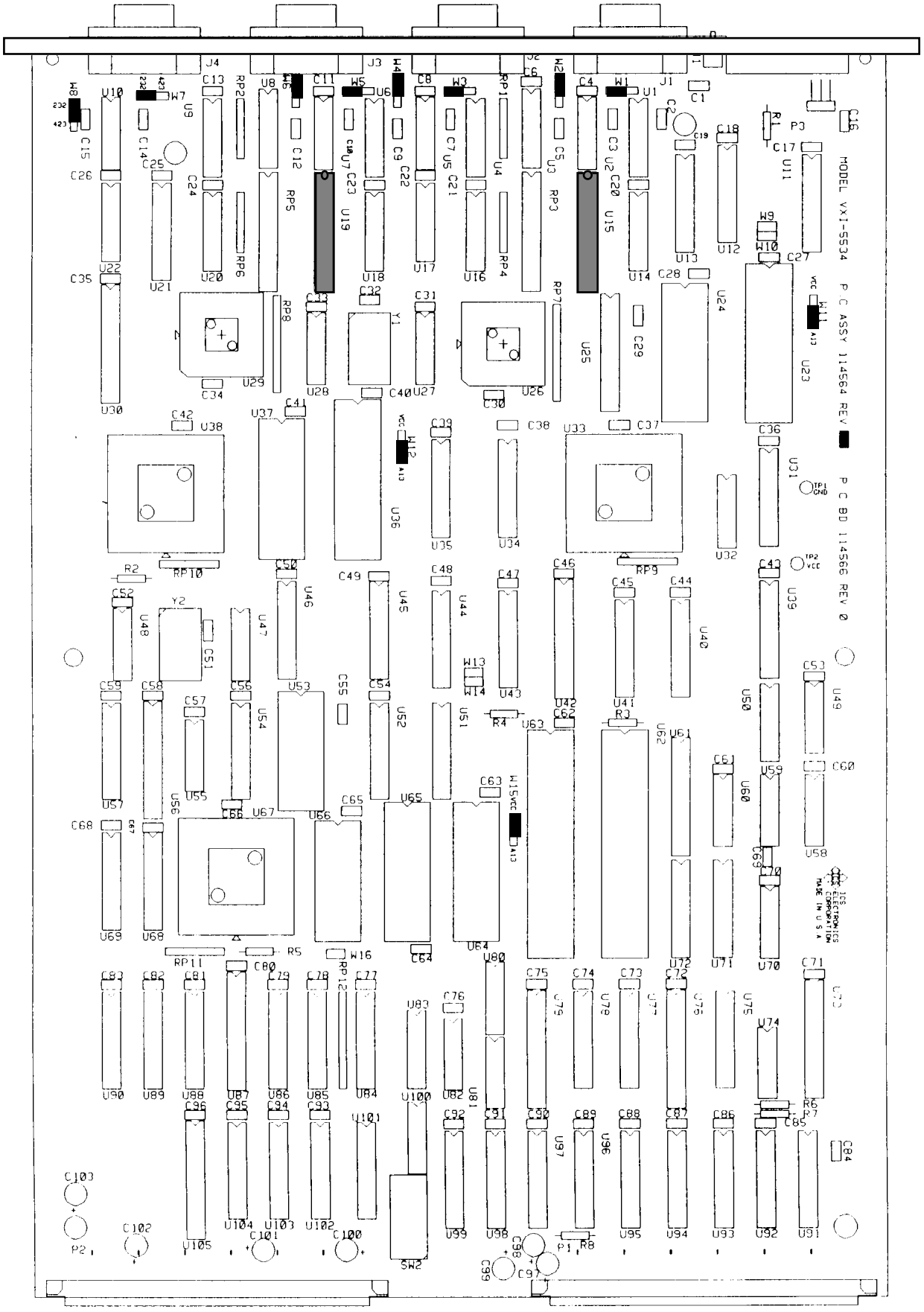


Figure 2-4 VXI-5534 Jumper Locations (Factory Settings)

2.4.2 RS-423 Signal Connections and Setup

RS-423 signal levels are set by moving a pair of jumpers per serial channel to a lower voltage position and operating the channel in the RS-232 mode. The jumpers are independent so the signal selection may be made on a channel-by-channel basis.

Figure 2-4 shows the location of jumpers W1 through W8. The black squares show the factory setting for RS-232 ±12 volt operation. All of the odd numbered jumpers are oriented across the board and the even numbered jumpers are oriented lengthwise on the board. The silkscreen on W7 applies to all odd jumpers; the silkscreen on W8 to all even numbered jumpers. To change the jumpers for a channel, refer to Table 2-2 for the corresponding W numbers and position the jumper as shown by the silkscreen on W7 and W8.

TABLE 2-2 RS-232/RS-423 JUMPERS

Channel	+ Jumper	- Jumper
1	W1	W2
2	W3	W4
3	W5	W6
4	W7	W8

Follow the directions in paragraph 2.4.1 to connect the RS-423 signals to the VXI-5534.

2.4.3 RS-422 and RS-485 Signal Connections and Terminations

When RS-422/RS-485 signals are selected, the signals change from single-ended, bipolar signals to two-line differential signals. The number of signals on the serial interface is reduced from 8 to 4. In full-duplex applications, the minimum connection is four wires (2 for transmit and 2 for receive) between the VXI-5534 port and the other RS-422 or RS-485 device. In half-duplex applications, only two wires are used to connect the VXI-5534 to the other devices. The 'A' signal is normally low (mark) and goes high (space). The 'B' signal is normally high (mark) and goes low (space). Table 2-1 lists the serial interface pinouts and signal directions for both modes.

The VXI-5534 does not support hardware handshaking for RS-422 and RS-485 transmission systems. Implement software flow control if the serial message length could overflow either devices' receive buffer.

VXI-5534s are shipped with internal terminating resistor networks that can be switched across the Tx and Rx signal pairs in either RS-485 mode. (Termination resistor networks are normally required in half-duplex systems to avoid transmission errors.) Each network consists of a 220 ohm load and 1 Kohm pullup and pulldown resistors that maintains a minimal differential voltage on the lines when the transmitter is tristated. The terminating networks are on plug-in modules so the resistor values can be easily changed by the user.

The switching is done by the two Switch ICs that were shipped with the VXI-5534. IC U15 switches the networks for channels 1 and 2. U19 switches the networks for channels 3 and 4. To configure a channel pair, remove the component side cover and install the Switch IC in U15 and/or U19 on the board as shown by the gray ICs in Figure 2-4. Two Switch ICs are supplied fastened to the inside of the component side cover. When they are not required for switching, they should be placed back in their original position so they will not interfere with the other VXI-5534 components.

CAUTION - While the Switch IC is installed, both channel pairs (1&2 or 3&4) must be used for RS-422 or RS-485 signals. RS-232 or RS-423 operation is not possible with the Switch IC installed.

3

Operation and Programming

3.1 INTRODUCTION

This section describes how to program and use the VXI-5534. This includes directions for using the Front Panel Display for diagnostics, for configuring the serial channels and for sending and receiving serial data.

3.2 FRONT PANEL DISPLAY

The VXI-5534 has a four character alphanumeric display on the top of its front panel that has four different display modes. The modes are selected by the Display Mode Button located below the display.

3.2.1 Power Turn-On Display

At power turn-on or when reset, the display operates in the Normal mode and displays the VXI-5534's status and last addressed serial channel. The power-on display sequence is:

SysF	On during self-test while SYSFAIL is asserted. If on after 4.9 seconds, the module could be defective or SYSFAIL is being held on.
ICS	Momentary on after self-test is passed.
5534	Momentary on after self-test is passed.
FAIL	On only if self-test failed or the module was commanded into the failed state.
Init	On after self-test passed while module is waiting for a Begin-Normal-Operation command.
Rdy	On after Begin-Normal Operation command is received.
SERn	On when a serial channel (n) has been addressed. 1<=n<=4

If the unit fails self-test, **FAIL** will be displayed for 5 seconds and then the display will show the appropriate error code (**ERxx**). The error codes are listed in Section 5.

TABLE 3-1 VXI-5534 DISPLAY MODES

Display Mode	Description
Norm	The **Norm** or normal mode selects the power on messages listed in Table 3-2A.
Extd	The **Extd** or extended mode selects the messages in Table 3-2B for display. These messages are useful for system testing and debugging.
Addr	The **Addr** or address mode is a temporary mode that displays the units current VXIbus address setting in hexadecimal form for 5 seconds. The unit then returns to is prior mode.
Stat	The **Stat** mode is a temporary mode that displays some of the VXI protocol register information in hexadecimal form for 5 seconds. The unit then returns to is prior mode. The Stat display is : **Most significant digit** — **Least Significant Digit** Bit 1 Channel #3 Wr Rdy — Bit 1 Channel #1 Wr Rdy Bit 2 Channel #3 Rd Rdy — Bit 2 Channel #1 Rd Rdy Bit 4 Channel #4 Wr Rdy — Bit 4 Channel #2 Wr Rdy Bit 8 Channel #4 Rd Rdy — Bit 8 Channel #2 Rd Rdy
SfSt	The **SfSt** mode is a temporary mode that displays the current Self-Test status on the least significant digit for 5 seconds. The unit then returns to its prior mode. The SfSt display is: **Least Significant Digit** Bit 1 Channel #1 Bit 2 Channel #2 Bit 4 Channel #3 Bit 8 Channel #4
Sv1T **Sv2T**	The **Sv1T** and **Sv2T** modes start a continuous test of the slave processors. Slave #1 supports Serial channels 1 and 2; slave #2 supports serial channels 3 and 4. In this mode, the selected processor is reset and allowed to only run its self-test routine. If its self-test passes, **Pass** will be displayed for 3 seconds and then the processor repeats the test routine. Messages **Tst1** or **Tst2** indicate that the test is in progress. To exit the **Sv1T** or **Sv2T** modes, press the Display Mode button to reset the unit and resume normal operation. If the slave process or failed to respond or run its test, the display will show **NOrs** for 3 seconds and then attempt to rerun the test.
Rst	The **Rst** selection will reset the VXI-5534 processors just as if a reset was received from the VXIbus. However, this type of reset does not reset the VXI-5534's hardware.

3.2.2 Display Mode Button

The Display Mode Button is a recessed bush button located below the display as shown in figure 3-1. The button selects the VXI-5534 diagnostic and display modes. Table 3-1 on the facing page describes the diagnostic and display modes. Tables 3-2A and 3-2B list the Normal Mode and Extended Mode Messages.

To change the display mode, gently hold the button closed. Use a toothpick or sone other small thin rod. The display will first show the current mode and after two seconds advance through the other modes. Release the button when the display shoes the desired mode. Momentarily pressing the Display Mode Button will cause the display to show the current mode without changing it.

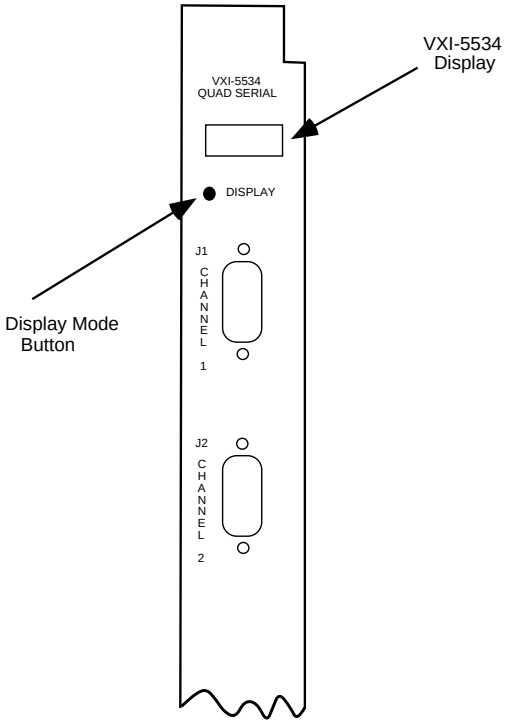


Figure 3-1 Display Mode Button Location

TABLE 3-2A VXI-5534 NORMAL MODE MESSAGES

Display	Meaning
5534	Power on ID message
BgN*n*	Begin normal operation for channel *n*
E2Sv	Data written to the E^2PROM
FAIL	Self Test failed
ICS	Power on ID message
Init	Initialized, waiting for begin normal operation command
NMI0	No slave access
NMI1	Slave 1 access error
NMI2	Slave 2 access error
Rdy	Normal ready message, begin normal operation received
SysF	SysFail Asserted
NOrs	No response from slave in Sv1T or Sv2T tests.
Pass	Selected slave test passed
Tst1	Slave1 test in progress
Tst2	Slave2 test in progress

TABLE 3-2B VXI-5534 EXTENDED MODE MESSAGES

Display	Meaning
Clr*n*	Serial channel *n* Clear command received
Dyn*n*	Dynamic configuration channel *n*
ER*nn*	Error message - see Table 5.1
Errn	Unsupported command error
Int?	Unserviced interrupt
Rpe*n*	Serial channel n Read Protocol Error query
SER*n*	Serial channel *n* write
ser*n*	Serial channel *n* read
SfR*n*	Serial channel *n* Soft reset
Spl*n*	Serial channel *n* Read STB query (Serial Poll)
S*n*ok	Serial channel *n* okay
S*n*cm	Serial channel *n* in command mode
S*n*dt	Serial channel *n* in data mode
Arm*n*	Serial channel *n* Arm Trigger command
Trap	Software Trap due to faulty processor command
Trg*n*	Serial channel *n* Trigger command

3.3 GENERAL OPERATING INSTRUCTIONS

New users and programmers not experienced with the VXI-5534 should read Section 3 of this manual. The few minutes it takes will save you may hours of needless work and speed up the integration of the VXI-5534 into your system

3.3.1 Pre-Operation Setup

Before using the VXI-5534, prepare the serial connections. If RS-232 or RS-423 signals are being used, their pinouts are the same as a PC's 9-pin COM port. Either use a cable with 9 pin connectors or use a 9-pin to 25-pin adapter to mate with standard 25-pin cables. If RS-422 or RS-485 signals are being used, wire the differential signals into the 9-pin plug. Use the pin assignments given in Table 2-1.

> CAUTION - If the Switch IC was installed per 2.4.3, remember that channels with the Switch IC installed will not operate correctly with RS-232 or RS-423 signals.

Set the VXI-5534's address switch as directed in Section 2. Slide the unit into its appropriate slot in the VXI chassis.

3.3.2 Operation

Turn the VXI chassis power on. The VXI-5534's display should cycle through its identification sequence while the unit does its power-on self-test. If the display shows **Rdy** the module is good and had received the Begin-Normal-Operation command. If the display shows **Init**, it is good but is waiting for the Begin-Normal Command. If the display shows other messages, refer to paragraph 3.2.

At power turn-on or when reset, all VXI-5534 serial channels default to the Command Mode. Anything sent to the serial channels while they are in the Command Mode is considered a command. Use the command mode to configure the serial channels as described in paragraph 3.3.3. below and to query the channels.

The serial channels must be individually put into the Data Mode before sending data and to enable the UART to receive data. In the Data Mode, the serial channels transparently transfer data between the serial ports and the VXIbus. Any thing sent to the serial channels while they are in Data Mode is considered data.

The VXI-5534 uses Word Serial Commands to switch the serial channels between Command Mode and Data Mode. If you are not familiar with the VXI Word Serial Command concept, refer to paragraph 3.7 for more information about using Word Serial Commands with the VXI-5534. The Word Serial DataMode command is 0000 hex (0x0). The Word Serial CmdMode command is 0100 hex (0x100)

3.3.3 Configuring the Serial Interface

If this is the initial use of the VXI-5534, its interfaces should be configured at this time. Table 3-3 lists the VXI-5534's Configuration Commands, the command definitions and the factory default settings. Reset the unit or use the Word Serial CmdMode command (0100 hex) to put the channel into the command mode. The suggested approach is to use the CONFIG? query to read the current configuration and then to make the necessary changes to adapt the channel to your use. After configuring a channel, use the CONFIG? query to verify that all changes were made. Use the 488.2 *SAV 0 command or the VXI-5534 SAVE command to save the current configuration as the new power-on default values. Saving the values completes the configuration process . The VXI-5534 will used the saved values to setup the unit anytime it is reset or turned on.

Use the Word Serial DataMode command (0000 hex) to switch back to data mode and enable data transmission/reception.

The user can override the current VXI-5534 configuration at any time by putting the channel into the Command Mode and sending it a new Configuration command. Configuration values are reset to the saved values at power turn-on or when the unit is reset.

3.4 VXI-5534 CONFIGURATION COMMANDS

The VXI-5534 accepts SCPI like commands to configure its serial interfaces and its operation. The commands are sent to the VXI-5534's serial channel as Word Serial Messages when the channel is in the Command Mode. The channel goes into the Command Mode at power turn-on, when reset or by the Word Serial CmdMode command (see Table 3-6).

3.4.1 Command Formats

The VXI-5534 commands are single word commands and do not have SCPI's tree and branch structure. The commands are not case sensitive so upper or lower case letters may be used for legibility. A space is required between the command and a parameter but not between the command and the question mark. Multiple commands can be put on one line by separating them with semicolons. When multiple commands are used, any query should be the last command. The following examples show some legal command variations:

```
BAUD 9600
DEFAULT; BAUD 19200
BAUD 9600; BITS 8; CONFIG?
```

3.4.2 Configuration Command Table

Table 3-3 lists the configuration commands and describes their functions in detail. Commands other than those listed in the table will have no affect on the VXI-5534's operation and a command error will be reported. If the display indicates an error, the VXI-5534 may have detected a command error and the command was not executed. Read the channel's ESR register to determine the cause of the error. Unless the previous setup is known it is recommended that the DEFAULT command be sent to the unit when changing the configuration.

TABLE 3-3 VXI-5534 CONFIGURATION COMMAND LIST

Command	Default	Description
BAUD <numeric>	9600	Sets baud rate. Allowed values are: 150,300,600, 1200, 2400, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 57600, 76800 and 115200.
BAUD# <numeric>	-	Sets baud rate to a user defined rate up to 153.6 Kbaud. The numeric value is computed per the following equation: $\frac{\text{Clock frequency}}{2 \times \text{Baud Rate} \times \text{Divider Ratio}} - 2$ where: clock frequency is 14.7456 MHz and the Divider Ratio is 16 unless changed by the EXTERN CLKX1 command For a baud rate of 7200, the time constant computation is: $((14.7456 \times 10^6)/(32 \times 7200))-2 = 62$
BITS <numeric>	8	Sets number of data bits per character. Allowed values are: 5,6,7, and 8.
CONFIG?	-	Requests current configuration message. Default values message is: **BAUD=9600, BITS=8, SBITS=1, PARITY=NONE, PACE =NONE, TYPE=232, TERMRES=OFF, EXTRN=OFF, CLK=X16, LOOPBACK =0FF.**
DEFAULT	-	Sets all parameters to default values and re-initializes the serial interface. Default values are listed in above CONFIG? response. CAUTION - This command resets the hardware portion of both serial channel pairs: 1&2 or 3&4.
EXTRN RECV <bool>	OFF	Selects external clock for received data. Allowed entries are ON, OFF
EXTRN TRANS <bool>	OFF	Selects external clock for transmit data. Allowed entries are ON, OFF
EXTRN OFF	ON	Selects internal clock for transmit and receive data and sets divider ratio to 16. Allowed entries are ON, OFF
EXTRN CLKX1	X16	Selects X1 Divider Ratio for internal and external clocks.
EXTRN CLKX16	X16	Selects X16 Divider Ratio for internal and external clocks.
LOOPBACK <bool>	OFF	Enables data loopback in the UART and at the interface driver level for testing. Allowed entries are: OFF, INT (UART) and EXT (Drivers). CAUTION - This command will transmit data on the RS-485 driver regardless of the type setting. Disconnect any cable connected to the serial channel or turn off the external serial device to prevent disturbing the external serial device.
PACE <alpha>	NONE	Enables X-on/X-off flow control. Allowed entries are: XON and NONE.

TABLE 3-3 VXI-5534 CONFIGURATION COMMAND LIST

Command	Default	Description
PARITY <alpha>	NONE	Enables parity generation and checking. Allowed entries are: EVEN, ODD, NONE
PDEFAULT <alpha>	CMD	Sets the power-on default to CMD or DATA mode. Follow the PDEFAULT command with a SAVE command. Allowed entries are CMD or DATA
SAVE	-	Saves the current configuration in EEPROM. Same function as the 488.2 *SAV 0 command.
SBITS <numeric>	1	Sets number of stop bits per character. Allowed entries are: 1, or 2
SET BUFINT <numeric>	0	Used for binary data. Sets receive buffer byte count that sets Bit 0 in theStatus Byte Register. Bit 0 is set when byte count >= set value. Value is 0 to max buffer size. A value of 0 disables this function.
SET EOM <value>	0A	Used for ACSII data. Sets the End-of -Message byte to the specified value. Sensing the EOM character sets Bit 0 in the Status Byte Register. The End bit is assered when the EOM character is put on the VXIbus. Value is two hex characters, 00 to FF. FF disables EOM character checking and the End bit is asserted when the last byte in the buffer is put on the VXIbus.
SET MASK <value>	FF	Sets the input character mask. A 0 bit causes the VXI-5534 to drop the bit from the received character. Default value varys with the number of data bits. Mask value is 00 to FF in hex. Default = FF for 8 bits, 7F for 7 bits, 3F for 6 bits and 1F for 5 bits.
STORE <n>, <string>	-	Stores string in buffer (n). Allowed buffers are: 0, 1, 2, etc. String can be any combination of characters up to 2046 bytes long.
TERMRES <bool>		Switches in terminating resistor network in RS-485 modes. Allowed entries are ON or OFF (not 1 or 0). Default is OFF.
TRIGGER <n>	-	Starts transmission of data stored in specified buffer. n=0 to 3.
TYPE <alpha>	232	Selects RS-232/RS-423 or RS-485 Drivers/Receivers and serial operating mode. Allowed entries are: 232 (automatic full duplex), 485 or 485FD (RS-485 with full duplex) 485HD (RS-485 with half duplex)

Field	Definition and Syntax
<alpha>	Value expressed as ASCII characters
<bool>	Logical value, either 0 and 1 or OFF and ON
<n> or <numberic>	Integer value from 0 to max value. HEX entries are only in capital letters
<string>	ASCII characters(s)

3.5 PROGRAMMING GUIDELINES

3.5.1 Setting the Baud Rate

The majority of baud rates can be entered with BAUD command as shown in Table 3-3. Nonstandard baud rates up to 153.6 Kbaud can be entered with the BAUD# command by entering a time constant. The time constant is for Zilog Z8530 SCC chip and is computed as shown in Table 3-3. The Divider is 16 for RS-232 signals but it can be changed to 1 when Type is set to 485. Note that not all baud rates come out as integers. Round the result to an integer value and compute backwards to see if the selected value is accurate enough for your needs. Otherwise change the baud rate crystal in the VXI-5534 or use an external clock. Units may be ordered with special crystal frequencies by specifying the -1 option.

CAUTION - The combined baud rate for a channel pair (1&2 or 3&4) should not exceed 230.4 Kbaud.

Some typical configuration commands are:

```
DEFAULT <nl>        //sets channel to known values
BAUD 28800 <nl>     //sets 28,800 baud
BITS 7 <nl>         //sets 7 data bits
TYPE 485FD <nl>     //sets 485 full duplex operation
CONFIG? <nl>        //reads the current configuration
*SAV 0 <nl>         //saves current configuration as the default power-on/reset values
```

For standard asynchronous transmission, the VXI-5534 generates and uses its internal baud rates to send or receive data. However, it is sometimes necessary to use external clocks when sending data to a high-speed data transmission system that multiplexes the data into a higher speed communication link or when operating with high speed modems. An example is a 64 Kbaud channel that is multiplexed into a T1 carrier. The VXI-5534 can be set to use 1X or 16X external clocks or to supply its transmit clock frequency to the external device.

External clocks may be programmed in the RS-485 mode only. When TYPE 485FD or 485HD is selected, the internally generated baud rate is available on the CLKO pins of the serial connector. The clock output will be 1 times or 16 times the baud rate depending upon the setting of the clock divider. The input and output clocks must be the same ratio. Reprogram the baud rate after setting the clock divider. Use the EXTRN commands to enable or disable the external clocks.

e.g. For a 7,200 baud rate:

$$\frac{\text{Clock Frequency}}{2 \times \text{Baud Rate} \times \text{Divider Ratio}} - 2 = \frac{14745600}{2 \times 7200 \times 1} - 2 = 1022$$

```
vxiWSOutput( 16, "EXTERN OFF");          //select internal clocks
vxiWSOutput( 16, "EXTERN CLKX1");        //set internal divider to 1 for x1 transmit clock
vxiWSOutput( 16, "BAUD# 510");           //set 7200 baud rate
```

Note: - vxiWSOutput is an ICS VXI-5543 Slot 0 Controller command, 16 is the logical address for VXI-5534 Channel #1

3.5.2 Sending Data

The easiest way to transmit data is to simply address the desired serial channel and send it the data. Use the Word Serial DataMode command (0000 hex) to put the serial channel into the data mode. Next send it the desired output string as a Word Serial Message. The VXI-5534 will place the output string in its transmit buffer and then output it at the set baud rate.

If the transmit message exceeds the transmit buffer size, the message will have to be sent in blocks. The easy way to send blocks is to write the first block into the serial channel's Transmit Buffer. Enable Bit 2 in the Status Byte to generate an interrupt when the Transmit buffer is empty or periodically query the Status Byte with the Word Serial Command ReadSTB to check the bits status. When the bit is high, load the next block of data into the transmit buffer. If Bit 2 was enabled and interrupts were used, the bit will have to be disabled after all of the data has been transmitted to avoid unwanted VXIbus interrupts. The following example polls Bit 2.

An example program is:

```
Do until data sent
   When buffer empty
      Write data block
    Do until Bit 2 high
      Wait  - minimum of 1/10 of block send time when testing Status Byte
       Test STB bit 2
   Loop
Loop
```

3.5.3 Using the Trigger Buffers

Each VXI-5534 serial channel has 4 or 8 trigger buffers depending upon the size of the memory in the slave processors. Transmit data can be stored in the trigger buffers and output upon receipt of a VXI trigger, a VXI-5534 TRIGGER command or an IEEE-488.2 *TRG command. To store data, use the Word Serial CmdMode command to put the channel into the command mode. Use the STORE command to place data in the desired trigger buffer.

```
e.g.   vxiWScmd (16, 0x0100) ;                          //logical address 16 is channel #1
       vxiWSOutput (16, "STORE 1, test data string" ); //places "test data string" in Buffer #1.
       vxiWScmd (16, 0x0000);                           //set Data Mode and enable receivers
       vxiWScmd (16, 0x0218);                           //enables buffer to be triggered
       vxiWScmd (16, 0xEDFF);                           //trigger starts data transmission
```

The serial channels respond to four types of triggers: the Word Serial Trigger command, the VXI-5534 Trigger command, a 488.2 *TRG command or a VXIbus TTL Trigger pulse. The *TRG and VXI TTL Trigger pulse require that the unit be first sent the ARMTRIGGER command (Paragraph 3.6.2) to specify the trigger buffer and to select the VXIbus TTL Trigger line. Software trigger commands can only be sent to one channel at a time while the TTL trigger pulse can be used to trigger several channels at the same time. Note - Software trigger commands overwrite the buffer number set by the ARMTRIGGER command. Any subsequent VXIbus TTL Trigger or *TRG command will require a new ARMTRIGGER command to reset the buffer number.

3.5.4 Receiving Data

The serial interface always inputs data in the Data Mode as long as the control lines are in their high state and there is room in the receive buffer. Do a Word Serial read to read out the received data. This works for simple applications where the data is known to be received prior to reading the data. A more advanced method is to let the VXI-5534 collect the data and then read the data when the VXI-5534 indicates that it has a complete message or the required number of characters.

If the input data is one or more strings of ASCII characters, the user should let the VXI-5534 buffer the received characters into a complete string or message before attempting to read the data. This will minimize the amount of time it takes to transfer the message over the VXI backplane. Use the SET EOM command to enable the VXI-5534 to detect the end of message character. When EOM character checking is enabled, each received character is compared against the EOM character pattern. If any character matches the EOM pattern, the serial channel sets bit 0 in the Status Byte. The user can sample the Status Byte Register and read the complete message when the Bit 0 bit is set. Resample the Status Byte Register after reading the string to test for more messages in the buffer.

CAUTION - To avoid false EOM bit indications, allow approximately 250 microseconds for the VXI-5534 to clear the EOM bit after reading a received message.

If the serial message is composed of binary data, EOM character checking must be disabled by setting the EOM pattern to FF. In a simple application, the user can wait until the expected message is received then read it out. The VXI-5534 will assert the END bit when outputting the last character in the buffer. The user can then sample the Status Byte Register and test Bit 1 to see if there is any more data in the buffer. The reading should continue until the complete binary message has been read.

CAUTION - If the user's program has a fast response time, the user may see a false end bit when reading data from slow baud rate systems. The proper procedure is to read the binary data in a loop that reads the expected byte count. A typical read loop is:

```
Do until n bytes read
        Input (channel address#, instring)      //read a portion of the data
        databuf = databuf + instring            //combine portions into
                                                  the data buffer
Loop
```

Another method to input binary data is to have the VXI-5534 test for a received byte count and set Bit 0 in the Status Byte Register when the number of bytes in the receive buffer equals or exceeds the set byte count. Byte count checking is normally disabled and is enabled by setting the count to a nonzero value with the BUFINT command. The user can sample the Status Byte Register and read the binary message or a portion of it each time the Bit 0 bit is set. Use a read loop similar to the one described above when reading binary data. There is normally no timing problem when re-sampling Bit 0 since the number of bytes in the buffer normally drops below the set count several milliseconds before the complete message has been read out of the buffer.

3.5.5 Reading the VXI-5534's Status Byte

There are several ways the user can test the VXI-5534 to see if there is data in the receive buffer. The simplest way is to use the Word Serial ReadSTB command to read the channel's Status Byte. This can be done while the channel is in the Data Mode and does not interfere with receiving data. Bit 0 is set when there is are **one or more** serial messages (EOM characters) in the receive buffer or the number of bytes in the receive buffer exceeds the preset character count. Bit 1 is set when there is data in the receive buffer. Refer to paragraph 3.6 and Figure 3-3 for a complete description of the VXI-5534's Status Reporting structure and Status Byte Register. If the test for data is positive, branch to a routine to input the data.

CAUTION - Do not read the Status Byte by a tight program loop. This ties up the VXI-5534 processors, wastes controller time and could result in lost data. Instead sample the Status Byte no more often than 1/10 the time estimated to receive the serial message.

3.5.6 Using VXIbus Interrupts to Input Data

A more sophisticated approach to inputting data is to have the VXI-5534's serial channel generate an interrupt when it has a message or the desired character count in the receive buffer. Interrupts are enabled by setting the Status Byte enable bits so that bit 0 can generate an service request. If the corresponding enable bits are set, a logic 1 in an enabled bit will set the RQS/MSS bit 6) and generate an interrupt if an interrupt level has been assigned to the serial channel and it is enabled. If your Resource Manager does not automatically assign an interrupt line, refer to its instruction manual for directions on manually assigning an interrupt line. The following example shows how to enable a serial channel to generate interrupts.

```
e.g.   vxiWScmd (17, 0x0100) ;                  //sets channel #2 to Command Mode
       vxiWSOutput (17, "SET EOM FF" );         //disables EOM character checking
       vxiWSOutput (17, "SET BUFINT 128" );     //sets character count to 128
       vxiWSOutput (17, "*SRE 01" );            //enables Status Byte bit 0 to generate an
                                                  interrupt
       vxiWScmd (17, 0x0000) ;                  //sets channel #2 to Data Mode
```

When binary data is being inputted, the interrupt service routine should read the number of bytes that caused the interrupt. Depending upon the data flow rates, it may improve the overall performance to retest the Status Byte Register to see if there is more data in the receive buffer before exiting the service routine. When character counts >10 are being used, bit 0 in the Status Byte will be reset by the time that the message has been read.

When ASCII data is being inputted and EOM checking is enabled, the interrupt service routine should read a message and exit the service routine. Allow 250 microseconds after reading a message from the VXI-5534's receive buffer before retesting Bit 0 to avoid false EOM indications. This delay time may have to be increased if the slave processor is busy receiving data or servicing the other serial channel. Note that VXI interrupts are only generated when Bit 0 sets. If multiple messages are expected, either the interrupt routine will have to test for presence of another message before exiting the routine and/or Bit 0 will have to be tested in the program's main line. Adding a periodic test of Bit 0 in the program is good insurance against any data loss and system hang-ups.

3.5.7 Controlling the VXI-5534 with Multi-Tasking Operating Systems

Outputting data to the VXI-5534 from a task in a Multi-Tasking environment does not require any special considerations. However, when inputting data from asynchronous sources, the user needs to insure that input tasks are not blocked by other tasks of equal priority. In addition, input tasks should verify that a message or data is in the VXI-5534's receive buffer before issuing a Word Serial message read. When a message read function is called, the task hangs until a message is received or the function times out. When a message is present in the receive buffer, the 'hang' time is only the time it takes to transfer the message over the VXIbus.

If multiple tasks are inputting data from channels on the a VXI-5534 using this approach, they will alternate in inputting messages and the channel with the highest message rate will eventually fill up and lose data . To avoid this problem, each task should do a Word Serial ReadSTB and test for data or for a message in the buffer. If none is present the task should 'sleep' until the next sample time. Task timing should be set so avoid polling the VXI-5534 channel at a rate higher than 1/10th of the estimated message receive time. High polling rates needlessly tie up the VXI-5534's processors. In addition, 'print' statements in tasks may cause them to occupy excessive amounts of CPU time due to delays in the operating system or text output queue problems. The following "Do's" and "Do Not's" summarizes these considerations.

Do

1. Check for data or messages in a task and sleep if none found.
2. Set all input tasks to the same priority
3. Set task timing to limit Word Serial ReadSTB commands to 1/10 of the message receive time or less. (The fewer samples the better).

Do Not

1. Issue Word Serial message reads without first checking for data or messages in the receive buffer.
2. Print messages to the console from input tasks. (If this is done during debugging, be aware that the print queue can back up and stop the task)
3. Poll the serial channel at a rate faster than 1/10 of the message receive time.

3.6 488.2 COMPLIANCE

3.6.1 488.2 Common Commands

The VXI-5534 responds to all of the required IEEE-488.2 common commands. The 488.2 commands may be sent to the serial channels as Word Serial messages while the serial channels are in the command mode. Table 3-5 lists the 488.2 Common Commands and their affect on the VXI-5534. Note that the *RCL, *RST and *SAV commands affect both channels in a channel pair.

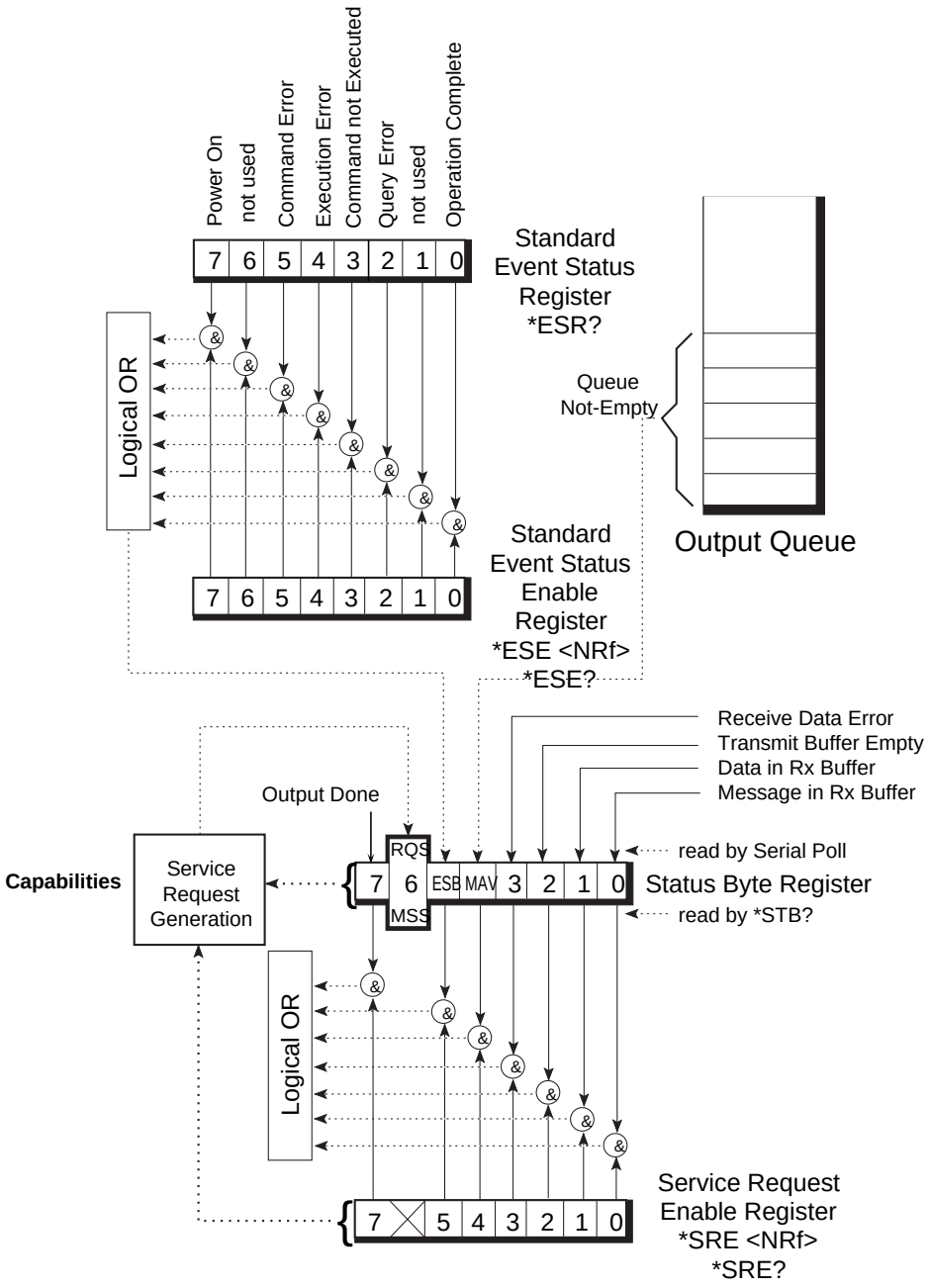


Figure 3-2 VXI-5534 IEEE-48.2 Reporting Structure

3.6.2 488.2 Status Reporting Structure

Each serial channel has its own IEEE-488.2 Status Reporting Structure as shown in Figure 3-3. The VXI-5534's Status Reporting Structure conforms to the IEEE-488.2 Standard and includes five additional information bits in the Status Byte Register for reporting the status of the Receive and Transmit Registers. These bits are included in the Status Byte Register so that the programming and operation match that of ICS's earlier Model VXI-5535 Multifunction interface Module.

In the 488.2 status reporting structure of Figure 3-3, SRQ generation is a multilevel function and is determined by the occurrence of a bit that has its corresponding enabling bit set to a '1'. When any of the enabled Event Status Register bits are set, they set the ESB bit (Event Summary Bit) in the Status Byte Register. When any of the enabled Status Byte Register bits are set, an SRQ is generated and the RQS bit is set. The SRQ would be reported as a VXI interrupt if a VXI interrupt line is assigned to the serial channel. The Status Byte Register can be queried at any time by a Word Serial Query or with the *STB? query (command mode). Querying the Status Byte Register only resets the RQS bit. The Event Status Register can be queried with the *ESR? query (command mode). Querying the Event Status Register resets all of the Event Status Register bits and the ESE bit in the Status Byte. The VXI-5534 does not use bits Bit 6 and Bit 1 in the Event Status Register.

At power turn-on or when the VXI-5534 is reset, all of the enabling registers are set to their saved values. When enabling or querying the ESE and SRE registers, the register values are expressed as decimal numbers. The decimal numbers represent the sum of the binary values for the enabled bits. e.g. 60 = 4 + 8 + 16 + 32 for bits 2-5. The *ESE and *SRE commands are used to change the enabling register values for the addressed serial channel. New values are saved with the 488.2 *SAV 0 command. Table 3-4 lists the recommended settings for the Event Status and Status Byte enable registers for normal send-receive operation.

TABLE 3-4 RECOMMENDED ESE AND SRE BIT VALUES

Register	Recommended Value	Comments
ESE	60 (3C HEX)	All error reporting bits enabled
SRE	41 (29 HEX)	Received message, received data error, and Event Status Summary bit enabled

Bits in the Status Reporting Structure registers are set when the reported condition occurs. Event bits in the Event Status Register are cleared when read or by the *CLS command. Bits in the Status Byte Register are cleared when the condition changes. The exception to this rule is the RQS bit and the Receive Data Error bits which are cleared when read. The clearing response time for the remaining Status Byte Register bits is approximately 250 microseconds after the end of the reported condition.

TABLE 3-5 IEEE 488.2 COMMAND LIST

Command	Factory Setting	488.2 Function
***CLS**	-	Clears all Event Registers and updates Status Byte register. The MAV bit is only cleared if the *CLS is the first message in the command line.
***ESE<mask>**	0	Sets the bits in the Event Status Enable Register to the <mask> value. The <mask> value is an integer between 0 and 255 whose binary equivalent is the state of the '1' and '0' bits in the register. If the <mask> value is not between 0 and 255, an Execution Error is generated.
***ESE?**	-	Queries the current contents of the Event Status Enable Register. Response is a decimal value between 0 and 255.
***ESR?**	-	Queries and clear contents in the Standard Event Status Register. Response is a decimal value between 0 and 255.
***IDN?**		Returns the unit's identification message which consists of four fields separated by commas: manufacturer, model, serial number and version number (date). e.g. "**ICS Electronics Corp.,VXI-5534, S/N 012345, Rev. X0.X0 (07-01-95)**"
***OPC**	-	Sets OPC bit in the Standard Event Register when all pending operations are completed.
***OPC?**	-	Returns a "1" to the output queue when all pending operations have completed.
***RCL <value>**	-	Restores state of the serial channel's configuration to the values stored in the EEPROM by the *SAV command. **Also resets the other channel in the channel pair (1&2 or 3 & 4)** *RCL 0 restores the power-on settings. <value> = 0
***RST**	-	Resets the serial channel to its saved configuration. Same action as *RCL above.
***SAV <value>**	-	Saves current serial channel's configuration in the EEPROM. *SAV 0 saves the current setting as the power-on setting. <value> = 0. **Wait 30 ms after the *SAV command before readdressing the VXI-5534.**
***SRE<mask>**	0	Sets the enable bits in the Service Request Enable Register to the <mask> value. The <mask> value is an integer between 0 and 255 whose binary equivalent is the state of the '1' and '0' bits in the register. If the <mask> value is not between 0 and 255, an Execution Error is generated.
***SRE?**	-	Queries the current contents in the Service Request Enable Register. Response is a decimal value between 0 and 255.
***STB?**	-	Queries the current contents in the Status Byte Register. Response is a decimal value between 0 and 255.
***TRG**	-	Transmits contents of buffer specified by the last ARMTRIGGER or Trigger n command.
***TST?**	-	Returns the results of the VXI-5534's last self test. Value is the sum of the folowing codes: 1 = EEPROM error, 8 = Port #1, 16 = Port #2, 32 = Port #3. Value = 0 if there are no errors.
***WAI**	-	Prevents the serial channel from executing any further commands or queries until the No-Operation-Pending flag is TRUE.

3.7 VXI WORD SERIAL COMMANDS

VXIbus systems use Word Serial Commands for handshaking data, controlling and querying VXI devices. Word Serial Commands are single word commands that contain 16 bits of information. They differ from Word Serial Messages which are multiple character messages that transfer 8-bit data characters or ASCII character strings to or from the VXI device. The VXI-5534 always recognizes Word Serial commands regardless of the serial channel's transmission mode. *(Refer to the VXIbus Glossary in Section 1 for more information about Word Serial Commands and Messages.)*

Table 3-6 lists Standard and ICS Defined Word Serial Commands. **Note that the Model VXI-5534 does not respond to commands marked with a pound sign (#).** These commands are included for reference purposes only.

3.7.1 Standard Word Serial Commands

The VXIbus Specification defines a standard set of Word Serial commands to control the VXIbus device. Word Serial commands are typically used to configure or query the devices's VXI interface. Table 3-6 lists the Word Serial Commands recognized by the VXI-5534. Non-supported commands are noted by a #.

3.7.2 ICS Defined Word Serial Commands

The VXI specification allows a device manufacturer to create device specific Word Serial Commands where they make sense for the device. ICS has defined several new Word Serial commands for the VXI-5534 Quad Serial Module to enhance its operation. The new commands are:

CmdMode (0100 HEX)	Enables the serial channel to recognize word serial messages as commands.
DataMode (0000 HEX)	Sets the serial channel to its transparent data mode.
Arm Trigger	Selects a data buffer to be transmitted when triggered.

The Arm Trigger command is coded so that it includes the buffer number, an enable/disable bit and the TTL trigger line value. The command format is '0000 0010 *bbbb ettt*' in binary. The *bbbb* field contains the buffer number (0-15). The *e* bit enables the buffer when set to a logic '1'. The *ttt* field selects a VXI TTLTrigger line (0-7). An example is:

021B HEX would set buffer 1 to be triggered on TTLTriger line #3

TABLE 3-6 VXI-5534 WORD SERIAL COMMAND LIST

Command	Hex Code	Function
Abort Normal Operation	C8FF	Cease normal operation and return to default configuration.
ArmTrigger	02xx	Selects a buffer to be transmitted when triggered and the TTLTrigger line. Command format is: 0000 0010 *bbbb ettt* where: *b* = buffer number, *e* = enable and *t* = trigger line
Assign Handler Line	A9xx	Assigns a IRQ line to an Interrupt Handler in the device.
Assign Interrupter Line	AAxx	Assigns a IRQ line to an Interrupter in the device.
Async Mode Control	A8xx	Directs the way a device responds to events.
Begin Normal Operation	FCFF	Notifies a device to begin normal operation.
Byte Available	BCdd	Sends a data byte to a servant. The code for the last byte with the END bit asserted is BDdd.
Byte Request	DEFF	Reads a data byte from the servant device.
Clear	FFFF	Clears a device's VXIbus interface, buffers and reinitializes the SCC chip for a channel pair (channels 1&2 or 3&4)
Clear Lock	EFFF	Device exits lock state.
CmdMode	0100	Sets a Serial Channel to its command mode. All subsequent Word Serial Messages will be parsed as commands.
Control Event	AFxx	Enables generation of events in a device.
Control Response #	8Fxx	Enables response signals or response interrupts.
DataMode	0000	Sets a Serial Channel to its transparent data mode. All subsequent Word Serial Messages will be transmitted as serial data.
End Normal Operation	C9FF	End normal operation an orderly fashion. The device becomes inactive.
Grant Device #	BFaa	Provides logical device addresses to a servant commander.
Identify Commander #	BEaa	Tells a servant the commander's logical address.

Read Handler Line #	8Cxx	Determines which IRQ line a handler is connected to.
Read Handlers #	C7FF	Determines the number of Interrupt Handlers in a servant.

TABLE 3-6 VXI-5534 WORD SERIAL COMMAND LIST

Command	Hex Code	Function
Read Interrupt Line	8Dxx	Determines which IRQ line a particular Interrupter in a servant is connected to.
Read Interrupters	CAFF	Determines number of Interrupters in a device.
Read MODID #	CCFF	Determines state of MODID lines from the Slot 0 Controller.
Read Protocol	DFFF	Finds what protocols a servant device supports.
Read Protocol Error	CDFF	Tells a servant to report its current error state.
Read STB	CFFF	Reads devices status word. Equivalent to 488.2 *STB? query.
Read Servant Area #	CEFF	Reads servant area size from servant commanders.
Release Device #	8Eaa	Tells a commander to relinquish control of a device.
Set Lock	EEFF	Tells a device to enter its locked state,
Set Lower MODID #	AExx	Changes the state of the lower eight MODID lines controlled by the Slot 0 Controller.
Set Upper MODID #	ADxx	Changes the state of the upper eight MODID lines controlled by the Slot 0 Controller.
Trigger	EDFF	Trigger a previously armed operation. In the VXI-5534, the Trigger command can be used to transmit data previously s tored in a transmit buffer.

Notes: aa = logical address field, dd = data field, xx = fill-in field
= commands not supported by the VXI-5534

4

Theory of Operation

4.1 BLOCK DIAGRAM DESCRIPTION

The Block Diagram for the VXI-5534 Quad Serial Interface Module is shown in Figure 4-1. The VXIbus is at the top of the figure. The upper section contains the VXIbus interface logic and registers. The lower section contain the two slave processors which are responsible for the four serial channels. Both slave processors are identical and have the same capabilities.

4.2 MASTER PROCESSOR

The VXI interface is controlled by the VXI Master Processor. Attached to the Master Processor is the EPROM for program storage, an E^2PROM for storing configuration data, a RAM for temporary storage and the address and display logic. The VXI Interface is a 16 bit wide dual port RAM that contains all of the VXI registers for all four channels. Communication between the VXI-5534 and the VXIbus is done by passing data and signals through the dual port RAM. The VXI TTL Triggers and IRQ lines are handled by separate logic. Data or messages for the serial interfaces are routed across the master bus to the appropriate slave processor. The Master Processor decodes and processes the Word Serial Commands.

The Master Processor also controls the 4 digit LED display. The display is automatically updated with the module's status during turn-on, initialization and self test. During normal operation, the display shows the current addressed serial channel.

Data transfer between the Master and slave processors is via the master bus and Bus Arbitration logic. Flags allow the mater processor to read and write messages into each slave processors memory. Each of the four internal devices is accessed via a separate VXI device address. The VXI Master Processor receives data from the VXIbus and places it in the RAM of the addressed interface via the Bus Arbitration Logic.

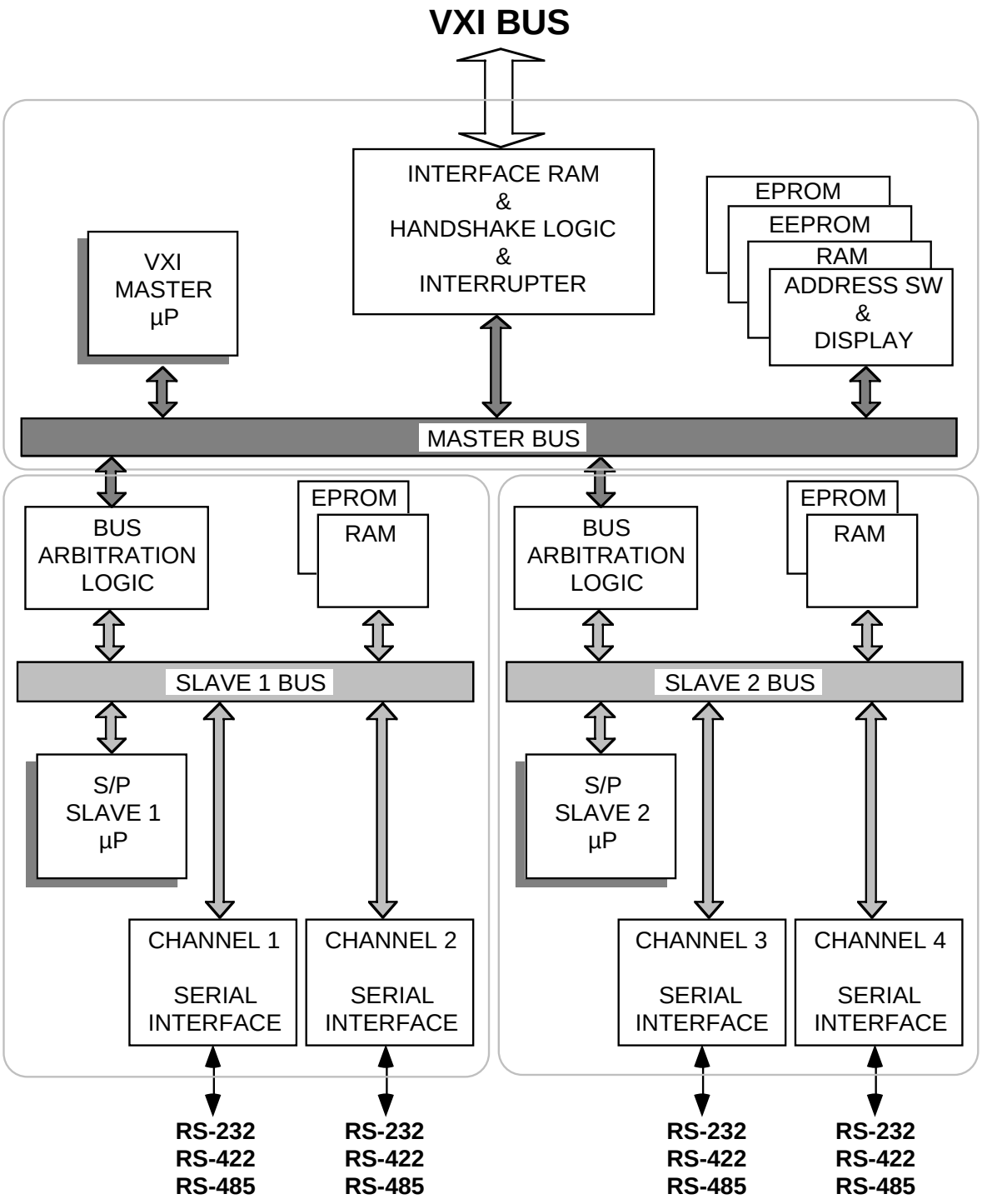


Figure 4-1 VXI-5534 Block Diagram

4.3 SLAVE PROCESSORS

Each slave processor has its own EPROM and RAM. The EPROM provides program storage and the RAM stores the received and transmit data for two serial channels. Each slave processor contains its own self test routines, input command parser, and data input/output routines. Slave Processor #1 controls serial channels 1 and 2. Slave processor #2 controls serial channels 3 and 4.

For standard VXI-5534 modules, the slave processors have 32 Kbytes of RAM memory. For VXI-5534s with extended memory, the slave processors have 128 Kbytes of RAM memory. The additional memory is used to expand the size of the transmit and receive data buffers.

VXIbus messages are placed in the slave processor's RAM by the Master Processor. The slave processor parses the VXI commands to control its interfaces or to return the requested response. VXI data messages are placed in a RAM buffer and then transmitted out the appropriate serial port. Received serial data is placed buffered in the slave processors RAM and an interrupt is generated to the Master Processor. The Master Processor generates any necessary VXIbus interrupts. When the appropriate serial channel is addressed, the Master Processor reads the data or message from the slave processors RAM and outputs it on the VXIbus.

Setup information is stored in the slave RAM and transferred to and from the E^2PROM by the Master Processor at power-on time or after a slave processor interrupt.

5

Maintenance

5.1 INTRODUCTION

This section describes the maintenance, troubleshooting and repair procedures for the VXI-5534 Interface card. The VXI-5534 does not require periodic calibration and has no internal adjustments.

5.2 TROUBLESHOOTING PROCEDURES

5.2.1 Self Test Failures

The VXI-5534 has a built in self test routine which is designed to detect basic circuit faults. The self test routine checks the PROM, RAM, E2PROM and to some extent, the interface chips. Any self test failure is indicated by a FAIL message followed by an error code (ERxx). These codes and possible repair procedure are given in Table 5-1.

Note that Table 5-1 only gives an approximate location of the problem and some possible solutions. When Table 5-1 recommends "Replace" then it is a definitive fault and the replaced part is the most likely problem. When Table 5-1 says "Try", the suggested solution is not definitive and the user should use an oscilloscope and other test equipment to narrow the problem down to a specific part.

Other failures are not field repairable and the unit must be returned to ICS for repair. Refer to paragraph 5.4 for return instructions.

Units under warranty should be returned to the factory for repair. Any attempts to repair a unit with out ICS's specific approval will void your warranty. If a failure is experienced, contact ICS before proceeding with any repairs.

Table 5-1 TROUBLESHOOTING GUIDE - error messages

Error Messages	Definitions	Action
ER01	VXI EPROM check sum error	Replace the VXI processor EPROM, U62.
ER02	VXI RAM error	Replace the VXI processor RAM, U61.
ER03	VXI E2PROM check sum error	Enable E2PROM initialization by setting Address switch bit 1 On. Reset the system twice or power the unit up. If the error persists past two times, replace E2PROM U63 and repeat the above procedure. Turn bit 1 of the Address Switch off when done.
ER04	VXI interface register error	Replace dual port RAM, U51 and U60. U59 is the lower 8 bits so try it first. Retest. If problem persists, try U60.
ER10	Slave #1 No Response Error	Slave processor may be dead or its clock is bad. Check clock input at U26 pin 3 for square wave and data and address buses for U31 for activity
ER11	Slave #1 EPROM error	Replace the Slave processor #1 EPROM, U23.
ER12	Slave #1 RAM error	Replace the Slave #1 processor RAM, U22.
ER15	VXI → Ser 1 RAM buffer error	Try replacing the Slave #1 processor RAM, U22. If the problem persists the bus arbitration logic may be at fault. Return unit to factory for service.
ER16	VXI → Ser 2 RAM buffer error	Try replacing the Slave #1 processor RAM, U22. If the problem persists the bus arbitration logic may be at fault. Return unit to factory for service.
ER18	Serial 1 interface error	Try replacing UART, U25 or interface chips U2 and U12.
ER19	Serial 2 interface error	Try replacing UART, U25 or interface chips U5 and U15.
ER20	Slave #2 No Response Error	Slave processor may be dead or its clock is bad. Check clock input at U27 pin 11 for a square wave and data and address buses for U36
ER21	Slave #2 EPROM error	Replace the Slave #2 processor EPROM, U35.
ER22	Slave #2 RAM error	Replace the Slave #2 processor RAM, U34.
ER25	VXI → Ser 3 RAM buffer error	Try replacing the Slave #2 processor RAM, U34. If the problem persists the bus arbitration logic may be at fault. Return unit to factory for service.

Table 5-1 TROUBLESHOOTING GUIDE - error messages cont'd

Error Messages	Definitions	Action
ER26	VXI → Ser 4 RAM buffer error	Try replacing the Slave #2 processor RAM, U34. If the problem persists the bus arbitration logic may be at fault. Return unit to factory for service.
ER28	Serial 3 interface error	Try replacing UART, U28 or interface chips U7 and U17.
ER29	Serial 4 interface error	Try replacing UART, U28 or interface chips U10 and U20.
ER??	Unknown error	Retest, if problem persists return unit to factory for service.

5.2.2 Operating Problems

Table 5-2 list some of the more common problems experienced by VXI-5534 users and their possible solutions. If the problem you are experiencing is not in Table 5-2, try debugging your program by adding error checking to the Word Serial Commands. Add print statements to see the errors. Refer to your Slot 0 Controller manual for a list of the errors and their meaning.

TABLE 5-2 TROUBLESHOOTING GUIDE - User Problems

Problem	Possible Cause	Action
Cannot set VXIbus Interrupts	Unit in Began Normal Mode	Use the Resource Manager to return the unit to the Init Mode, set the VXI interrupt line and return the unit to Began Normal.
RS-232/RS-423 not working	Units wired wrong	Check Tx and Rx signals for correct direction. Remember, DTE to DTE connections need a null modem crossover. Also some RS-232 devices require RTS-CTS and DTR-DSR-DCD jumpers. Use a LED indicator to analyze the RS-232 signal problems and signal conflicts.
	Baud rate and signal formats	Check setup, VXI-5534 defaults and device settings
RS-485 not working	Units wired wrong	For full-duplex systems, us a DVM to compare the output of the VXI-5534's transmitter to that of the other unit's transmitter when both units are at idle. Use the VXI-5534 as the standard and mark the other unit's +/- outputs to match the VXI-5534. Wire the other unit's Tx+ to the VXI-5534 Rx+, Tx- to Rx-. Do the same for the VXI-5534 transmitter output.

TABLE 5-2 TROUBLESHOOTING GUIDE - User Problems cont'd

Problem	Possible Cause	Action
		For half-duplex systems, try reversing the wires.
	Baud rate and character format	Check VXI-5534 settings vs RS-485 device. Use CONFIG? to query the VXI-5534.
	Device needs addressing	RS-485 devices that work in multi-drop systems need address sequences at the start of each message. Check device manual and add the address sequence to the outgoing messages as required.
RS-485 bad leading character.	Termination network not active	Install the Switch IC and enable the termination network. For long lines, provide a termination network at the end of the transmission line.
Unit not responding correctly when multiple channels are active	Multitasking software	Check the multitasking software for conformance to the guidelines in paragraph 3.5.7.
	Serial data overrun	Check receivers for overrun error. Check data for loss of messages.

5.3 RETURNING FOR FACTORY SERVICE

When returning a VXI-5534 board assembly or other products to ICS for repair, it is necessary to go through the following steps:

1. Contact the ICS customer service department and ask for a return material authorization (RMA) number. An ICS applications engineer will want to discuss the problem at this time to verify that the unit needs to be returned, or assist in correcting the problem. We have discovered that one-third of the difficulties customers call about can be resolved over the phone, rather than having to return a unit.

2. Write a description of the problem and attach it to the material being returned. Describe the installation, systems failure symptoms, and how it was being used. If the item being returned is a board assembly, describe how you isolated the fault to it. Include your name and phone number so we can call you if we have any questions. Remember, we need to locate the problem in order to fix it.

3. Pack the item with the fault description in a box large enough to accommodate a minimum of two inches of packing material on all four sides, the top, and the bottom of the box. Securely seal the box.

4. Mark the shipping label to the attention of RMA #_____. The RMA number is very important since it is our way of identifying your unit in order to return it to you.

5. Ship the box to ICS freight prepaid. ICS does not pay freight to return the unit to ICS, but will prepay the freight to return the repaired item to you.

6

Parts List and Location

6.1 INTRODUCTION

This section contains all information necessary to locate, identify, and order parts. The listing of parts and information for an exact replacement part are shown in the attached parts list. All component locations are identified by reference designators in the parts list and in the attached circuit board assembly drawings. Figure 6-1 shows the component locations on the circuit board.

6.2 REPLACEMENT PARTS

6.2.1 Standard Parts

All parts can be purchased directly from ICS Electronics Corporation, at current market price, plus a handling charge. However, since most parts are standard electronic components, it is suggested that they be secured locally for prompt replacement. The parts list gives all pertinent information including the recommended manufacturers and manufacturers' part numbers. Where not noted, equivalent parts meeting the original part specifications may be substituted. A list of manufacturers by abbreviations is given in Table 6-1.

6.2.2 Special Parts

Parts marked with an ICS part number should be procured directly from ICS Electronics Corporation. These parts are manufactured or selected to satisfy specific requirements. Substitution of other parts might not yield equivalent performance and will void any warranty.

6.2.3 Parts Ordering Information

All orders should be directed to ICS Electronics Corporation, at the address shown on the front page, or to ICS Electronics in care of your local representative. When ordering, be sure to include the following information:

a. Part description and reference designator
b. part number, manufacturer, and stock number
c. Instrument model, serial number, and program revision level

TABLE 6-1 LIST OF MANUFACTURERS BY ABBREVIATION

Code	Company Name	Location
ABC	Allen Bradley	Milwaukee, WI
ACT	Advanced Components Tech	Redwood City, CA
ACW	Alpha - CW	Elizabeth, NJ
AD	Analog Devices	Norwood, MA
ADI	ADI Electronics, Inc.	Bohemia, NJ
ADV	Advanced Interconnections	Warwick, RI
AEP	Alco Electronics Products, Inc	Lawrence, MA
AIW	American Insulated Wire	Pawtucket, RI
AMA	Amatom	New Haven, CT
AMD	Advanced Micro Devices	Sunnyvale, CA
AMP	AMP, Inc.	Harrisburgh, PA
AMR	American Relays, Inc.	Gardena, CA
AMZ	American Zettler, Inc.	Irvine, CA
AND	Alpha Numeric Displays	Burlingame, CA
APH	Amphenol Corp.	Oakbrook, IL
APL	Amplicon	Brighton,England
APT	Aptronics Corporation	Mentor, OH
APX	Ampex	Sunnyvale, CA
ARC	Arco	Commack, NY
ARI	Aries Industries, Inc.	Gardena, CA
ARO	Aromat Corp./Matsushita	San Jose, CA
ARR	Arrow Hart	Hartford, CT
ARX	Amperex Electronics	Slatersville, RI
ASC	American Switches Corp.	Wakefield, MA
ASS	Assmann Corporation	Chandler, AR
AST	Asyst Software Technology, Inc.	Rochester, NY
ATM	Atmel Corporation	San Jose, CA
AUG	Augat, Inc.	Attleboro, MA
AVD	Aavid Eng., Inc.	Laconia, NH
AVT	Advantech Co. LRD	Taipei, Taiwan
AVX	AVX Corp.	Myrtle Beach, SC
BDI	Bud Industries, Inc.	Peoria, AZ
BEC	Beckman	Fullerton, CA
BEL	Belden Corp.	Richmond, VA
BER	Bergquist	Minneapolis, MN
BEV	Bevmar Industries, Inc.	Carson, CA
BHE	BH Electronics, Inc.	Burnsville, MN
BLF	Bel Fuse, Inc.	Jersey City, NJ
BOR	Bourns	Riverside, CA
BRG	Berg Electronics	New Cumberland, PA
BRN	Burr-Brown	Tuscon, AZ
BTD	BT&D Technologies	San Jose, CA
BUC	Buchanan	Union, NJ
BUD	Budwig	Los Angeles, CA
BUR	Burndy	Norwalk, CT
BUS	Bussmann	Earth City, MO
BVR	Bivar	Santa Ana, CA
C&K	C&K Components	Newton, MA
CAB	Cable Connections	Cambell, CA
CAC	Circuit Assembly Corp.	Irvine, CA
CAD	Caddock	Riverside, CA
CAM	Ecam Technology	Scottsdale, AZ
CAN	Cannon	Santa Ana, CA
CAT	Catalyst Semiconductor	Santa Clara, CA
CAX	Calex Mfg. Co., Inc.	Pleasant Hills, CA
CDE	Cornell Dublier	Newark, NJ
CEL	Cellotape	Sunnyvale, CA
CHE	Cherry Electronics Products	Highland Park, CA
CHO	Chomerics, Inc.	Woburn, MA
CHR	Cuttler Hammer	Milwaukee, WI
CJO	Cinch Mfg. Company	Elk Grove Village, IL
CMS	Component Mfg. Service	Bridgewater, MA
CNT	Centralab	Los Angeles, CA
COL	Columbia Electronic Cables	Los Angeles, CA
CON	Condor Electronics	Sunnyvale, CA
COR	Corcom, Inc.	Chicago, IL
CRD	Concord Electronics Corp.	New York, NY
CRN	Corning Glass Works	Corning, NY
CRZ	Crazy Glue	Chicago, IL
CTK	Crystek Corp.	Fort Meyers, FL
CTR	Centre Engineering	State College, PA
CTS	CTS Corp.	Elkhart, IN
CYP	Cypress Semiconductor	San Jose, CA
DAL	Dale Electronics, Inc.	Columbus, NB
DEL	Delta Product Corporation	Fremont, CA
DEU	Deutsch Fastener Corp.	El Segundo, CA
DIA	Dialco	Brooklyn, NY
DII	Diodes Incorporated	Chatsworth, CA
DLL	Dallas Semiconductor	Dallas, TX
DSP	DSP Development Incorp.	Cambridge, MA
EBI	Ensign-Bickford Ind.	Simsburg, CT
ECL	Ecliplek Corporation	Fountain Valley, CA
EDC	Edac, Inc.	Ontario, Canada
EEE	Eaton Electrical/Electronic	New Haven, CT
ELL	Elec-trol	Saugus, CA
ELM	Elma Electronic, Inc.	Fremont, CA
ELN	Elna America, Inc.	Carson, CA
EMC	Electronic Molding Corp.	Woonsocket, RI
ENT	Entrelec	Spring Valley, NY
EPI	Epitek, Kanta	Ontario, Canada
ERG	Endicott Research Group	Endicott, NY
ERI	Erie Technology Products	Erie, PA
ESC	ESC Electronics Corp.	Palisades Park, NJ
ESI	EMC Shielding Incorprated	Fall River, MA
EUR	Euro-Dip	Dattwil, Switzerland
EVT	Electrovert, Inc.	Elmsford, NY
EWC	EWC, Inc.	Kenilworth, NJ
EXE	Exel Microelectronics	San Jose, CA
EXL	Excel	Chicago, IL
EXR	Exar Corporation	Sunnyvale, CA
FAS	Fastex	Des Plains, IL
FCL	Freedom Crystal Lab	Freedom, CA
FIS	Fairchild Inst. & Controls Div.	Mountain View, CA
FLK	Fluke	Santa Clara, CA
FOX	Fox Electronics	Cape Coral, FL
FSC	Fairchild Semiconductor Div.	Mountain View, CA
FUJ	Fujitsu Microelectronics	San Jose, CA
GAL	Gillis and Lane	Redwood City, CA
GAM	G & A Mounting Bracket	Issaquah, WA
GCE	GC Electronics	Rockford, IL
GE	GE Semiconductor	Syracuse, NY
GHI	Grayhill	La Grange, IL
GHW	Grant Hardware Company	City of Industry, CA
GI	General Instruments	Hicksville, NY
GMS	Globe Manufacturing Sales, Inc.	Mountainside, NJ
GOR	Gordos Corp.	Bloomfield, NJ
GRC	Gries Reproduction Co.	New Rochelle, NY
GSI	General Semi.	Tempe, AZ
GTI	Goldstar Tecnology, Inc.	Sunnyvale, CA
HAM	Hamlin Relays	Lake Mills, WI
HAR	Harris Semiconductor	San Jose, CA
HEY	Heyboer Transformers	Grand Haven, MI
HHS	Herman Smith, Inc.	Brooklyn, NY

TABLE 6-1 LIST OF MANUFACTURERS BY ABBREVIATION (CONT.)

Code	Company Name	Location
HIT	Hitachi	Toyko, Japan
HOL	Holmberg Electronics Corp.	Inman, SC
HP	Hewlett-Packard	Palo Alto, CA
HRS	Hirose Electric, Inc.	Chatsworth, CA
HUR	Hurricane Electronics	Hurricane, UT
HYU	Hyundai Electronics America	San Jose, CA
ICO	Ico-Rally Corp.	Palo Alto, CA
ICS	ICS Electronics Corporation	Milpitas, CA
IDE	IDEC Corporation	Sunnyvale, CA
IDI	Industrial Devices, Inc.	Edgewater, NJ
IDT	Intergrated Device Technology	Santa Clara, CA
IEE	Industrial Electronic Engineer	Van Nuys, CA
IER	IERC	Burbank, CA
IMC	Inmac	Santa Clara, CA
INE	Ines GMGH	Koln, Germany
INL	Intel	Sunnyvale, CA
INT	Intervor	Melville, NY
IRC	TRW/IRC Resistors	Philadelphia, PA
ISC	Instrument Specialties	San Jose, CA
ISL	Intersil	Mountain View, CA
ITT	ITT General Controls	Glendale, CA
JAR	Jarome Wire	Mountain View, CA
JFR	Jeffers Electronics	Nogales, AZ
JWM	J.W. Miller	Rancho Dominguez, CA
KAP	Kappa Networks Inc.	Rahway, NJ
KCC	Keltron Connector Company	Bayshore, NY
KEM	Kemet	Greenville, SC
KES	Kester	Chicago, IL
KEY	Keystone Electronics	New York, NY
KOA	KOA Speer Electronics	Santa Ana, CA
KOS	Koszeigi	South Bend, IN
KYO	Kyocera International, Inc.	San Diego, CA
LAN	Lansing Instrument Corp.	Ithaca, NY
LAT	Lattice Semiconductor	Portland, OR
LCM	L-Com Incorporation	N. Andover, MA
LDI	Logic Dynamic, Inc.	Gardena, CA
LEA	Leader Tech	Tampa, FL
LED	Ledtronics, Inc.	Torrance, CA
LFS	Little Fuse, Inc.	Des Plaines, IL
LOC	Loctite Corporation	Hollister, CA
LOP	Zollin J. Lopaugh	San Francisco, CA
LYN	Lyntron, Inc.	Burbank, CA
LYT	Lytel Incorporated	Somerville, NJ
LYX	Lynx Enterprises	Watsonville, CA
MAN	Manhattan Electric Cable Corp.	Station Plaza-Rye, NY
MAR	Marcon	Northbrook, IL
MAX	Maxim Integrated Prod., Inc.	Sunnyvale, CA
MCB	Mepcocentalab	Fort Dodge, IA
MCC	Microchip Technology, Inc.	Chandler, AZ
MCI	MCI Transformer Corp.	Babylon, NY
MCK	McKenzie Technology	Fremont, CA
MCS	Microsemi Corporation	Scottsdale, AZ
MDA	Media Products	San Jose, CA
MDY	Midway Mfg. Co.	Franklin Park, IL
MEC	Magnum Electric Corp.	Erie, MI
MED	Meadows Mfg.	Sunnyvale, Ca
MIC	Microntran Company, Inc.	Valley Stream, NY
MIN	Minicomputer Accessories	Sunnyvale, CA
MIT	Mitsubishi Semiconductors	Sunnyvale, CA
MLR	Midland Ross Corporation	North Mankato, MN
MLX	Molex Products Co.	Downers Grove, IL
MLY	Mallory Dist. Prod. Co.	Indianapolis, IN
MMI	Monolithic Memories	Sunnyvale, CA
MMM	3M	Minneapolis, MN
MON	Monsanto (Genl. Instr.)	Palo Alto, CA
MOS	Thompson Components	Carrollton, TX
MOT	Motorola Semicond. Prod.	Phoenix, AZ
MPC	Montior Products Corp.	Oceanside, CA
MPI	Multi Products International	Cedar Grove, NJ
MPR	Micropower Systems	Santa Clara, CA
MSC	Master Specialties Co.	Costa Mesa, CA
MSL	Mosel	Sunnyvale, CA
MTN	M-Tron Corporation	Yankton, SD
MUR	Murata Corporation	Marietta, GE
NAT	National Semi	Santa Clara, CA
NCS	Nor-Cal Seal Co.	San Leandro, CA
NDK	NDK America Inc.	Cupertino, CA
NEC	NEC Microcomputers, Inc.	Wellesley, MA
NEL	NEL Frequency Control, Inc.	Burlington, WI
NEM	Nova Electronics Mfg. Co.	Nutley, NJ
NIC	Nichicon	Chicago, IL
NKK	NKK Switches	Scottsdale, AZ
NMB	NMB Technologies	Chatsworth, CA
NSC	National Semicond. Corp.	Santa Clara, CA
OFT	Optical Fiber Tech.	Billerica, MA
OKI	OKI Semiconductor	Sunnyvale, CA
OMG	Omega Printing	Palo Alto, CA
OPT	Optrex Corp.	Torrance, CA
PAN	Panduit	Tinley Park, IL
PBD	Potter & Brumfield Company	Princeton, IN
PCD	Preci Dip	Oyster Bay, NY
PCL	Precision Crystal Lab	Santa Monica, CA
PEC	Pacific Electricord Co.	Gardena, CA
PIC	Piher International Corp.	Mt. Prospect, IL
PLX	PLX Technology, Inc.	Mountain View, CA
PMI	Precision Monolithics, Inc.	Santa Clara, CA
PNS	Panasonic	Seacaucus, NY
POS	Positronic Industries, Inc.	Springfield, MO
POT	Potter Company	Wesson, MS
POW	Power Sonic	Long Beach, CA
PRE	Precicontact, Inc.	Langhorne, PA
PRM	Prem Magnetics Incorporated	McHenry, IL
PTB	Phoenix Terminal Blocks, Inc.	Harrisburg, PA
PTS	Promptus Electronic Hdwr.	Lomita, CA
PUL	Pulse Engineering, Inc.	San Diego, CA
RAF	RAF Electronics Hardware	Seymour, CT
RAY	Raytheon	Mountain View, CA
RCA	RCA Corporation	Iselin, NJ
RCD	RCD Components, Inc.	Manchester, NH
RCH	Richlock	Chicago, IL
RED	Redwood Stationers	Menlo Park, CA
REM	Remee Products Corporation	Florida, NY
REN	Renco Electronics, Inc.	Deer Park, NY
RGA	RG Allen	Van Nuys, CA
RGS	Rogers Corporation	Tempe, AZ
RIC	Richco	Chicago, IL
RNU	Robinson Nugent	New Albany, IN
ROM	Rohm	Irvine, CA
RTE	RTE Aerovox, Inc.	New Bedford, MA

TABLE 6-1 LIST OF MANUFACTURERS BY ABBREVIATION (CONT.)

Code	Company Name	Location
RUS	Russell Industries, Inc.	Oceanside, NY
RXD	RXD, Incorporated	Norfolk, NE
SAE	Stanford Applied Engineering	Long Beach, CA
SAM	Samsung Semi Conductor, Inc.	San Jose, CA
SAN	Sangamo Western, Inc.	Pickens, SC
SAR	Saronix	Palo Alto, CA
SCH	Schadow, Inc.	Eden Prairie, MN
SCN	Scanbe	El Monte, CA
SEC	Secma, Inc.	Irvine, CA
SEI	Seiko Instruments	Torrance, CA
SEK	Seiko Circuits	Sunnyvale, CA
SEQ	Seeq Technology, Inc.	San Jose, CA
SGC	Silicon General	Westminster, CA
SGL	Signal Transformer	Inwood, NY
SGS	SGS-Ates Semiconductor	Phoenix, AZ
SHA	Saha	New York, NY
SHK	Shakeproof	Edgin, IL
SHO	Shoin	Japan
SHP	Sharp	Manwah, NJ
SHR	Schurter, Inc.	Petaluma, CA
SIE	Siemens Components, Inc.	Iselin, NJ
SIG	Signetics Corp.	Sunnyvale, CA
SIL	Siliconix, Inc.	Santa Clara, CA
SLN	Sullins Electronics Corp.	San Marcos, CA
SMC	Standard Microsystems Corp.	Hauppauge, NY
SMK	SMK Corporation	Placentia, CA
SMN	Seimens	Iselin, NJ
SMO	S-Mos Systems, Inc.	San Jose, CA
SMT	Samtec	New Albany, IN
SOC	Socket Express	Princeton, NJ
SOL	Solid Electric Inc.	San Jose, CA
SOU	Souriau, Inc.	Van Nuys, CA
SPC	Spectra Strip	Garden Grove, CA
SPR	Sprague Electronics	Chicago, IL
STR	Star Micronics, Inc.	Piscataway, NJ
SWC	Switchcraft, Inc.	Chicago, IL
SYN	Synertec	Santa Clara, CA
SYO	Sanyo Electric, Inc.	Compton, CA
TAD	Tadiran	Tel-Aviv, Isreal
TAM	Tamura Corporation of America	Carson, CA
TAW	TAW	Burbank, CA
TBA	T&B Ansley	Los Angeles, CA
TCN	Tra-Con	Medford, MA
TEE	Telemecanique, Inc.	Westminster, MD
TEK	Tektronics, Inc.	Beaverton, OR
TEL	Teledyne Relays	Hawthorne, CA
TEM	Temple Industries, Inc.	Tecate, CA
TEX	Textool	Irving, TX
THC	Thermalloy Co.	Dallas, TX
TI	Texas Instruments	Dallas, TX
TKR	Thacker Container Co.	None available
TMI	Tri-Mag, Incorporated	Visalia, CA
TMX	Thermax Wire	Flushing, NY
TOM	Thomson Passive Comp. Corp.	Woodland Hills, CA
TOS	Toshiba America, Inc.	Tustin, CA
TRM	Trompeter	Chatsworth, CA
TRW	TRW Capacitors	Ogallala, NE
TYT	Tyton Corporation	Milwaukee, WI
UCH	United Chemcon	Rosemont, IL
USE	Useco	Van Nuys, CA
USI	Universal Semiconductor, Inc.	San Jose, CA
VAT	Varta	Elmford, NY
VEC	Vector Electronics Corp., Inc.	Sylmar, CA
VEM	Vermaline	Warwick, RI
VER	Bicc-Vero Electronics Corp.	Hamden, CT
VIK	Viking	Chatsworth, CA
VIR	Virginia Plastics	Roan Oke, VA
WDC	Western Digital Corp.	Newport Beach, CA
WEI	Weidmuller	Richmond, VA
WEK	Weckesser	Chicago, IL
WFD	Wakefield Engineering, Inc.	Wakefield, MA
WIN	Winchester	Oakville, CT
WLD	Waldom	Chicago, IL
WMA	Wima (Distr. by TAW, Inc.)	Burbank, CA
WPG	Western Packaging	Santa Clara, CA
WPS	Wescon Production Sockets	South Bend, IN
XEC	Xecom, Incorporated	Milpitas, CA
XIC	Xicor, Incorprated	Milpitas, CA
ZIL	Zilog	Cupertino, CA

6.3 PARTS LISTS

The parts list tables contains both the ICS Electronics Corporation stock numbers and the manufacturers' true part numbers where applicable. True manufacturers' part numbers are not shown for industry standard parts nor for items unique to the VXI-5534 Interface Card.

Table 6-2 lists the recommended spare parts for 1 to 9 units. To spare at the assembly level, order items 1 and 2 in tAble 6-2. To spare at the component level, order items 3 through 37 as the VXI-5534 Spare Parts List. Tables 6-3 thru 6-4 break the VXI-5534 module assembly down to the component part level.

TABLE 6-2 VXI-5534 RECOMMENDED SPARE PARTS

LN#	PART#	QTY	DESCRIPTION	REF-DES	MFGR	MFGR PART #
1	114564	1	Assy VXI-5534 PCB		ICS	114564
2	114570	1	Assy VXI-5534 Display		ICS	114570
3	590000	9	Cap dip .01uF 50V	C1-68;C70-96	AVX	MD015E103AZAA
4	535222	1	Cap Mono TS .0022 uF 50V	C69	CNT	CW15C222K
5	521686	1	Cap Tant 68uF 10V	C97-103	SPR	199D686X0010DB1
6	490005	1	D-sub Female Screwlock kit	(J1-4)	CJO	D204180-2
7	602333	1	Res 1/4W 33K 5%	R1	KOA	CF1/4-5-33K
8	602123	1	Res 1/4W 12K 5%	R2-17	KOA	CF1/4-5-12K
9	602103	1	Res 1/4W 10K 5%	R3,4;7	KOA	CF1/4-5-10K
10	602821	1	Res 1/4W 820 5%	R5;6;8	KOA	CF1/4-5-820
11	696017	1	SIP 33K 5 comm res	RP1;2	BOR	4306R-101-333
12	696011	1	SIP 10K 5 comm res	RP4;6;9-11	BOR	4306R-101-103
13	696004	1	SIP 10K 9 comm res	RP7;8;12	BOR	43010R-101-103
14	114574	2	Assy Termination Resistors	RP3;5		
15	907042	1	Sw Miniature Push-button	SW1	C&K	GP11-MCKE
16	907011	1	Sw Rocker dip 8 pos	SW2	CTS	CTS206-8
17	735175	2	IC Quad Diff Rcvr	U1;4;6;9;14;16; 18;20	TI	SN 75175N
18	731032	1	IC Quad Low Pwr Line Dvr	U2;5;7;10	TI	LT1032CN
19	748004	1	IC Hex Inverter	U27	NSC	MM74HCT04N
20	748541	2	IC Octal Buffer	U57;68;84;85; 93-95	SIG	74HCT541N
21	735174	1	IC Quad Diff Xmtr	U3;8;17;22	TI	SN75174N
22	748574	2	IC Octal Triggered 3-state F/F	U11;13;21;31; U39;45;54-69; U72;78;86;88-90	TI	SN74HCT574N
23	792256	1	IC RAM 32K x 8	U23;36	CAT	71C256L-85
24	797256	3	IC EPROM 32K x 8	U24;37;65	NOT	Special
25	749012-415	6	IC GAL 20V8-15	U25;30;56;61;76 U79	LAT	GAL20V8-150P
26	798530-02	1	IC Dual Serial Comm NMOS	U26;29	ZIL	Z0853008VSC
27	748132	1	IC Quad Nand Schmidt Trig	U28;32;47	HAR	CD74HCT132

TABLE 6-2 VXI-5534 RECOMMENDED SPARE PARTS

LN#	PART#	QTY	DESCRIPTION	REF-DES	MFGR	MFGR PART #
28	790189-16	1	IC MPU Z180	U33;38;67	ZIL	Z8S18016VSC
29	748245	2	IC Octal Bus Xcvr	U12;34;35;40;41 U43;44-46;51;52	SIG	74HCT245N
30	749014	1	IC EE GAL 6001-30	U42	LAT	GAL6001-30P
31	748074	1	IC Dual F/F	U49;55;58-60;70	NSC	MM74HCT74N
32	748138	1	IC 3-8 Dcdr	U50	SIG	74HCT138N
33	748154	1	IC 4-16 Dcdr	U53	SIG	74HCT154N
34	792130	2	IC RAM 1K x 8 dual port	U62;63	AMD	AM2130-10PC
35	776264	1	IC RAM 8K x 8	U64	FUJ	MB8464A-80
36	792816-15	1	IC EEPROM 2K x 8	U66	SAM	KM28C16-15
37	749011-415	7	IC GAL 16V8	U71;98;99;101-104	LAT	GAL16V8-15QP
38	772210	3	IC PAL 22V10	U73;87;105	CYP	PALC22V10
39	745038	1	IC Quad Nand	U74	SIG	N74F38N
40	748241	1	IC Octal Bus Xcvr	U75	RCA	CD74HCT241
41	748688	1	IC 8-bit Comp	U77	HAR	CD74HCT688E
42	748125	1	IC Quad 3-state Buffer	U80-82;100	SIG	74HCT125N
43	742139	1	IC Dual 2-4 line Dcdr	U83	TI	SN74LS139N
44	745245	1	IC Octal 3-state Xcvr	U91;92	SIG	N74F245N
45	745641	1	IC Octal Xcvr	U96;97	SIG	N74F641N
46	706147	1	Oscillator 14.7456	Y1	FOX	F1100-14.7456
47	706320	1	Oscillator 32.0000	Y2	FOX	F1100-32.0000

TABLE 6-3 VXI-5534 MODULE ASSEMBLY PARTS LIST (114562)

LN#	PART#	QTY	DESCRIPTION	REF-DES	MFGR	MFGR PART #
1	1140112-01	1	Assy VXI Circuit SW Shield			
2	114012-02	1	Assy VXi Component Shield			
3	114568	1	Front Panel, VXI-5534		ICS	114568
4	490036	1	Assy VXI Ejector Kit SW			
5	114017	2	EMI Shield Sticky Finger			
6	114564	1	Assy VXI-5534 PCB		ICS	114564
7	412416	6	Screw PH Flat 4-40‘x 1			
8	114570	1	Assy VXI-5534 Display		ICS	114570
9	410404	1	Screw PH Pan 4-40 x 1/4			
10	431400	1	L/W Std Split 4-40			

TABLE 6-4 VXI-5534 PCB ASSEMBLY PARTS LIST (114564)

LN#	PART#	QTY	DESCRIPTION	REF-DES	MFGR	MFGR PART #
1	114566	1	PCB VXI-5534	A1		
2	590000	95	Cap dip .01uF 50V	C1-68;C70-96	AVX	MD015E103AZAA
3	535222	1	Cap Mono TS .0022 uF 50V	C69	CNT	CW15C222K
4	521686	7	Cap Tant 68uF 10V	C97-103	SPR	199D686X0010DB1
5	-	-				
6	902149	4	Conn 9-pin D-sub Male Rt-Angle	J1-4	APH	777DEE9PA
7	490005	4	D-sub Female Screwlock kit	(J1-4)	CJO	D204180-2
8	418406	8	Screw Button HD 4-40 x 3/8	(J1-4)		
9	422400	8	Nut sm kep 4-40	(J1-4)		
10	902026	2	Conn DIN 96 pin male R/A	P1;2	PAN	100-096-053
11	410207	4	Screw PH pan 2-56 x 7/16	(P1;2)		
12	431200	4	L/W Std Split 2-56	(P1;2)		
13	420200	4	Nut std hex 2-56	(P1;2)		
14	902212	1	Header 3x3 R/A	P3		
15	602333	1	Res 1/4W 33K 5%	R1	KOA	CF1/4-5-33K
16	602681	1	Res 1/4W 680 5%	R2	KOA	CF1/4-5-680
17	602103	3	Res 1/4W 10K 5%	R3;4;7	KOA	CF1/4-5-10K
18	602821	3	Res 1/4W 820 5%	R5;6;8	KOA	CF1/4-5-820
19	696017	2	SIP 33K 5 comm res	RP1;2	BOR	4306R-101-333
20	696011	5	SIP 10K 5 comm res	RP4;6;9-11	BOR	4306R-101-103
21	696004	3	SIP 10K 9 comm res	RP7;8;12	BOR	43010R-101-103
22	114574	2	Assy Termination Resistors	RP3;5		
23	907042	1	Sw Miniature Push-button	SW1	C&K	GP11-MCKE
24	907011	1	Sw Rocker dip 8 pos	SW2	CTS	CTS206-8
25	-	-				
26	735175	8	IC Quad Diff Rcvr	U1;4;6;9;14;16 18;20	TI	SN 75175N
27	731032	4	IC Quad Low Pwr Line Dvr	U2;5;7;10	TI	LT1032CN
28	735174	4	IC Quad Diff Xmtr	U3;8;17;22	TI	SN75174N
29	748574	14	IC Octal Triggered 3-state F/F	U11;13;21;31; U39;45;54;69;72 U78;86;88-90	TI	SN74HCT574N
30	748245	10	IC Octal Bus Xcvr	U12;34;35;40; U41;43;44;46; U51;52	SIG	74HCT245N
31	792256	2	IC RAM 32K x 8	U23;36	CAT	71C256L-85
32	797256	3	IC EPROM 32K x 8	U24;37;65	AMD	AM27C256-120
33	749012-415	6	IC GAL 20V8-15	U25;30;56;61;76 U79	LAT	GAL20V8-150P
34	798530-02	2	IC Dual Serial Comm	U26;29	ZIL	Z853008VSC
35	748004	1	IC Hex Inverter	U27	NSC	MM74HCT04N
36	748132	3	IC Quad Nand Schmidt Trig	U28;32;47	HAR	CD74HCT132
37	790180-16	3	IC MPU Z180	U33;38;67	ZIL	Z8S18016VSC
38	749014	1	IC EE GAL 6001	U42	LAT	GAL6001-30P
39	745074	1	IC Dual F/F FAST	U48	SIG	74F74N
40	748074	6	IC Dual F/F	U49;55;58-60;70	NSC	MM74HCT74N
41	748138	1	IC 3-8 Dcdr	U50	SIG	74HCT138N
42	748154	1	IC 4-16 Dcdr	U53	SIG	74HCT154N
43	748541	7	IC Octal Buffer	U57;68;84;85; U93-95	SIG	74HCT541N

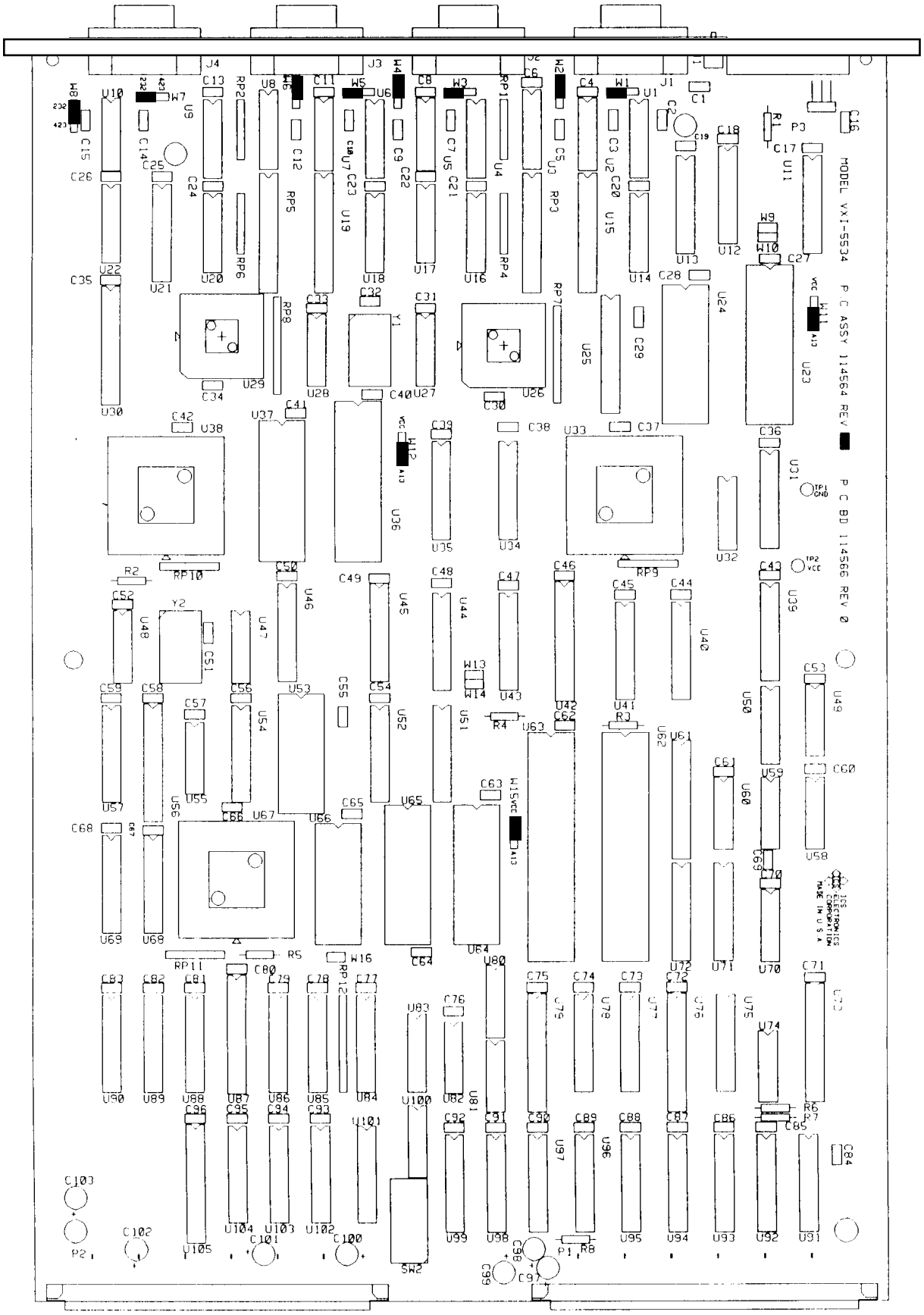


Figure 6-1 VXI-5534 Component Layout

TABLE 6-4 VXI-5534 PCB ASSEMBLY PARTS LIST (114564) CONT'D

LN#	PART#	QTY	DESCRIPTION	REF-DES	MFGR	MFGR PART #
44	792130	2	IC RAM 1K x 8 dual port	U62;63	AMD	AM2130-10PC
45	776264	1	IC RAM 8K x 8	U64	FUJ	MB8464A-80
46	792816-15	1	IC EEPROM 2K x 8	U66	SAM	KM28C16-15
47	749011-415	7	IC GAL 16V8	U71;98;99;101-4	LAT	GAL16V8-150QP
48	772210	3	IC PAL 22V10	U73;87;105	CYP	PALC22V10-35WC
49	745038	1	IC Quad Nand	U74	SIG	N74F38N
50	748241	1	IC Octal Bus Rcvr	U75	RCA	CD74HCT241
51	748688	1	IC 8-bit Comp	U77	HAR	CD74HCT688E
52	748125	4	IC Quad 3-state Buffer	U80-82;100	SIG	74HCT125N
53	742139	1	IC Dual 2-4 line Dcdr	U83	TI	SN74LS139N
54	745245	2	IC Octal 3-state Xcvr	U91;92	SIG	N74F245N
55	745641	2	IC Octal Xcvr	U96;97	SIG	N74F641N
56	-	-				
57	903021	2	Socket 32 pin	(U23;36)	WPS	101-732-2812
58	903014	4	Socket 28 pin	(U24;37;64;65)	CAC	OF628GT-ST
59	903009	14	Socket 24 pin	(U15;19;25;30;42 U56;61;73;76;79 U;87;105)	ARI	24-3518
60	903025	2	Socket 44 pin	(U26;29)	AMP	821575-1
61	903024	3	Socket 68 pin	(U33;38;67)	SAM	PLC-062-T-S
62	903017	7	Socket 20 pin	(U71;98;99;101-104)	AUG	520-AG11D
63	112574	4	Label PROM Copyright			
64	112936	14	Label PAL Copyright			
65	902075	11	Post 3 pin sip	W1-8;11;12;15	AMP	87224-3
66	902110	5	Post 2 pin sip	W9;10;13;14;16	AMP	87224-2
67	902087	11	Conn 2 pin shorting	see Assy Dwg	SAE	RSR2610-2b
68	706147	1	Oscillator 14.7456	Y1	FOX	F1100-14.7456
69	706320	1	Oscillator 32.0000	Y2	FOX	F1100-32.0000

TABLE 6-5 VXI-5534 DISPLAY ASSEMBLY PARTS LIST (114570)

LN#	PART#	QTY	DESCRIPTION	REF-DES	MFGR	MFGR PART #
1	114572	1	PCB VXI-5534 Display	A1	ICS	114572
2	535104	1	Cap Mono 0.1uF 50V	C1	ERI	8121-050-651-104M
3	707003	1	LED 4 Digit Serial Matrix Grn	U1	HP	HCMS-2903
4	903013	.6	Socket 20 pin SIP	(U1)	SMT	SS-120-G2
5	902213	1	Recpticle 3x3 .1	W1 (farside)	SMT	SSW-103-01-T-T

TABLE 6-6 VXI-5534 HEADER ASSEMBLY PARTS LIST (114574)

LN#	PART#	QTY	DESCRIPTION	REF-DES	MFGR	MFGR PART #
1	903035	1	Header 24 pin forked carrier	A1	CAC	CA-24MP-A1B-3
2	602102	8	Res 1/4 W 1K 5%		KOA	CF1/4-5-1K
3	602221	4	Res 1/4 W 220 5%		KOA	CF1/4-5-220

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Drawings, Diagrams, Wire Lists

This section includes the following figures and table: