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VX5260 Waveform Digitizer Instruction Manual

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Preface

Purpose of This Manual

This manual provides information about how to configure, install and operate the instrument module.

Organization of This Manual

This manual is organized into the following sections and appendices:

Section 1 — General Information. Provides an overview of the instrument's capabilities, and lists its specifications.

Section 2 — Preparation for Use. Provides information about how to configure and install the instrument.

Section 3 — Operation. Describes the instrument's front panel connectors and indicators, triggering capabilities, and its power-up sequence.

Section 4 — Rear Panel Interface. Describes the pin and signal assignments for the VXIbus P1, P2, and P3 connectors on the rear panel.

Section 5 — Introduction to Programming. Contains introductory information about the command sets.

Section 6 — Instrument Control Command Dictionary. Contains an alphabetical and functional listing of the instrument control commands, and a description of each command.

Section 7 — Signal Analysis Command Dictionary. Contains an alphabetical listing and description of the signal analysis commands.

Section 8 — System Command Dictionary. Contains information about the IEEE 488, VX5520 Slot 0 Resource Manager, and Word Serial Protocol commands.

Section 9 — Calibration. Describes the internal calibration capability of the instrument and gives calibration command examples.

Section 10—Performance Verification. Provides a procedure for verifying all the Performance Specifications.

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Organization of This Manual (continued)

Appendix A — ASCII/GPIB Chart.

Appendix B — VXIbus Glossary.

Related Documentation

The following documents on related subjects may be useful for information on the use of the module:

- *IEEE Standard 194-1977, IEEE Standard Pulse Terms and Definitions.*
- *ANSI/IEEE Standard 181-1977, IEEE Standard of Pulse Measurements and Analysis by Objective Techniques.*
- *VXIbus System Specification, Revision 1.2, June 21, 1988.*
- *ANSI/IEEE Std 1014-1987, IEEE Standard for a Versatile Backplane Bus: VMEbus.*
- *ANSI/IEEE Std 488.2-1987, IEEE Standard Codes, Formats, Protocols, and Common Commands.*

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Appendix A ASCII/GPIB Code Chart

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GENERAL SAFETY SUMMARY

Only qualified personnel should perform service procedures. The Service Safety Summary and the General Safety Summary should be read before performing service procedures.

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

TERMS IN THIS MANUAL

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

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

TERMS AS MARKED ON EQUIPMENT

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

WARNING indicates solely a personal injury hazard not immediately accessible as you read the marking.

DANGER indicates a personal injury hazard immediately accessible as you read the marking.

SYMBOLS AS MARKED ON EQUIPMENT


DANGER - High Voltage


Protective ground (earth) terminal


ATTENTION — REFER TO MANUAL

GROUNDING THE PRODUCT

WARNING: This module is grounded through the grounding connector of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation (I.E.C. Safety Class I).

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DANGER ARISING FROM LOSS OF GROUND

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulated) can render an electric shock.

USE THE PROPER FUSE

To avoid fire hazard use only a fuse of the correct type, voltage rating, and current rating.

REMOVE LOOSE OBJECTS

During disassembly or installation procedures, screws or other small objects may fall to the bottom of the mainframe. To avoid shorting out the power supply, do not power-up the instrument until such objects have been removed.

DO NOT OPERATE WITHOUT COVERS

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

USE CARE WITH COVERS REMOVED

To avoid personal injury, remove jewelry such as rings, watches, and other metallic objects before removing the cover. Do not touch exposed connections and components within the product while the power cord is connected.

REMOVE FROM OPERATION

If you have reason to believe that the instrument has suffered a component failure, do not operate the instrument until the cause of the failure has been determined and corrected.

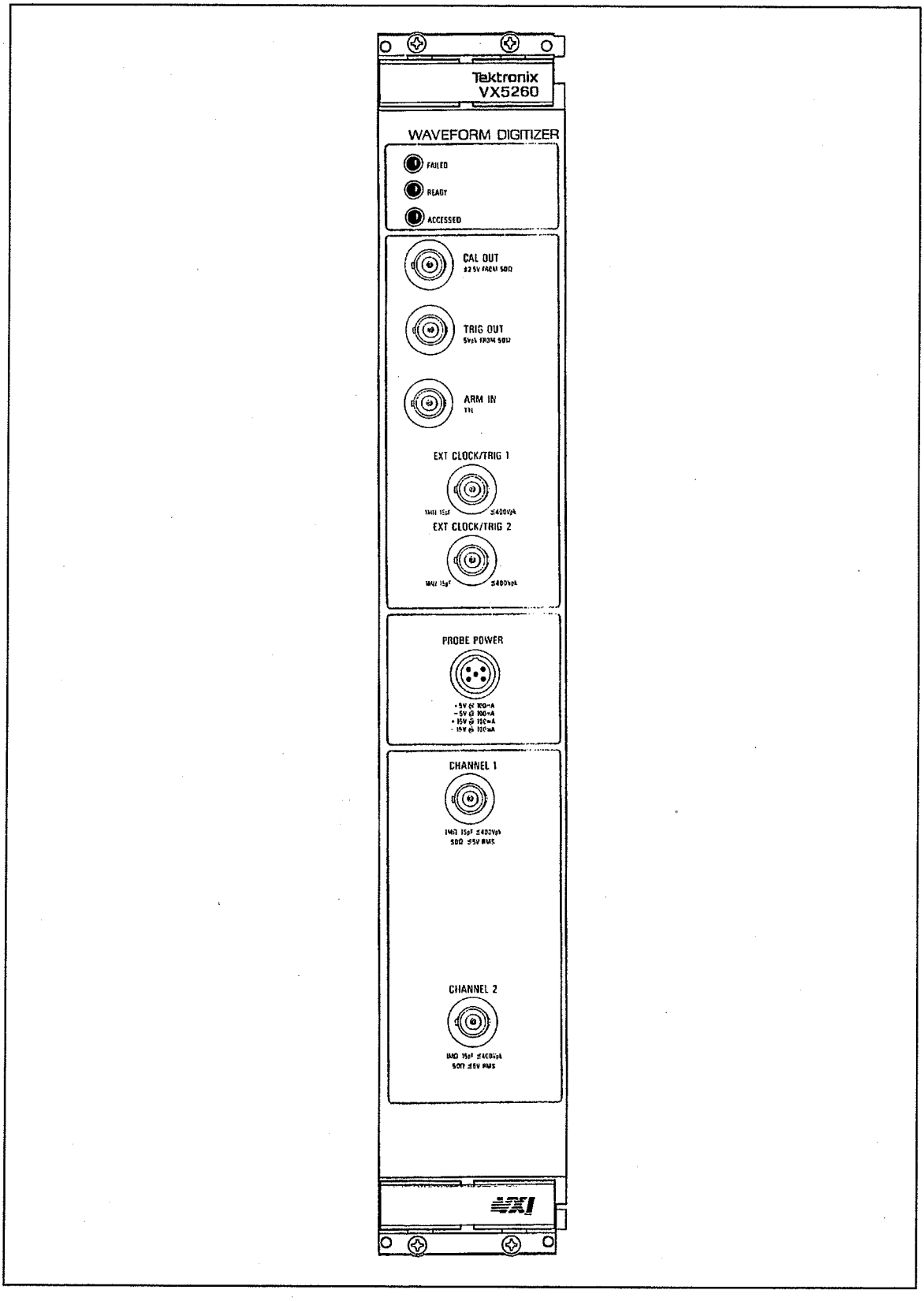
DO NOT OPERATE IN EXPLOSIVE ATMOSPHERE

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

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The Tektronix VX5260 Digitizer.

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Section 1
General Information

Introduction

Description

The Tektronix VX5260 Waveform Digitizer is a double-wide, D-size, high-performance, dual-channel digitizing instrument module designed for use in a VXIbus system. Its 200 MS/s real time digitizing rate provides high time resolution on transient events.

The module is a self contained VXIbus system component, and provides signal conditioning, triggering, timebase and memory functions, extensive internal signal analysis functions, and internal self-test, diagnostic, and calibration routines.

Waveform memory can be configured to store long records for high resolution on long duration events, or many short records can be used to store a variety of reference waveforms. These reference waveforms can then be used as go/no-go waveform templates in functional testing applications.

Internal signal analysis commands are available to provide answers rather than just waveform data. Flexible analysis of acquired data can be performed in the VX5260, often eliminating the need to analyze waveforms using software installed on a separate controller, as well as the corresponding transfer of long waveforms around the system.

The VX5260 has several acquisition recording modes, as well as signal averaging for improved signal-to-noise ratio when acquiring repetitive signals.

The trigger system provides flexibility for synchronizing the VX5260 with the device under test as well as other instruments in the test system. VXIbus STAR, SYNC100, and TTL and ECL Trigger lines can be used to synchronize multiple digitizers or other instruments, thus providing timing accuracy and efficiency in high throughput systems.

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Input Conditioning

The VX5260 provides an input analog bandwidth of 250 MHz with selectable input coupling of 50 Ω or 1 MΩ, depending upon probing requirements. The input system supports Tektronix TekProbe Level 1 encoding for automatic scale factor compensation when using encoded probes.

Waveform Memory

The VX5260 has a flexible structure for allocating waveform memory. Waveform acquisition and storage memory can be configured in various record lengths to efficiently balance time resolution and number of points captured. Figure 1-1 illustrates the basic memory architecture.

The high speed acquisition memory buffers the real time data from the A/D system. When acquisition is complete, the contents of high speed memory are transferred to a specified location in waveform storage memory. Depending upon record length, the waveform storage memory can store 1 to 128 individual waveforms for each channel. Table 1-1 shows the combinations of record lengths and number of records available.

The VX5260 can function as a real time analog-to-digital (A/D) converter at rates to 200 MS/s. Direct data output from this A/D conversion system is available over the VXI Local Bus, thus providing continuous real time digital waveform data.

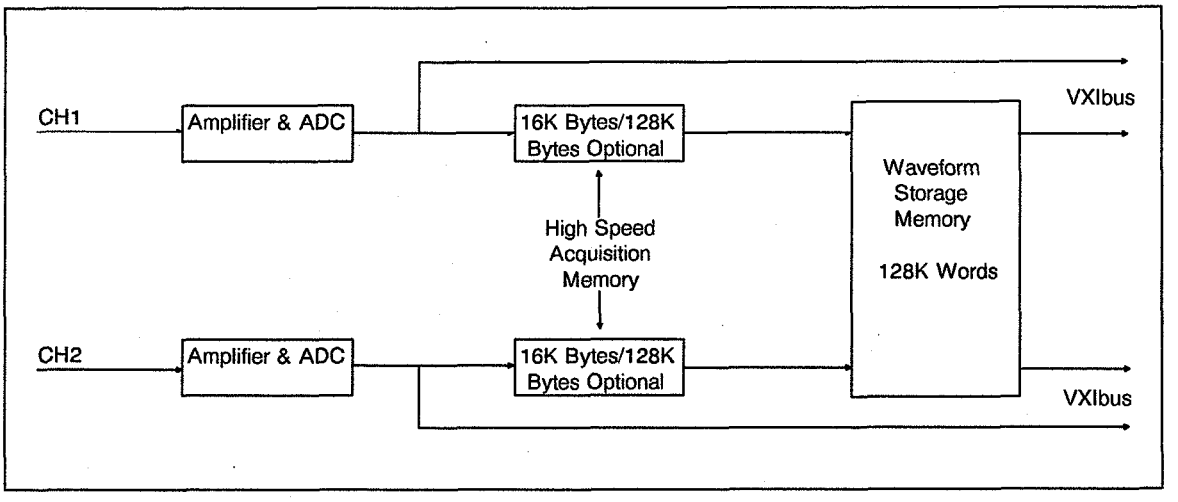


Figure 1-1. Overview of Memory Organization

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Table 1-1. Waveform Storage

Configuration	Record Length	Records Per Channel
Standard Memory	256	64
	512	64
	1024 (1K)	64
	2048 (2K)	64
	4096 (4K)	32
	8192 (8K)	16
	16384 (16K)	8
Optional Memory	32768 (32K)	4
	65536 (64K)	2
	131072 (128K)	1

Acquisition Modes

The VX5260 acquisition system has four recording modes (standard, envelope capture, envelope comparison, and auto-advance) and signal averaging.

The standard mode provides 8-bit vertical resolution over the input range. Acquisitions are captured by the High speed Memory, then placed in any specified available record in Waveform Storage Memory.

In the envelope capture mode, waveform memory is 16 bits wide, which allows the storage of two 8-bit values representing the minimum and maximum values of each sampled waveform point. During acquisition in this mode, two 8-bit values representing the minimum and maximum value sampled at each waveform point are recorded. As successive waveforms are recorded, new values are compared to previously recorded minimum and maximum values and the extremes are updated. This process results in an envelope of values that represent the minimum and maximum signal levels of all waveforms captured in the sequence. This mode can be used to efficiently analyze signal drift and jitter.

The envelope comparison mode performs a point by point comparison on a reference waveform (envelope) from one or both input channels. These comparisons can be made on any point outside or all points within the envelope. Reductions in record length allow more reference waveforms to be acquired. These reference waveforms may be downloaded into waveform storage through the VXIbus, or acquired using the envelope recording mode. This mode is very powerful when the upper and lower boundaries of the expected waveform are defined, and it provides a rapid go/no-go verification of the waveform data.

The auto-advance mode allows the user to capture multiple waveforms and store them in sequential locations in waveform storage memory (see Table 1-1). The VX5260 automatically arms and waits for a trigger event for each waveform captured. This feature provides rapid capture of multiple events.

Signal averaging can average from 2 to 256 waveforms, thus reducing random noise on repetitive signals.

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Trigger System

With oscilloscope style triggering that provides familiar internal and external triggering, the VX5260 offers a high degree of trigger system versatility. In addition, VXIbus lines can be used with the trigger system for synchronizing multiple instruments. The sources for trigger signals are shown in Table 1-2.

Table 1-2. Trigger Sources

Trigger	Trigger Source
Freerun	Continuous acquisition; disregards trigger signals.
Channel 1	Channel 1 analog input.
Channel 2	Channel 2 analog input.
External	Two front panel BNC connectors.
Internal	Generated by Slot 0 device.
Manual	Generated by CMDTRG command.
STAR Lines	VXIbus STARX line.
SYNC100	Synchronized with CLK100.
Autotrigger	Generated from signal on selected channel.

With CH1, CH2, and the external inputs, trigger coupling provides versatile, selective filtering for various types of measurement applications. Noise rejection is provided by increasing the hysteresis window for the reject trigger modes. Table 1-3 lists the available trigger coupling modes.

Table 1-3. Trigger Coupling

Coupling Mode	Description
DC	Direct Coupled from DC - 250 MHz.
HF Reject	30 kHz Low Pass Filter
LF Reject	80 kHz High Pass Filter
DC Noise Reject	DC with Noise Rejection Filter
AC	60 Hz High Pass Filter
AC HF Reject	60 Hz to 30 kHz Bandpass Filter
AC Noise Reject	60 Hz High Pass Filter with Noise Rejection Filter

Pre-trigger and post-trigger data capture is available when operating in the real time mode. The entire waveform record can consist of data captured before the trigger event, representing pre-trigger. A post-trigger delay is possible, thus providing an up to five record length delay before acquisition.

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Trigger and recording event output signals are available at the front panel and on the VXIbus. It also is possible to generate a trigger event on the VXIbus STARY line from an analog or digital trigger point that is coincident with the start of a record, the end of a record, or at the trigger point within a record. These trigger output signals offer significant capability when synchronizing instruments in a measurement system.

Signal Analysis Capabilities

The VX5260 contains firmware to provide manipulation and parametric analysis of the acquired waveform data. For many types of functional testing, the parameters of interest can be directly determined by the VX5260. This eliminates the overhead of transferring waveform records to another controller for analysis and also reduces software development on the host controller.

Signal analysis can take place over an entire record or be limited to a subset (window) of a specified waveform. Parameters that can be measured using the pulse analysis functions are listed in the first three columns of Table 1-4. Other waveform arithmetic and processing functions are listed in the last column.

Table 1-4. Signal Analysis

Magnitude Pulse Functions	Time Pulse Functions	Extended Pulse Functions	Arithmetic/Other Functions
Top	Rise Time	Mean	Add
Base	Fall Time	RMS	Multiply
Maximum	Width	Area	Subtract
Minimum	Period	Energy	Smooth
Top Overshoot	Frequency		Settling Time
Base Overshoot	Duty Cycle		Time A-to-B
Mid Point			
Peak-to-Peak			
Proximal			
Mesial			
Distal			

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Self-Test, Diagnostics, and Self-Calibration

The VX5260 provides self-test routines that verify instrument functionality. These routines can be invoked at anytime with the *TST?* command. The results of the self-test are written to an on-board ID-ROM in the form of error codes, and reported to the local controller over an asynchronous error reporting channel.

Should an instrument module fail the power-up self-test, or report an event code indicating some problem during operation, there are diagnostic routines that can be invoked to help isolate the problem.

A self-calibration function verifies the basic analog calibration of the module, and causes self-adjustments to compensate for system variables such as temperature. This function is invoked with a *CAL?* command. The function uses stored calibration constants to maintain instrument calibration to an external standard, and internal references to perform re-calibration of those constants. An internal connector is provided to connect the self-calibration function to an external reference to verify calibration of the instrument.

Standard Accessories

The only standard accessory for the Digitizer is the *VX5260 Digitizer Instruction Manual*.

Options

The following option is available for the VX5260:

- **Option 02** — The Extended Memory option provides 128 Kbytes of storage memory.

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Specifications

Performance Conditions

The performance limits for the specifications listed in Tables 1-5 and 1-6 are valid only when the instrument is operating under the following conditions:

- The instrument module must have at least a 20 minute warm-up period.
- The instrument module must be in an environment whose limits are specified in Table 1-5.
- Any condition not stated above that is unique to a specific characteristic is stated as part of the characteristic in the tables.
- The VX5260 has been fully calibrated with external references within the last 12 months.
- The VX5260 has been autocalibrated at the specified operating temperature; the current ambient temperature is within ±5° C from the temperature at the time of the autocalibration; and the time period is within four weeks of the autocalibration.

The electrical and environmental performance limits, together with their related validation procedure (if any), comprise a complete statement of the performance of a calibrated instrument module. For Environmental Specifications, the module meets or exceeds Military Specification MIL-T-28800D, Class 5.

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Table 1-5. Electrical Specifications

Characteristic	Performance Requirement	Supplemental Information
CHANNEL 1/CHANNEL 2 INPUT		
Input Range		±20 mV — ±100 V full scale
DC Gain Accuracy	±(2% of Signal + 1.2% of Input Range + 2 mV)	
Input Offset		
Range		0 — ±50% of Input Range
DC Accuracy	±(1% of Input Range + 2 mV)	
DC Zero Volt Shift	< ±(1.2% + 1 mV) after Auto-Cal	DC component excluding noise
Input R and C		
1MΩ (R and C)		1MΩ ±0.5%; 15 pF ±2 pF
50 Ω (R)		50 Ω ±1%
VSWR (dc — 250 MHz)		1.4:1 or better
Frequency Response (-3 dB Bandwidth)	dc — 250MHz	
Bandwidth Limiter	3 dB at 120 ±25 MHz	
Step Response		≤1.40 ns (10 — 90% of signal level)
Delay Difference Between Channels		≤250 ps
Crosstalk Between Driver Channel and Unused Channel	≤40 dB, dc — 250 MHz - ≤50 dB, dc — 100 MHz	
Maximum Input Voltage		
1MΩ, Coupling set to DC, AC, or GND		400 V (dc + peak ac); 800 V_{p-p} at 10 kHz or less
50 Ω, DC Coupled Only		5 V_{rms}; 0.5 watt-seconds during any 1 s interval for instantaneous voltage from 5 — 50 V
Input Protection Disconnect Time		<6 ms
TIME BASE		
Sources		Internal (VXI backplane CLK100) External Input 1 External Input 2 VXI STARX
Sample Rate		
Internal Clock		5 – 20 ns in 5 ns increments 20 ns to 10 ms in 10 ns increments
Accuracy		Determined by the source

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Table 1-5. Electrical Specifications (cont.)

Characteristic	Performance Requirement	Supplemental Information
TRIGGER SYSTEM		
Trigger Sources		Input Channels Either front-panel external trigger BNC STARX ESTST Protocol (uses CLK100, SYNC100, 1 ECLTRG line from ECLTRG0-5, and 1 TTLTRG line from TTLTRG0-7) SYNC100 Protocol (uses CLK100, SYNC100, and 1 ECLTRG line from ECLTRG0-5) ECLTRG SYNC Protocol (uses one ECLTRG line from ECLTRG0-5) TTLTRG SYNC Protocol (uses 1 TTLTRG line from TTLTRG0-7)
Sensitivity of A or B trigger (for CH1 & CH2)		For each coupling configuration, the minimum peak-to-peak signal amplitude required for stable triggering from Channel 1 or 2
DC Coupled	12% of Input Range, dc — 100 MHz 20% of Input Range, 100 — 250 MHz	
DC Coupled with HF Reject	12% of Input Range, dc — 30 KHz	Attenuates signals above 30 KHz
DC Coupled with LF Reject	12% of Input Range, 80 — 100 MHz 20% of Input Range 100 — 250 MHz	Attenuates signals below 80 KHz
DC Coupled with Noise Reject	12% of Input Range, dc — 100 MHz 20% of Input Range, 100 — 250 MHz	
AC Coupled	12% of Input Range, 60 Hz — 100 MHz 20% of Input Range, 100 — 250 MHz	Attenuates signals below 60 Hz
AC Coupled with HF Reject	12% of Input Range, 60 Hz — 30 KHz	Attenuates signals below 60 Hz and above 30 KHz
AC Coupled with Noise Reject	12% of Input Range, 60 Hz — 100 MHz. 20% of Input Range, 100 — 200 MHz.	

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Table 1-5. Electrical Specifications (cont.)

Characteristic	Performance Requirement	Supplemental Information
TRIGGER SYSTEM (cont.)		
Maximum peak-to-peak signal rejected by NOISE REJ coupling signals within the vertical bandwidth		
Channel 1 or Channel 2		≥4 % of Input Range for all Input Range settings
EXT CLOCK/TRIG 1 or EXT CLOCK/TRIG 2		≥20 mV when |level| < 0.8 V ≥100 mV when 0.8 V < |level| < 4 V
EXT CLOCK/TRIG1 and EXT CLOCK/TRIG 2 Inputs		
Resistance		1 MΩ ±1%
Capacitance		15 pF ±3 pF
Maximum Input Voltage		400 V (dc + peak ac); 800 V_{p-p} ac at 10 kHz or less
Internal Trigger Level		
Range		±120% of Input Range
Accuracy		
dc coupled	Within ±[3% of trigger level setting + 3% of p-p signal + 2% of Input Range + 0.5 mV + (0.5 mV × probe attenuation factor)]	
With NOISE REJ Coupling	Add ±(6% of Input Range) to dc coupled specifications	
External Trigger Level Range		±4 V
Trigger Uncertainty		±1 sample interval

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Table 1-5. Electrical Specifications (cont.)

Characteristic	Performance Requirement	Suplemental Information
TRIGGER SYSTEM (cont.)		
Trigger Position Range		
Maximum Pre-Trigger		8,388,608 ($2^{20} \times 8$) sample points
Maximum Post-Trigger		16,777,216 (2^{24}) sample points
Front Panel Arm Input		
Signal Level		TTL level (maximum 5.5 V) arms instrument on the rising edge
Trigger Out Function		Available from either front-panel BNC, STARY, ECLTRG, or TTLTRG. Analog Trigger Pulse. Digital Trigger Latched. Acquisition Complete.
Front-Panel Trigger Out		
Signal Level		TTL and +5 V CMOS compatible
Output Impedance		Driven from 50 Ω
SYSTEM		
Amplitude Resolution		8 bits
Sampling Interval		5ns, 10 ns, 15 ns, 20 ns, 30 ns, 40 ns, and additional 10 ns steps up to a 10 ms limit
Calibration Output		±2.0 V with a resolution of 12 bits
Accuracy		±1 mV
Acquisition Modes		
Normal		Triggering occurs only after valid trigger events
Envelope Capture		
Envelope Comparison		
Auto-Advance		The instrument will be automatically armed and ready to accept a trigger event after the previous acquisition is completed. The re-arm time is dependent on the selected record length.
Probe Decoding		Detects Tektronix encoded probes (X10 or X100) on EXT CLOCK/TRIG1, EXT CLOCK/TRIG 2, CH1, and CH2 inputs

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Table 1-5. Electrical Specifications (cont.)

Characteristic	Performance Requirement	Supplemental Information
	SYSTEM (cont.)	
Local Bus		
Real time data from A-D converters available from local bus lines to the right of the module on P2 and P3		
LBUSC00 P2-C5		CH1CLK
LBUSC01 P2-C6		CH1B7
LBUSC02 P2-C8		CH1B6
LBUSC03 P2-C9		CH1B5
LBUSC04 P2-C11		CH1B4
LBUSC05 P2-C12		CH1B3
LBUSC06 P2-C14		CH1B2
LBUSC07 P2-C15		CH1B1
LBUSC08 P2-C17		CH1B0
LBUSC09 P2-C18		CH1A7
LBUSC10 P2-C20		CH1A6
LBUSC11 P2-C21		CH1CLKEN
LBUSC12 P3-C9		CH1A5
LBUSC13 P3-C10		CH1A4
LBUSC14 P3-C11		CH1A3
LBUSC15 P3-B10		CH1A2
LBUSC16 P3-C12		CH1A1
LBUSC17 P3-C13		CH1A0
LBUSC18 P3-C14		CH2CLKEN
LBUSC19 P3-B13		CH2CLK
LBUSC20 P3-C15		CH2B7
LBUSC21 P3-C16		CH2B6
LBUSC22 P3-C17		CH2B5
LBUSC23 P3-B16		CH2B4
LBUSC24 P3-C18		CH2B3
LBUSC25 P3-C19		CH2B2
LBUSC26 P3-C20		CH2B1
LBUSC27 P3-B19		CH2B0
LBUSC28 P3-C21		CH2A7
LBUSC29 P3-C22		CH2A6
LBUSC30 P3-C23		CH2A5
LBUSC31 P3-B22		CH2A4
LBUSC32 P3-C24		CH2A3
LBUSC33 P3-C25		CH2A2
LBUSC34 P3-C26		CH2A1
LBUSC35 P3-B25		CH2A0
External Clock		
EXT CLOCK/TRIG 1 or EXT CLOCK/TRIG 2		Selectable levels < ±4 V from dc — 200 MHz
STARX		Differential ECL levels from dc — 200 MHz

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Table 1-5. Electrical Specifications (cont.)

Characteristic	Performance Requirement	Supplemental Information
SYSTEM (cont.)		
STARX/STARY Functions		Connected to left hand P3 connector of instrment STARX+ = Pin A28 STARX- = Pin A29 STARY+ = Pin C28 STARY- = Pin C29
Signal Level		STARX+/STARX-, and STARY+/STARY- are used as differential ECL compatible lines
STARX Function		External Clock Source Trigger In Source Arm In Source
STARY Function		Trigger Out
POWER		
Power Consumption		
Standard Instrument		120 W (Nominal)
Standard Instrument with 128K Memory		160 W (Nominal)
Probe Power available from front panel socket		+5 V 100 mA -5 V 100 mA +15 V 100 mA -15 V 100 mA
Current Requirements (assuming no current drawn from front-panel probe power connector)		
16K Version		Ipm Maximum
+5 V		8.4 A
-5.2 V		5.4 A
-2 V		3.4 A
+12 V		0.7 A
-12 V		0.9 A
+24 V		0.3 A
-24 V		0.1 A

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Table 1-6. Mechanical Specifications

Characteristic	Description
Overall Dimensions	
Height	366.70 mm (14.437")
Width	60.00 mm (2.388")
Depth	345.03 mm (13.584")
Weight	
Net	≈3.3 kg (7.28 lbs)
Shipping	≈4.7 kg (10.28 lbs)
Cooling	Forced air circulation. Airflow direction is from the base of the unit to the top.

Table 1-7. Environmental Specifications

Characteristic	Description
Temperature:	
Operating	0 — +50° C.
Nonoperating	-40 — +71° C.
Humidity:	
0 — +30 °C.	95 ±5%, noncondensing.
+30 — +40 °C.	75 ±5%, noncondensing.
+40 — +50 °C.	45 ±5%, noncondensing.
Altitude:	
Operating	3.05 km (10,000'). Derate maximum operating temperature by -1° C for each 300 m (1000') above 1.5 km (5000').
Nonoperating	4.7 km (15,000').
Vibration, Nonoperating	Withstands 0.33 mm (0.013") p-p;, 5 — 55 Hz sine wave, 15 minutes each axis and 10 minutes each axis at resonance or 55 Hz.
Shock, Nonoperating	Withstands 30 g, half sine, 11 ms duration, 3 shocks in each direction along 3 major axes, 18 total shocks.
Bench Handling, Nonoperating	12 drops from 45°, 4", or equilibrium, whichever occurs first.
Transportation	Qualified under National Safe Transit Association Preshipment Test Procedures 1A-B-1 and 1A-B-2.
Electromagnetic Compatibility	Within limits of FCC Regulations, Part 15, Subpart J, Class A when operated in a certified mainframe.
Electrostatic Immunity, Operating:	
Noninterruptive	15 kV, 100 Ω in series with 500 pF.
Nondestructive	20 kV, 100 Ω in series with 500 pF.

Note: The VX5260 meets or exceeds these selected specifications of MIL-T-28800D, Class 5 environmental requirements.

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Section 2
Preparation for Use

Introduction

The only operator configurable component on the VX5260 is the Logical Address Switch (SW1). There are two jumpers (J1 and J200) that can be configured for servicing. These components are accessible by removing the right side panel (the right side is identified when facing the front panel).

Removing the Side Panel

To remove the side panel, unlock the six (6) quarter-turn fasteners that attach the panel to the module chassis. These fasteners unlock when turned 1/4 turn counterclockwise from their locked position, which is indicated when their screwdriver slot is inline with the small plastic insert adjacent to the fastener. When replacing the panel, be sure to lock all of the quarter-turn fasteners by turning them 1/4 turn clockwise.

Configuration

The following paragraphs contain configuration information for the Logical Address Switch (SW1), Diagnostic Jumper (J1), and Reset Jumper (J200). These components are all located about 3" down from the top front of the printed circuit board.

Logical Address Switch (SW1)

Each VXI device must be assigned a unique 8-bit Logical Address in the range 0 — 255. Of these addresses, 0 is reserved for a Slot 0 module and 255 is reserved for Switchless Auto-Configuration (SWAC). When the Logical Address is set to 255 and a Tektronix Slot 0 module is installed and operating as the resource manager, that module will automatically set the logical address for the VX5260.

The VX5260 uses an 8-bit, binary coded, DIP switch (SW1) to set this address. The ON position of the switch corresponds to a logical 0; the OFF position corresponds to a logical 1. The factory default setting for all positions is 0FFh (Logical Address 255). The LSB for the switch is toward the top (keyed end).

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Configuring the Backplane Jumpers

VXIbus mainframes contain daisy chain jumpers for the Bus Grant (BG0 – BG3) and Interrupt Acknowledge (IACK) signals. When a VX5260 module is installed in two mainframe slots, the IACK jumper in the slot on the right (the higher numbered slot) must be configured for IACK to pass through the module. Generally, this is accomplished by *removing* the jumper. Because the VX5260 does not touch the P1 connector on the left (lower slot number), the IACK signal must remain by-passed in that slot. Consult the mainframe documentation for the backplane jumper configuration procedure.

WARNING

The mainframe compartment may be capable of delivering high current. Do not configure jumpers unless you are qualified to do so.

Installation

The VX5260 can be installed in any two adjacent mainframe slots, except Slot 0.

Note

Due to power requirements, some mainframes may contain a maximum number of digitizers that is less than the number of available slots.

Module Installation Using Injector/Ejector Handles

The following procedure is for installing the module into a Tektronix VX1500 VXI Mainframe. If the module is being installed in another mainframe, the procedure may need to be modified.

To install the module using the Injector/Ejector Handles:

1. Ensure that the front-panel ON/STANDBY switch on the Mainframe is turned to STANDBY.

2. Insert the module into the Mainframe top and bottom module guides for the slot(s) where the module is to be installed and push it partially into the Mainframe. Then pull out the Injector/Ejector Handles to their fully extended position (see the INJECT and EJECT views of Figure 2-1), and push the upper handle fully up and lower handle fully down.

3. Push the module into the Mainframe as far as it will go without forcing it. Then simultaneously pull the upper Injector/Ejector Handle fully down and the lower handle fully up to INJECT the module.

4. Ensure the module is fully seated into its VXI connectors and the front panel is flush with the front of the Mainframe chassis. Then install the top and bottom module retainer screws to secure the module in the Mainframe. Push in the Injector/Ejectors Handles and set them to a level horizontal position (see NORMAL view in Figure 2-1).

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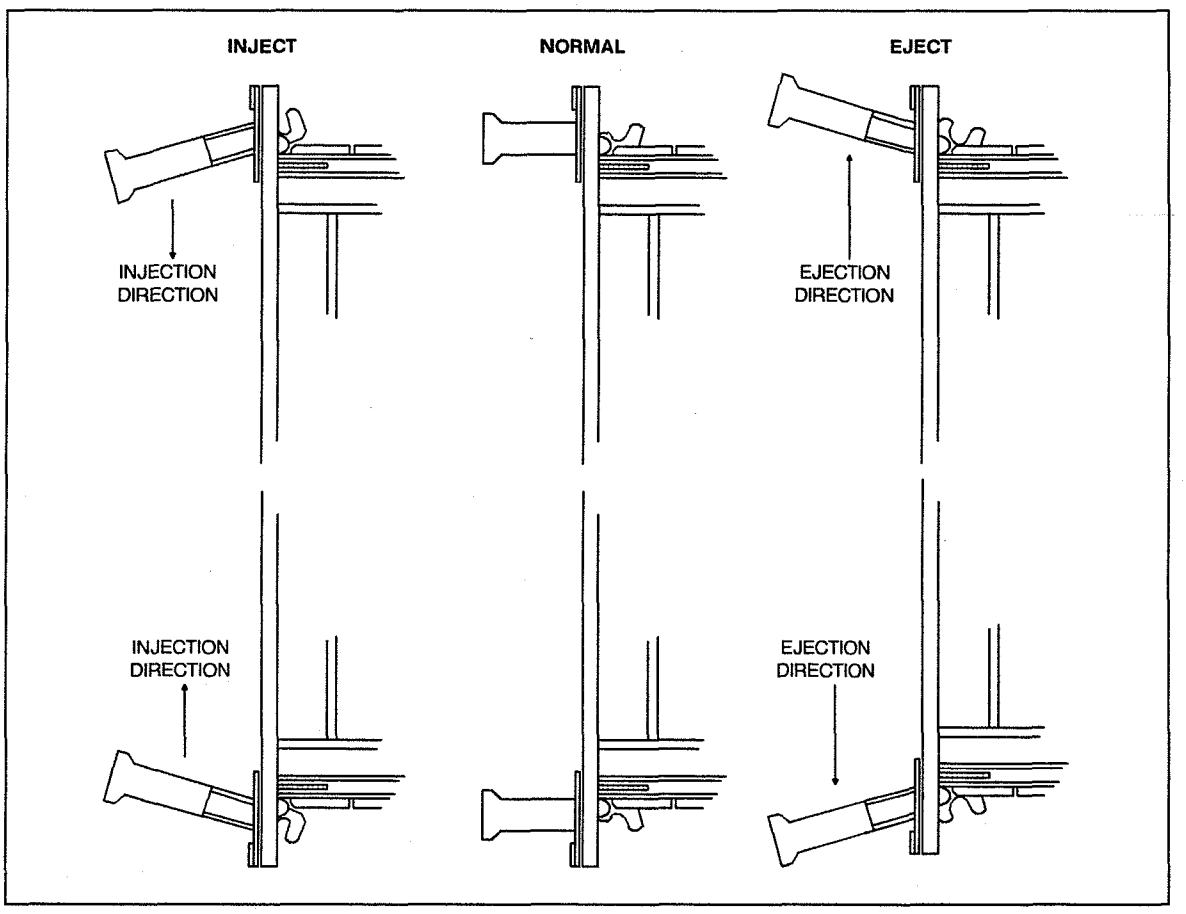


Figure 2-1 Injector/Ejector Mechanism

Module Removal Using Injector/Ejector Handles

The following procedure is for removing the module from a Tektronix VX1500 VXI Mainframe. If the module is being removed from another mainframe, the procedure may need to be modified.

To remove the module using the Injector/Ejector Handles:

1. Ensure that the front-panel ON/STANDBY switch on the Mainframe is turned to STANDBY, and the top and bottom module retainer screws are removed.

2. Pull out the Injector/Ejector Handles to their fully extended position (see the INJECT and EJECT views of Figure 2-1). Then simultaneously push the upper Injector/Ejector Handle fully up and the lower handle fully down to EJECT the module. Once the module is EJECTed, it can be removed from the Mainframe.

3. Push in the Injector/Ejectors Handles and set them to a level horizontal position (see NORMAL view in Figure 2-1).

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Section 3
Operation

Front Panel Indicators and Connectors

The front panel contains three LED indicators (FAILED, READY, and ACCESSED) and eight connectors (CAL OUT, TRIG OUT, ARM IN, EXT CLOCK/TRIG1, EXT CLOCK/TRIG2, CHANNEL 1, CHANNEL 2, and PROBE POWER).

Indicators

FAILED — A red LED that illuminates when the SYSFAIL* line is asserted. It is hardwire-controlled by the SYSFAIL* line. This indicator remains illuminated if the power-up kernel test fails.

READY — A green LED that indicates the module is ready for operation. It is hardwire-controlled by the SYSFAIL* line. If the module has just been powered-up, this indicator illuminates and the FAILED indicator extinguishes when the power-up kernel test is successfully completed.

ACCESSED — A yellow LED that illuminates whenever the module's MODID line is asserted. It also blinks whenever there is communications with the module over the VXIbus.

Connectors

CAL OUT — A standard BNC connector used when performing external trigger calibration. See *Section 9, Calibration* for more information.

TRIG OUT — A standard BNC connector that provides a TTL-compatible High output signal when the instrument triggers. The output impedance is 50 Ω.

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ARM IN — A standard BNC connector for connecting an external arming signal to the instrument when it is programmed to be externally armed. Arming occurs on the positive-going edge of a TTL signal.

EXT CLOCK/TRIG1 — A standard BNC connector programmable to accept an external clock signal (in the range of ±4 V) to drive the time base when the clock source is external, or an external trigger signal. The input impedance is 1MΩ. The maximum non-destructing input voltage is 400 V_{dc} + peak ac, or 80V_{p-p} at 10 kHz or less.

EXT CLOCK/TRIG2 — A standard BNC connector programmable to accept an external clock signal (in the range of ±4 V) to drive the time base when the clock source is external, or an external trigger signal. The input impedance is 1MΩ. The maximum non-destructing input voltage is 400 V_{dc} + peak ac, or 800 V_{p-p} at 10 kHz or less.

CHANNEL 1 — A standard BNC probe connector with attenuator coding ring for inputting signals to digitizer Channel 1. The Channel 1 connector accepts standard Tektronix passive probes and has a coding ring contact that causes instrument range switching when Tektronix attenuating probes containing encoding pins are attached. The input impedance is selectable between 1MΩ and 50 Ω, and the maximum input voltage is 400 V_{dc} + peak ac, or 800 V_{p-p} at 10 kHz or less.

CHANNEL 2 — A standard BNC probe connector with attenuator coding ring for inputting signals to digitizer Channel 2. The Channel 2 connector accepts standard Tektronix passive probes. For passive probes, the connector has a coding ring contact that causes instrument range switching when Tektronix attenuating probes containing encoding pins are attached. The input impedance is selectable between 1MΩ and 50 Ω, and the maximum input voltage is 400 V_{dc} + peak ac, or 800 V_{p-p} at0 kHz or less.

PROBE POWER — Provides ±5 V @ 100 mA and ±15 V @ 100 mA for active probes and other active accessories that do not provide their own power. Figure 3-1 shows the pinout for the Probe Power connector.

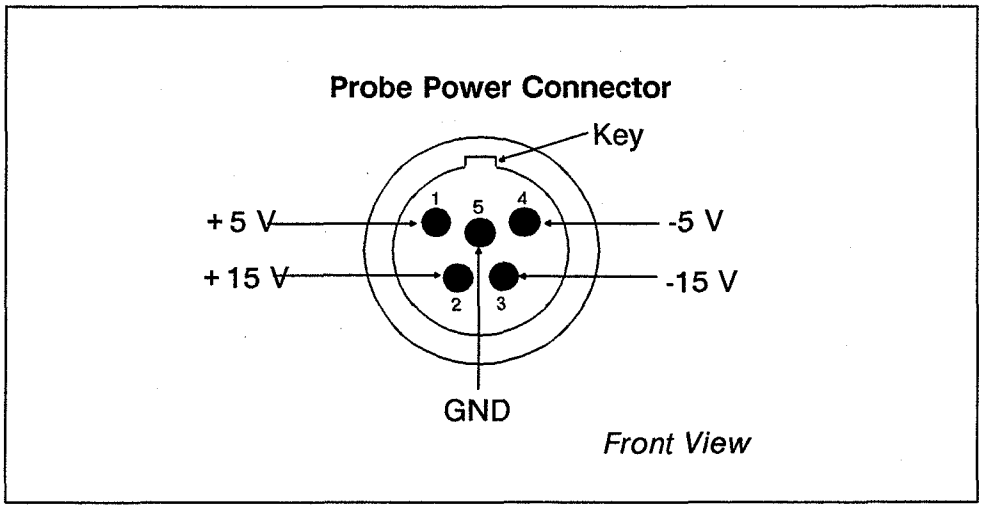


Figure 3-1. Probe Power Connector

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Triggering

Trigger Protocols

The VX5260 supports four trigger protocols: SYNC, ESTST (Extended STart/STop), SYNC100, and STAR Bus. The SYNC, SYNC100, and ESTST protocols are implemented using the TTLTRG* and ECLTRG lines, while the STAR Bus uses the STARX and STARY lines for triggering.

SYNC Protocol

SYNC protocol is a single source multi-acceptor trigger implemented by using one TTLTRG* or ECLTRG trigger line. The maximum repetition rate using a TTLTRG* line is 12.5 MHz, and the repetition rate while using an ECLTRG line is 62.5 MHz.

ESTST Protocol

Figure 3-2 illustrates the VXIbus resources and their relative timing used to implement ESTST protocol. While ESTST is not precisely a triggering function, the purpose of ESTST protocol is to be able to start or stop the operation of an instrument or group of instruments synchronously with the rising edge of the CLK100 clock signal. As shown in Figure 3-2, the SYNC100 signal identifies a unique clock edge to indicate when the start or stop is to be instigated. One of the ECLTRG trigger lines is designated for the instruments controlled by the ESTST protocol. This ECLTRG line is used as a qualifier to allow multiple groups of instruments within the same subsystem to be independently started or stopped. A qualifier is required for each group of instruments since both CLK100 and SYNC100 are shared resources, common to all instrument modules.

The combination of CLK100, SYNC100, and the designated ECLTRG line transmit at a specified instant of time to the instrument modules for start or stop. A designated TTLTRG* line indicates the start or stop state. When this line is asserted (low) it indicates the start state; when unasserted (high) the stop state is indicated.

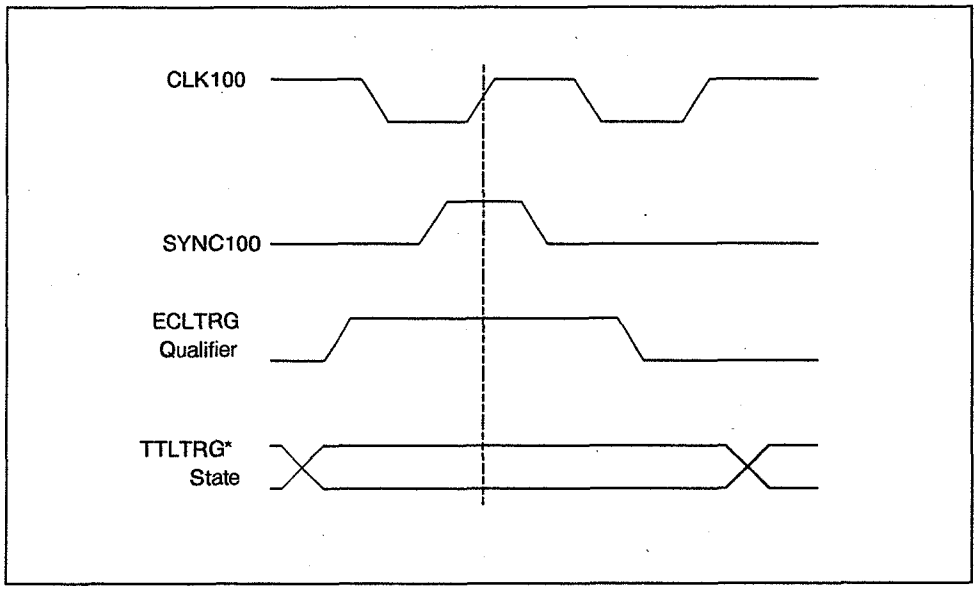


Figure 3-2. ESTST Protocol

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The following paragraph illustrates one possible scenario with ESTST protocol and the VX5260:

The VX5260 is setup ready to take an acquisition. Upon receipt of a *START* command, it begins acquiring data into its high speed memory buffer. When a valid trigger event is seen, a counter within the Digitizer circuitry is loaded with a value determined by the *ATRIGGER:DELAY* command. This counter decrements each time a sample point is acquired. When the terminal value of the counter is reached, the acquisition is ended and the waveform record is available for analysis.

Before an acquisition is finally terminated by the trigger event and counter operation (determined by the *ATRIGGER:DELAY* value), ESTST protocol allows for the acquisition of a record to be synchronously suspended and restarted multiple times. This feature allows one or more VX5260s to capture a record consisting of segments controlled by the ESTST protocol. The ESTST events might be the result of some physical aspect of the test system device under test, so that waveform memory is not used to store data that has no value. Alternatively, each segment could represent a different test point on the device under test allowing multiple measurements to be made within one waveform record.

SYNC100 Protocol

The SYNC100 protocol is a subset of the ESTST protocol allowing synchronous triggering of multiple instrument modules. Figure 3-3 illustrates how SYNC100 protocol uses the same resources as ESTST protocol, with the exception of using a TTLTRG* line to indicate the state. In the SYNC100 protocol, CLK100, SYNC100, and an ECLTRG qualifier combine to transmit a point in time to a group of instruments, causing them to trigger synchronously.

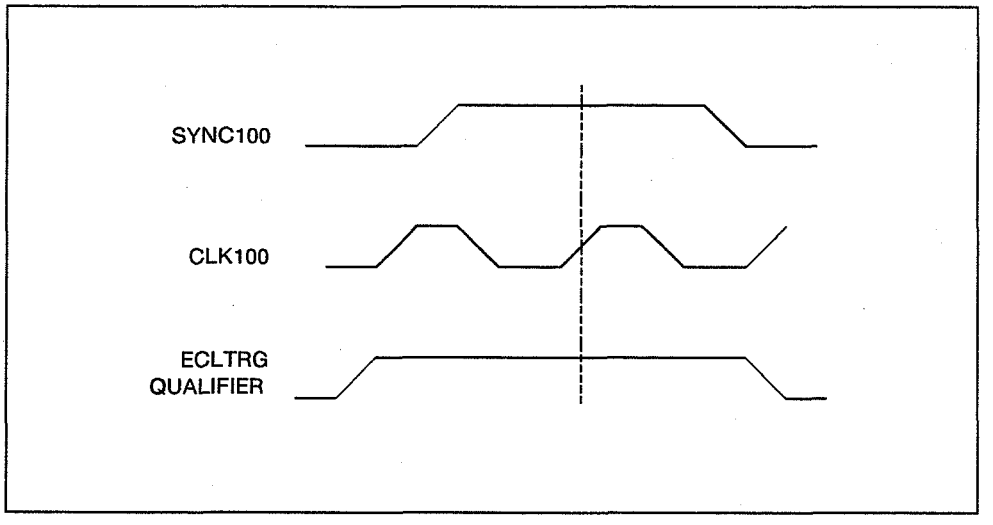


Figure 3-3. SYNC100 Protocol

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STAR Bus

The STAR Bus is made up of two bidirectional differential ECL lines (STARX and STARY) connected to each module slot in the VXI Mainframe. The STAR configuration can be described as a 12-int star with the Slot 0 Controller in the center.

The STARX and STARY lines have a maximum timing skew of 2 ns between any STAR signals, and a maximum delay of 5 ns between the Slot 0 Controller and any module. Thus, the STAR Bus can route high speed trigger signals to any module in the subsystem.

Export Triggering

In addition to the variety of trigger sources, the VX5260 also has the ability to export various events to the TTLTRG, ECLTRG, and STARY lines, as well as the front panel TRIG OUT connector. The control of the trigger export is implemented using the *ATRIGGER:EXPORT:SOURCE, ATRIGGER:EXPORT:TTLTRG, ATRIGGER:EXPORT:ECLTRG,* and *ATRIGGER:EXPORT:STARY* commands.

The trigger export signal can be simultaneously applied to any of the trigger export lines and TRIG OUT connector. The purpose of this signal is to link instrument operations together in a system and minimize the amount of external cabling required. The exported signal can be chosen to take on one of four possible personalities related to the trigger event. The four export signals, TRIG (the trigger event), ACQCOM (acquisition complete), TRIGL (latched trigger signal), and ACQRDY (ready for acquisition) are defined in the following paragraphs and are shown in Figure 3-4.

- The TRIG signal corresponds to the trigger event of the Digitizer either from an analog source or one of the VXI trigger lines. If a VXI digital trigger is selected, the same signal is routed to the export TRIG signal. If an analog trigger source is selected (CH1, CH2, EXTTRIG1, or EXTTRIG2), a nominal 20 ns wide pulse is seen as the trigger export signal.
- If ACQCOM is selected as the trigger export, a transition is seen when the acquisition completes. This transition can occur at a related but different point in time, depending on the *TRIGGER:DELAY* setting (i.e., the amount of post-trigger delay).
- TRIGL is used to give a transition when the Digitizer passes from an un-triggered to a triggered state.
- The ACQRDY export signal shows when the instrument has completed an acquisition and is armed and ready for the next acquisition.

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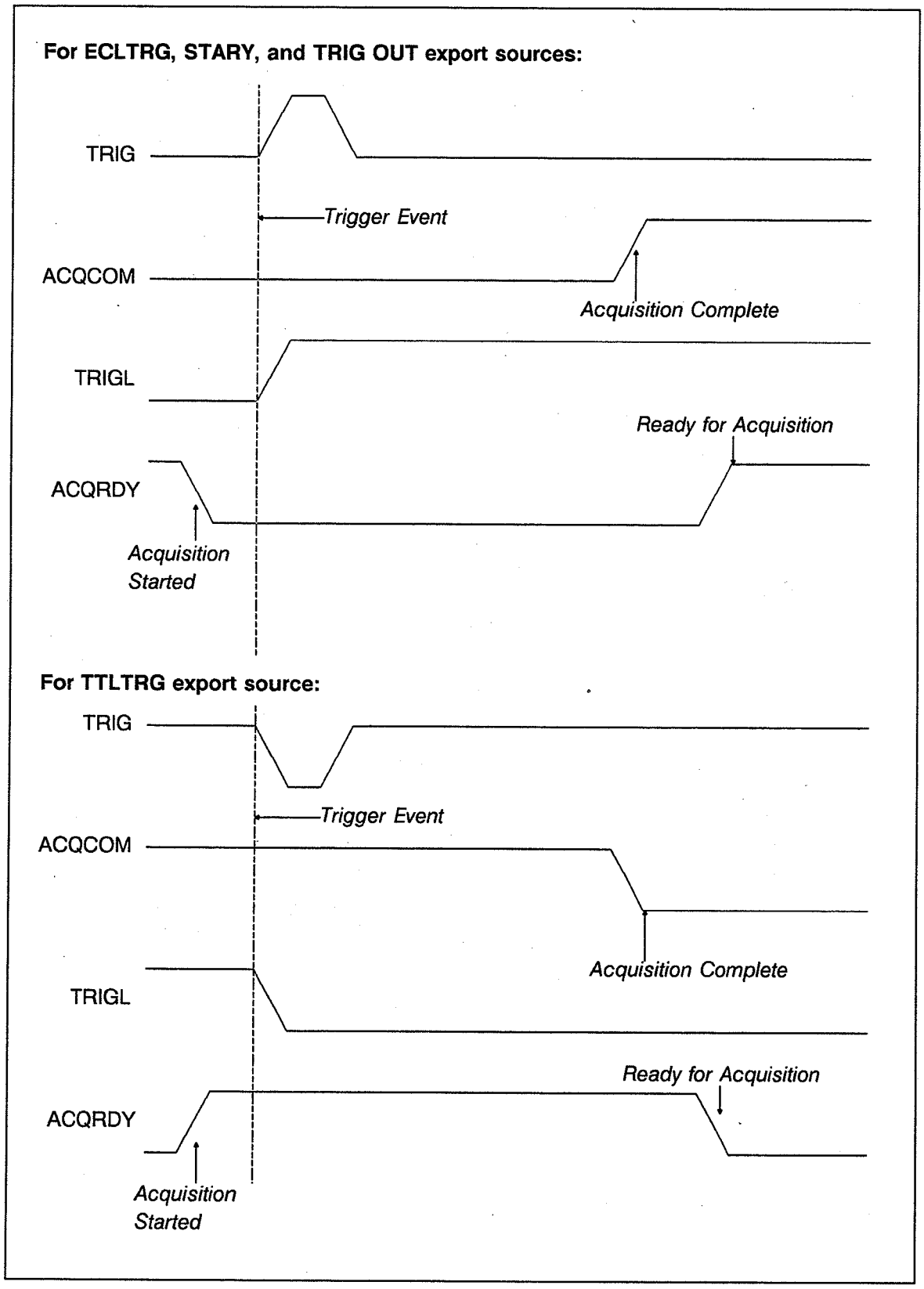


Figure 3-4. Export Triggering

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Initial Power-Up

The following power up sequence and information assumes the VX5260 contains Tektronix firmware, and is installed in a VXI mainframe with a Slot 0 Resource Manager.

As soon as power is applied to the VX5260, the RED FAILED LED illuminates and the Power-up Kernel Test is started.

If the Power-up Kernel Test is completed successfully, the FAILED indicator extinguishes, the READY indicator illuminates, and the VX5260 boots its operating firmware.

If the Kernel Test fails, or takes longer than five (5) seconds, the FAILED indicator remains illuminated.

If any of the Extended Self-Test routines fail, an error message is sent to the Slot 0 module, which in turn sends it to the external (or embedded) controller (provided the controller has a display device and is configured to display error messages).

Power-up Kernel Test

The kernel is defined as that part of the module that must be functional to support intelligence. For the VX5260, it includes the CPU, EPROM, RAM, Local and Remote Interrupts, Configuration Registers (used by the Slot 0 Module when configuring the VXI Mainframe), and a Watchdog Timer (a hardware timer that is continuously reset by firmware as proof that the kernel is still operating).

Extended Self-Tests

Extended Self-Test are groups of test routines that exercise various hardware and software functions of the module to verify their operability and functionality. Some groups have a hierarchial dependency such that they depend upon the success of a previously tested group.

A Test Monitor function calls each group and executes each test in the group. If an error occurs, an error message is communicated to the Slot 0 Module, which in turn sends the message to the external (or embedded) controller. The error code also is converted to a binary value and logged into the VX5260's ID-ROM (because of limited space, all errors may not be logged). Once these actions are completed, testing continues. Because some tests have a dependency on the successful completion of a prior test, once an error occurs, each subsequent test may generate an error.

If the external (embedded) controller has communications with the Slot 0 Module, and it includes a display device error, messages are displayed as they occur. When all testing is completed, the display should indicate the total number of errors found. If a zero (0) is displayed, the Extended Self-Test routines were completed without error.

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The binary error code logged into the ID-ROM can be converted to a decimal error code and displayed on the external (embedded) controller display using the ID-ROM *STERR?* command. The Test Monitor and its Extended Self-Tests routines can be invoked at any time during normal operation with either the **TST?* or *TST?* command. The test groups executed by the Test Monitor and a brief description of each follows:

Group 1: ID-ROM Verification — tests the health of the ID-ROM.

Group 2: Waveform Memory Test — tests the memory used by the processor to store waveform data transferred from acquisition memory.

Group 3: Control and Status Registers — verifies the registers used to control the hardware.

Group 4: Digitizer Acquisition Memory — tests all acquisition memory locations and their control circuitry.

Group 5: Acquisition Control Circuitry — tests the timebase and acquisition state machine.

Group 6: Power Supplies — tests all analog supplies generated in the digitizer module (external supplies are monitored by the Slot 0 Module).

Group 7: Calibration — tests that the self-calibration function and its circuitry is operational.

Group 8: Trigger Circuitry — Verifies that each trigger mode is functional.

Group 9: Flash Converter/Signal Path — Verifies that the analog-signal/digital-data path, including the A/D converters, is operational for both channels. If possible, the test routines will isolate the defective channel.

Group 10: Abnormal Conditions Circuitry — tests all of the abnormal condition sensors to ensure they are not currently showing any abnormal condition.

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Section 4
Rear Panel Interface

Introduction

The rear-panel interface consists of the VXIbus Interface connectors P1, P2, and P3. The pins on P1 and the inner row of P2 (Row B) are configured in accordance with the ANSI/IEEE 1014 Std for a VMEbus (see Preface). The pins on the outer rows of P2 (Rows A & C) and all of P3 are configured in accordance with the VXIbus System Specification V1.2 (see Preface). The pin assignments for these connectors are shown in Tables 4-1 through 4-3 (nc indicates there is no electrical connection made to the pin). For detailed information about the signals assigned to each pin, refer to the VMEbus Standard and the VXIbus Specifications.

The rear panel of the Digitizer contains five VXIbus connectors. The left slot of the Digitizer contains P2 and P3 connectors, while the right slot contains P1, P2, and P3 connectors.

Active Signal States

An asterisk (*) following a signal mnemonic, such as ACFAIL*, denotes that the signal is active when in its low state. Signals without an asterisk (*) are active when in their high state.

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Table 4-1. P1 Pinout
(nc = no connection)

Pin Number	Row A Signal	Row B Signal	Row C Signal
1	D00	nc	D08
2	D01	nc	D09
3	D02	ACFAIL*	D10
4	D03	BG0IN*	D11
5	D04	BG0OUT*	D12
6	D05	BG1IN*	D13
7	D06	BG1OUT*	D14
8	D07	BG2IN*	D15
9	GND	BG2OUT*	GND
10	nc	BG3IN*	SYSFAIL*
11	GND	BG3OUT*	BERR*
12	DS1*	nc	SYSRESET*
13	DS0*	nc	nc
14	WRITE*	nc	AM5
15	GND	nc	A23
16	DTACK*	AM0	A22
17	GND	AM1	A21
18	AS*	AM2	A20
19	GND	AM3	A19
20	IACK*	GND	A18
21	IACKIN*	nc	A17
22	IACKOUT*	nc	A16
23	AM4	GND	A15
24	A07	IRQ7*	A14
25	A06	IRQ6*	A13
26	A05	IRQ5*	A12
27	A04	IRQ4*	A11
28	A03	IRQ3*	A10
29	A02	IRQ2*	A09
30	A01	IRQ1*	A08
31	-12v	nc	+12V
32	+5v	+5V	+5V

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Table 4-2. P2 Pinout
(nc = no connection)

Pin Number	Row A Signal	Row B Signal	Row C Signal
1	ECLTRG0	+5V	nc
2	-2V	GND	nc
3	ECLTRG1	nc	GND
4	GND	nc	-5.2V
5	nc	nc	CH1 A/D DCLK
6	nc	nc	CH1 A/D B7
7	-5.2V	nc	GND
8	nc	nc	CH1 A/D B6
9	nc	nc	CH1 A/D B5
10	GND	nc	GND
11	nc	nc	CH1 A/D B4
12	nc	GND	CH1 A/D B3
13	-5.2V	+5V	-2V
14	nc	nc	CH1 A/D B2
15	nc	nc	CH1 A/D B1
16	GND	nc	GND
17	nc	nc	CH1 A/D B0
18	nc	nc	CH1 A/D A7
19	-5.2V	nc	-5.2V
20	nc	nc	CH1 A/D A6
21	nc	nc	CH1 CLK ENABLE
22	GND	GND	GND
23	TTLTRG0*	nc	TTLTRG1*
24	TTLTRG2*	nc	TTLTRG3*
25	+5V	nc	GND
26	TTLTRG4*	nc	TTLTRG5*
27	TTLTRG6*	nc	TTLTRG7*
28	GND	nc	GND
29	nc	nc	nc
30	MODID	nc	GND
31	GND	GND	+24V
32	nc	+5V	-24V

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Table 4-3. P3 Pinout
(nc = no connection)

Pin Number	Row A Signal	Row B Signal	Row C Signal
1	ECLTRG2	+24V	+12V
2	GND	-24V	-12V
3	ECLTRG3	GND	nc
4	-2V	nc	+5V
5	ECLTRG4	-5.2V	nc
6	GND	nc	GND
7	ECLTRG5	+5V	-5.2V
8	-2V	GND	GND
9	nc	+5V	CH1 A/D A5
10	nc	CH1 A/D A2	CH1 A/D A4
11	nc	nc	CH1 A/D A3
12	nc	GND	CH1 A/D A1
13	nc	CH2 A/D DCLK	CH1 A/D A0
14	nc	nc	CH2 CLK ENABLE
15	nc	+5V	CH2 A/D B7
16	nc	CH2 A/D B4	CH2 A/D B6
17	nc	nc	CH2 A/D B5
18	nc	-2V	CH2 A/D B3
19	nc	CH2 A/D B0	CH2 A/D B2
20	nc	nc	CH2 A/D B1
21	nc	GND	CH2 A/D A7
22	nc	CH2 A/D A4	CH2 A/D A6
23	nc	nc	CH2 A/D A5
24	nc	+5V	CH2 A/D A3
25	nc	CH2 A/D A0	CH2 A/D A2
26	nc	nc	CH2 A/D A1
27	GND	GND	GND
28	STARX+	-5.2V	STARY+
29	STARX-	GND	STARY-
30	GND	-5.2V	-5.2V
31	CLK100+	-2V	SYNC100+
32	CLK100-	GND	SYNC100-

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Section 5
Introduction to Programming

Introduction

This section contains introductory information about the programming commands for the VX5260. The actual command dictionaries are located in: *Section 6, Instrument Control Command Dictionary*; *Section 7, System Command Dictionary*; and *Section 8, ID-ROM Information*. Commands follow the formats and conventions established by the *ANSI/IEEE Std 488.2 — 1987, IEEE Standard Codes, Formats, Protocols, and Common Commands*.

Command Notation

Command format descriptions and descriptive tables use the following standard notation:

< >	Delimits a defined element that must be provided by the user.
[ ]	Delimits an optional element.
[ ]...	Delimits an optional element that may be omitted, or repeated one or more times .
{ }	Delimits a group of elements from which one must be selected.
|	Delimits exclusive-OR selectable elements.
::=	Means "is defined as".
:	Compound Command Program Header Separator used to separate "device names" from Command/Query Program Headers, and to separate Compound Command Headers.
;	Program Message Unit Separator used to separate functional parts of compound commands.
,	Program Data Separator used to separate compound Program Data elements.

Number Base

All numbers used in text are assumed to be decimal, unless otherwise noted with a suffix using the characters 'b', 'h', or 'o' immediately following the number.

- Binary numbers (base 2) are denoted by a 'b' suffix, such as: 1101b.
- Hexadecimal numbers (base 16) are denoted by an 'h' suffix, such as: 97FFh.

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Program Message

A VXIbus Program Message is a sequence of zero or more Program Message Units separated by a Program Message Unit separator, the semicolon (;). A Program Message Unit represents a single command message, programming data, or a query message intended for a device such as the VX5260. A Command Message represents a single command or programming data sent from the external (or embedded) controller through an interface device to the VXIbus device, such as the VX5260. A Query Message represents a single query sent over this same path to the VX5260.

Each Program Message Unit contains a series of syntactic elements, which may include a Device Name, a Command/Query Program Header (the command) and the associated Program Data elements (the command parameters), or multiple Program Message Units separated by semicolons (;). For a more detailed explanation about Program Messages, refer to the *ANSI/IEEE Std. 488.2-1987.*

After the automatic execution of its initial power-up and configuration sequence, the VX5260 relies on Program Messages received over the VXIbus to control its on-going operations. These messages may originate from an external controller, then be transferred through a serial (RS232) or IEEE 488 (GPIB) interface to a VXIbus Interface Device, such as a Tektronix VX5520 Slot 0 Resource Manager, which finally transfers the messages to the VX5260 over the VXIbus. Messages also may originate from an embedded controller (installed in the VXIbus Mainframe), which would transfer all messages to the VX5260 directly over the VXIbus. Explanations in this section assume that messages are transferred to the VX5260 through a VX5520. Each message is parsed by the VX5520 to determine its destination, or action to be taken.

Messages sent to the VX5260 through the VX5520 (using either the AUX PORT or IEEE 488 port) are of the form:

```
:<device name>:<command>
```

such as:

```
:DEV06:CHANNEL:COUPLING 1,DC;RANGE 1,10;OFFSET 0,6
```

where:

:DEV06 is the *<device name>* and the rest of the message is the command and its parameters.

When the VX5260 is installed in another manufacturer's mainframe, the interface device in that mainframe, and the mainframe, must provide the command path and format from the external (or embedded) controller to the VX5260.

ASCII Code

The 7-bit ASCII code is used for the majority of syntactic elements and semantic definitions. However, 8-bit ASCII code is allowed in special block messages, such as Arbitrary Block Program Data.

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Syntactic Delimiters

Syntactic elements in a Program Message Unit are delimited with colons, white space, commas, or semicolons.

Colons (:) typically delimit "<device names>" and device-dependent Command/Query Program Headers, such as in the following message:

```
:DEV06:INST:AMP 12
```

where *:DEV06* is the "<device name>" and *:INST:AMP* is the Command Program Header.

White Space (defined below under the White Space topic) typically delimits device-dependent Command/Query Program Headers from Program Data, such as reserved word command names in a command set from device-dependent command arguments. In the example above, *:INST:AMP* is the Command Program Header and *12* is the Program Data.

Commas (,) typically delimit multiple Program Data elements (arguments).

Semicolons (;) typically delimit multiple Program Message Units and compound Command Program Header tree structures in commands suited for compound program headers.

An example of delimiting multiple Program Message Units is the combining of the following two single Program Message Units:

```
:DEV01:CHANNEL:COUPLING 1,DC

:DEV01:CHANNEL:RANGE 1,10
```

into the following single compound message using the semicolon:

```
:DEV01:CHANNEL:COUPLING 1,DC;RANGE 1,10
```

which allows the tree structure to regress to the root Command Program Header Element (*CHANNEL*) before parsing the final Command Program Header Element (*RANGE*) and its Program Data (*1,10*).

White Space

White space is essential to a program, but is not a part of the program. Typically, it is used to separate certain syntactic elements in a command. In the VX5260, white space is defined the same as in the *ANSI/IEEE Std 488.2-1987*, which is as a single ASCII-encoded byte in the range ASCII 0-32 (decimal), except ASCII 10, which is the Line Feed (LF) or Newline (NL) character.

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Special Characters

The VX5260 firmware defines Special Characters as the Line Feed (LF) or Newline (NL) character (ASCII 10), and all characters in the range ASCII 127 — 255. These characters may be used in Arbitrary Block Program Data without consequence.

Valid Device Name

During system configuration at power-up, the VX5520 assigns a device name to the VX5260, and places it into a device master configuration table along with other data about the device such as (slot location, logical address in the VXI System, and so on.). The device name is of the form "DEVxx", where "xx" is a two-digit, sequential number starting with 00. Once power-up configuration is completed, the assigned name in the device master configuration table can be changed by using the VX5520 NAME command (for information on using this command, refer to the VX5520 Programmer's Manual.). A valid device name must comply with the following rules:

- The maximum number of characters is 12.
- The first character must be alphabetic (ASCII 65-90 or 97-122).
- Characters after the first may be any alphanumeric character (ASCII 48-57, 65-90, or 97-122) or the underscore character "_" (ASCII 95), except, the underscore character cannot be the last character in the name.
- The VX5520 is case insensitive with respect to device names and commands, thus upper-case and lower-case alphabetical characters are treated as equivalents.

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Program Data

The types of Program Data recognized by the VX5260 are:

- Decimal Numeric
- Non-Decimal Numeric
- String
- Arbitrary Block

Numeric Program Data Value Range

The range of acceptable Program Data numeric values is limited to that allowed by a 32-bit signed binary number. If out-of-range values are entered, an error message is generated, and execution of the command, or the multiple message unit containing the error, is terminated.

Decimal Numeric Program Data

Decimal Numeric Program Data is defined the same as in *ANSI/IEEE Std 488.2-1987*, which is as three numeric representations NR1, NR2, and NR3. When any one of the three is acceptable, the flexible representation NRf is specified. The general description of NRf data is shown below.

Type	Format	Examples
NR1	Implicit-point (Integer)	1, +3, -2, +10, -20
NR2	Explicit-point-unscaled (Fixed Point)	1.2, +23.5, -0.15
NR3	Explicit-point-scales (Floating Point)	1E+2, +3.36E-2, -1.02E+3

If NR1 is specified as the input value format, NRf is acceptable, but if the value is not NR1, a warning message is issued. Query response is NR1 if the input is NR1, otherwise it is NR2.

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Non-Decimal Numeric Program Data

Non-Decimal Numeric Program Data is defined the same as in *ANSI/IEEE Std 488.2-1987*, which is as the three alternate radix representations: hexadecimal, octal, and binary. These are represented as follows:

Hexadecimal

#Hd..d

where:	H	is H or h.
	d	is 0..9, A..F, or a..f

Octal

#Qd..d

where:	Q	is Q or q.
	d	is 0..7.

Binary

#Bd..d

where:	B	is B or b.
	d	is 0 or 1

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String Program Data

String Program Data, sometimes referred to as "string literals", "literals", or just "strings", is defined as:

```
"[<non-double quote character>]..."
```

such as:

```
"This is a string constant."
```

or

```
"0..127"
```

To include a double quote character in the string, insert an additional double quote character ahead of the double quote character in the string. For example, the string:

```
serial number "B010000"
```

would be sent as:

```
"serial number ""B010000"""
```

String constants may be of any length, up to the memory limits of the VX5520.

Arbitrary Block Program Data

Arbitrary block program data is defined as:

```
#<byte count digit><byte count>[<contiguous 8-bit data
byte>]...
```

where:

<byte count digit >::= a non-zero digit in the range ASCII 1-9 that defines the number of digits (bytes) in the *<byte count>* field that follows.

<byte count>::= any number of digits in the range ASCII 0-9 that define how many bytes are in the *<contiguous 8-bit data byte>* field that follows.

<contiguous 8-bit data byte>::= a *<byte count>* number of 8-bit bytes in the range ASCII 0-255 that define the message. Each byte defines one character.

An example is:

```
#17AB4ZL?
```


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Command Formats

All commands follow the Functional Element Syntax formats for Command Message Units and Query Message Units as defined by *ANSI/IEEE Std 488.2-1987*. These formats are defined to have Simple Command Program Headers, Simple Query Program Headers, Compound Command Program Headers, Compound Query Program Headers, Common Command Program Headers, and Common Query Program Headers, which are further described with examples in the paragraphs that follow.

Simple Command Program Header

A command with a Simple Command Program Header is one that contains only one Program Mnemonic, or only one Program Mnemonic plus Program Data. Its message format is:

```
<Program Mnemonic> [<Program Data>]
```

such as:

```
INIT
```

or

```
INIT ALL
```

Simple Query Program Header

A command with a Simple Query Program Header is one that contains only one Program Mnemonic followed by a question mark (?). Its message format is:

```
<lst Program Mnemonic>?
```

such as

```
WFMPRE?
```


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Compound Command Program Header

A command with a Compound Command Program Header is one that contains multiple Program Mnemonics plus Program Data. Its message format is:

```
<1st Program Mnemonic>[:<2nd Program Mnemonic>]
```

or:

```
<1st Program Mnemonic>[:<2nd Program Mnemonic>] <Program Data>
```

such as:

```
CHANNEL:COUPLING 1,DC
```

Notice that this format is the same as for sending messages to the VX5260, since the destination address(es) in the command format are formatted the same as for multiple program mnemonics. When our example above is sent from an external controller, the message format would be:

```
:DEV06:CHANNEL:COUPLING 1,DC
```

where *DEV06* is the device name assigned to the VX5260 by the VX5520 during power-up configuration.

When this message is received by the VX5520, it strips off the destination address (*:DEV06*) and sends the remaining message to the VX5260.

The Compound Command Program Header has an additional variation when associated with the allowable IEEE 488.2 compound header organization using the compound command "tree" structure. The following example, which has already had the destination "device name" of *:DEV06* stripped off by the VX5520:

```
:CHANNEL:COUPLING 1,DC;RANGE 1,10;OFFSET 1,6
```

is equivalent to the commands:

```
:CHANNEL:COUPLING 1,DC

:CHANNEL:RANGE 1,10

:CHANNEL:OFFSET 1,6
```

In the tree structured command, the use of the semicolon allows the VX5260 parser to regress to the root level Program Mnemonic, which in this case is the command word *CHANNEL.*

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Compound Query Program Header

A command with a Compound Query Program Header is one that contains multiple Program Mnemonics followed by a question mark (?). Its message format is:

```
<1st Program Mnemonic>:<2nd Program Mnemonic>?
```

such as:

```
:CHANNEL:COUPLING?
```

This format also lends itself to the tree structured regression. An example is:

```
:CHANNEL:COUPLING?;RANGE?;OFFSET?
```

Common Command Program Header

A command with a Common Command Program Header is one that precedes its Program Mnemonic with an asterisk (*). Its message format is:

```
*<1st Program Mnemonic>
```

such as

```
*RST
```

Common Query Program Header

A command with a Common Query Program Header is one that precedes its Program Mnemonic with an asterisk (*), and follows it with a question mark (?). Its message format is:

```
*<1st Program Mnemonic>?
```

such as:

```
*TST?
```


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Instrument Response Queuing

Queries sent to the VX5260 will generate a response that must be read prior to sending further commands or queries to that instrument. The proper procedure is to send a query followed by a read of the response to that query. If a command or query is sent before reading the previous response, the instrument will not accept that command and the controller will time out. In this case, the previously ignored response should then be read. Commands that do not produce a response can be sent without performing a read.

This response queuing has special ramifications for compound commands and queries. If the Slot 0 Controller (such as a Tektronix VX5520) sends the compound command or query to the VX5260 as a single message, a single response will be generated that must be read prior to sending further commands or queries. However, if the Slot 0 Controller breaks the compound command or query into several simple commands and/or queries, the VX5260 will process all commands until the first query. The first query will produce a response that must be read prior to executing further commands or queries. If more commands or queries are present in the compound command, the communication can become deadlocked, unless the Slot 0 Controller reads the pending response prior to sending the next command.

The Tektronix VX5520 Resource Manager can be set to always read a response from an instrument for both commands and queries using the *CMDRESP* command. Always reading the instrument responses allows compound commands and queries to be sent to the VX5260 without communications deadlocking. When *CMDRESP* is enabled on the VX5520 for communication with the VX5260, the VX5260, the VX5260 must generate a response for all commands and queries. To generate a null response for a command in the VX5260 requires setting the Command Completion bit (Bit 0) in the Service Request Enable (SRE) Register. To generate a response for queries requires setting the Message Available (MAV) bit (Bit 4) in the SRE Register. The following example shows how to enable the command response for the VX5520 and the VX5260:

```
CMDRESP "VX5260",1
:VX5260:SRE 17
```

The "SRE 17" portion of the example command enables only the SRE Register bits (Bits 0 and 4) necessary for generating command and query responses. Refer to the **SRE* command description in Section 8 of this manual for more detail on the Status Byte Enable bits.

If a command or query is sent to the VX5260 and the VX5520 times out, the VX5260 may be waiting to for its response to be read. The *FROM?* query should be used to get the VX5260 response, which will clear the communication channel and allow the VX5260 to accept the next command or query. The timeout may also be an indication that the timeout period on the VX5520 should be extended.

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Case Sensitivity

The command set parser is insensitive to case; therefore, command mnemonics or Program Data may be entered in either upper-case or lower-case characters. Responses are returned in all uppercase, except for string data, which is returned in the same case as entered. For ease of recognition, command mnemonics, predefined parameter words (such as : ON and OFF), and decimal number formats (such as: NR1, NRf, and so on.) are capitalized in the command set. Where the user must provide a parameter, the parameter name is set off with left and right angle symbols (< >), and have lower-case parameter names such as : <length>. String Program Data is case sensitive.

Command Dictionary Layout

The Command Dictionary for the VX5260 firmware has a layout similar to that of many command dictionaries, but with some differences to accommodate the hybrid nature of the firmware. The following paragraphs describe the elements included in each Command Dictionary entry.

Each command is listed alphabetically at the top of a new page.

Purpose — Provides a brief description of what the command does.

Syntax — Shows the command format as it must appear at the VXIbus input to the VX5260. The command name, and some common Program Data elements (e.g., ON, OFF, NONE, and so on.), are shown in all capital letters for readability only, as the firmware treats upper-case and lower-case letters the same. Mandatory user-defined entries are listed in lower-case letters and are enclosed in angle brackets (< >). Where the command descriptions include both command and query forms, there may be separate Command and Query header titles.

Parameters — Describes the parameters values, including their allowable ranges, and any required delimiters, such as commas.

Description — Provides additional details about the command.

Examples — Provides one or more examples of actual command use including input parameters and returned values.

Related Commands — Lists other commands that may perform either parallel functions on different data, or different functions on the same data.

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Section 6
Instrument Control Command Dictionary

Introduction

Instrument control commands control the primary instrument functions. They initialize the instrument, change its function settings, query for its status, trigger an acquisition, query for the results of the acquisition, transfer waveform data to or from the instrument, perform internal self-test and calibration, and so on.

Alphabetical Command Listing

Following is an alphabetical listing and a purpose statement for each Instrument Command.

ACQUIRE	Sets the parameters that control waveform acquisition.
ACQUIRE?	Queries for all *ACQUIRE* settings.
ACQCOM?	Returns the state of the current acquisition.
ARM	Selects the mode and source for the trigger arming function.
ARM?	Queries for all *ARM* settings.
ATRIGGER	Selects the mode, source, and operating parameters for the A trigger.
ATRIGGER?	Queries for all *ATRIGGER* settings.
BTRIGGER	Selects the mode, source, and operating parameters for the B trigger.
BTRIGGER?	Queries for all *BTRIGGER* settings.
CAL	Selects the channel, mode, and function to be calibrated and inputs the calibration parameters.
CAL?	Performs the same function as *CAL*, except both channels are automatically selected for calibration.
CHANNEL	Selects the input channel and sets the input signal conditioning parameters.

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CHANNEL?	Queries for all *CHANNEL* settings.
CMDARM	Manually arms the digitizer asynchronously; overrides other arming sources.
CMDTRIG	Manually triggers the digitizer asynchronously; overrides other trigger sources.
CURVE	Transfers waveform data from an external source to waveform memory.
CURVE?	Transfers waveform data from waveform memory to an external destination.
DATA	Selects the waveform memory segment for subsequent *WFMPRE*, *WFMPRE?*, *CURVE*, *CURVE?*, or *WAVFRM?* commands.
DATA?	Queries for all *DATA* settings.
DESE	Permits the setting of the Device Event Status Register.
DESE?	Reads the Device Event Status Register.
ENVELOPE	Sets the envelope function parameters.
ENVELOPE?	Queries for all *ENVELOPE* settings.
EVENT?	Provides notification that an error has occurred on the Digitizer.
EVMSG?	Provides error messages when errors occur on the Digitizer.
EXTTRIG	Selects an external trigger source and sets the trigger level.
EXTTRIG?	Queries for the *EXTRIG* settings.
INIT	Initializes the instrument to its power-up state, and resets default values.
REPORT	Enables or disables error, warning, and event message functions.
REPORT?	Queries for the enabled/disabled status of the *REPORT* function.
SAMPLE	Selects the sampling clock source and sets the sampling rate.
SAMPLE?	Queries for all *SAMPLE* settings.
SEQPROTO	Selects the triggering protocol.

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SEQPROTO? Queries for the *SEQPROTO* setting.

START Enables the instrument to start a waveform acquisition sequence.

STERR? Recalls error information from the ID-ROM (NVRAM).

STOP Terminates a waveform acquisition sequence.

WAVFRM? Sequentially executes the *WFMPRE?* and *CURVE?* commands.

WFMPRE Specifies various parameters of a waveform preamble.

WFMPRE? Queries for all waveform preamble items for a specified waveform.

Functional Command Listing

Following is a functional listing of Instrument Control Commands:

Input/Signal Conditioning	Calibration
CHANNEL	CAL
CHANNEL?	CAL?
Arm/Trigger	**Waveform Transfer**
ARM	DATA
ARM?	DATA?
ATRIGGER	WFMPRE
ATRIGGER?	WFMPRE?
BTRIGGER	CURVE
BTRIGGER?	CURVE?
CMDARM	WAVFRM?
CMDTRIG	INIT
EXTTRIG	
EXTTRIG?	
Time Base/Recording	**Control**
SAMPLE	SEQPROTO
SAMPLE?	SEQPROTO?
ACQUIRE	START
ACQUIRE?	STOP
ENVELOPE	
ENVELOPE?	
Error Reporting	
REPORT	
REPORT?	
DESE	
DESE?	
EVENT?	
EVMSG?	
STERR?	

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Power-Up Default Control Settings

When the VX5260 powers up, its default instrument control command settings are as shown in Table 6-1.

Table 6-1. Power-up Default Settings
(na = not applicable)

Command	Function	Default Setting
ACQUIRE	AVERAGE	OFF
	CHANNEL	1,ON 2, ON
	LOC	1,1; 2,2
	MODE	SINGLE, 1024
	NUMAVG	2
ARM	MODE	AUTO
	SOURCE	STARX
ATRIGGER	ABSELECT	A
	COUPLING	DC
	DELAY	0.0
	DUNIT	TIME
	EXPORT:ECLTRG	NONE
	EXPORT:SOURCE	TRIG
	EXPORT:STARY	OFF
	EXPORT:TTLTRG	NONE
	LEVEL	0.0
	MODE	NORMAL
	SLOPE	PLUS
	SOURCE	CH1
BTRIGGER	COUPLING	DC
	LEVEL	0.0
	SLOPE	PLUS
	SOURCE	CH1
CAL	CH1/CH2	
	<fcnt>	INTC
	<mode>	ALL
CHANNEL	BWLIMIT	FULL
	COUPLING	DC
	INVERT	OFF
	OFFSET	0.0
	RANGE	200.0
	TERM	1.0E+6
CMDARM	na	na
CMDTRIG	na	na
CURVE	na	na
DATA	COUNT	1024
	ENCDG	RIB
	LOC	1
	START	0

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Table 6-1. Power-Up Default Settings (continued)
(na = not applicable)

Command	Function	Default Setting
DESE	na	na
ENVELOPE	CHANNEL	1,ON 2,ON
	LOC	1,3 2,4
	MAXWFM	1
	MODE	OFF
EVENT?	na	na
EVMSG?	na	na
EXTTRIG	LEVEL	TTL
INIT	na	na
REPORT	CMDERR	ON
	CMDEVENT	ON
	CMDWARN	ON
	EXERR	ON
	EXEVENT	ON
	EXEWARN	ON
SAMPLE	CLOCK	INT
	DIVISOR	1
	INTERVAL	1E-8
SEQPROTO	na	AUTO
START	na	na
STERR?	na	na
STOP	na	na
WAVFRM?	na	na
WFMPRE	BNFMT	RI
	BYTNR	1
	ENCDG	BINARY
	NRPT	1024
	PTFMT	NORM
	PTOFF	0
	WFID	""
	XINCR	1E-08
	XUNIT	SEC
	YMULT	0.78125
	YUNIT	VOLTS
	YZERO	0

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ACQUIRE, ACQUIRE? **ACQUIRE, ACQUIRE?**

Purpose: *ACQUIRE* sets the parameters controlling waveform acquisition.

ACQUIRE? queries for all *ACQUIRE* settings..

Command Syntax: `ACQUIRE:<pm2>[;<pm2>]...`

where *<pm2>* is any of the following:

```
AVERAGE {ON|OFF} (OFF)
CHANNEL {1|2},{ON|OFF} (1,ON;2,ON)
LOC {1|2},<wfm number> (1,1;2,2)
MODE {SINGLE,<length>|ADVANCE,<length>,<numadv>}
     (SINGLE, 1024)
NUMAVG <NRf> (2)
```

Command Parameters: `AVERAGE {ON|OFF}`

Turns the waveform acquisition averaging function *ON* and *OFF*. When *ON* is selected, successive waveform acquisitions up to the number specified by *NUMAVG* are added to previously summed and stored acquisitions. (The original *YMULT* value is divided by the number of summed waveforms; when it is multiplied by the *CURVE?* output values an averaged waveform will be obtained.)

`CHANNEL {1|2},{ON|OFF}`

Selects the channel whose signal is to be acquired, and turns acquisition recording *ON* or *OFF*; the input signal is sampled regardless of the recording selection.

`LOC {1|2},<wfm number>`

Selects the memory channel and waveform segment number where the acquired waveform is stored.

`<wfm number>` ::= 1 — 128. In *MODE SINGLE*, the defaults are *LOC 1 = 1* and *LOC 2 = 2*. In *MODE ADVANCE*, the defaults are *LOC 1 = 1* and *LOC 2 = numadv + 1*.

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MODE {SINGLE,<length>|ADVANCE,<length>,<numadv>}

Selects the acquisition mode (*SINGLE* or *ADVANCE*) and specifies its record length (*<length>*), and depending upon the mode selected, the number of waveforms to acquire (*<numadv>*).

SINGLE selects an acquisition mode where only one waveform is acquired from each selected channel.

ADVANCE selects an acquisition mode where waveforms from each channel are acquired into successive waveform segments, starting with channel 1 in segment 1, and channel 2 in segment *<numadv +1>*. A total of *<numadv>* waveforms are successively acquired. Enveloping is not available in this mode.

<length> ::= 256 — 16384 in a binary sequence for standard memory (16K) and 256 to 131072 for expanded memory (128K).

<numadv> ::= 1 — 128. In SINGLE mode, a single waveform of the length specified is acquired from the selected channel.

CAUTION

Whenever the acquisition mode or length is changed, waveform memory is reconfigured, and any previously stored waveforms are lost.

When the acquisition length is 128K, only two waveforms segments are available; therefore, no enveloping is allowed.

NUMAVG <NRf>

Specifies the number of acquisitions to be averaged.

<NRf> ::= 2 — 256 in powers of 2.

If *<NRf>* is not a power of 2, it selects the nearest legal value; if outside the range of hardware settings, the nearest range limit is used. A warning message is issued if a value other than the one entered is used.

Query Syntax:

ACQUIRE?
ACQUIRE:<pm2>[;<pm2]...

where *<pm2>* is any of the following:

AVERAGE?
CHANNEL? {1|2}
LOC? {1|2}
MODE?
NUMAVG?

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Query Parameters:

AVERAGE?

Returns the *AVERAGE* setting.

CHANNEL? {1|2}

Queries for the acquisition status of the specified channel.

LOC? {1|2}

Returns an NR1 value where the waveform segment for the channel specified is stored.

MODE?

Returns the MODE settings.

NUMAVG?

Returns a numeric value that indicates the *NUMAVG* setting.

Description: Waveform memory is always configured to contain the maximum number of waveform segments consistent with the selected acquisition mode and length. These segments are numbered 1 — N, where N is the maximum number of segments. Any segment may be used to store channel 1 or channel 2 acquisitions, as there is no pre-assignment of waveform segments to channels.

The maximum number of waveform segments is limited to 128 by the amount of memory.

Example: Command:

```
ACQUIRE:CHANNEL 1,OFF;CHANNEL 2,ON;MODE SINGLE,4096
```

Query:

```
ACQUIRE:CHANNEL? 1;CHANNEL? 2;MODE?
ACQUIRE:CHANNEL 1,OFF;CHANNEL 2,ON;MODE SINGLE,4096
```

Related Commands: None

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ACQCOM? **ACQCOM?**

Purpose: Returns the state of the current acquisition.

Syntax: `ACQCOM?`

Parameters: None

Description: *ACQCOM?* returns *COMPLETE* if the current acquisition has completed, *INCOMPLETE* if it is still pending.

Related Commands: `STOP, START`

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ARM, ARM? **ARM, ARM?**

Purpose: *ARM* selects the mode and source for the trigger arming function.

ARM? queries for all *ARM* settings.

Command Syntax:

ARM:<pm2>[;<pm2>]...

where *<pm2>* is one of the following:

MODE {AUTO|SIGNAL} (AUTO)
SOURCE {STARX|EXT} (STARX)

Command Parameters:

MODE {AUTO|SIGNAL}

Selects the trigger arming mode.

AUTO causes the digitizer to be automatically armed internally as soon as it is enabled for an acquisition.

SIGNAL requires an external TTL arming signal.

SOURCE {STARX|EXT}

Selects the source of the arming signal when *ARM:MODE SIGNAL* is selected.

STARX selects the STARX trigger line to provide the arming signal. Since this line also may be used as a clock or trigger input, an error message is generated if it is selected to be the arming source when it is already selected for another source.

EXT selects the front panel *ARM INPUT BNC*, which requires a TTL signal as the arming source.

Query Syntax:

ARM?
ARM:<pm2>[;<pm2]...

where *<pm2>* is any of the following:

MODE?
SOURCE?

Query Parameters:

MODE?

Returns the *MODE* setting.

SOURCE?

Returns the *SOURCE* setting.

Description: None

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Example: Command:

```
ARM:MODE AUTO
```

Query:

```
ARM:MODE?
ARM:MODE AUTO
```

Related Commands: `CMDARM`

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ATRIGGER, ATRIGGER? ATRIGGER, ATRIGGER?

Purpose: *ATRIGGER* selects the mode, source, and operating parameters for the A trigger.

ATRIGGER? queries for all *ATRIGGER* settings.

Command Syntax: `ATRIGGER:<pm2>[;<pm2>]...`

where *<pm2>* is any of the following:

```
ABSELECT {A|B|AANDB|AORB} (A)
COUPLING {DC|HFREJECT|LFREJECT|DCNREJECT|AC|
          ACHFREJECT|ACNREJECT} (DC)
DELAY <NRf> (0.0)
DUNIT {TIME|SAMPLE} (TIME)
EXPORT:ECLTRG {<NR1>|NONE} (NONE)
EXPORT:SOURCE {TRIG|ACQCOM|TRIGL|ACQRDY} (TRIG)
EXPORT:STARY {ON|OFF} (OFF)
EXPORT:TTLTRG {<NR1>|NONE} (NONE)
LEVEL <NRf> (0.0)
MODE {NORMAL|AUTOLEVEL|FREERUN} (NORMAL)
SLOPE {PLUS|MINUS} (PLUS)
SOURCE {CH1|CH2|EXT1|EXT2|STARX|SYNC100,<NR1>|
        TTLTRG,<NR1>|ECLTRG,<NRf>}      (CH1)
```

Command Parameters: `ABSELECT {A|B|AANDB|AORB}`

Selects whether A or B is the active trigger for both *ATRIGGER* or *BTRIGGER*.

A selects A trigger as the active trigger.

B selects B trigger as the active trigger.

AANDB selects the AND'd result of the A and B trigger as the active trigger.

AORB selects the OR'd result of the A and B trigger as the active trigger.

Note

This command is relevant only to analog trigger sources, and has no effect on digital sources.

Note

If SAMPLE:CLOCK is EXT1 or EXT2, then BTRIGGER is disabled.

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COUPLING {DC|HFREJECT|LFREJECT|DCNREJECT|AC|ACHFREJECT|ACNREJECT}

Selects the A trigger coupling filters as follows (Trigger coupling is relevant to analog trigger sources and has no effect on digital trigger sources):

DC selects direct coupling with no filter.

HFREJECT selects coupling with a 30 kHz low pass filter.

LFREJECT selects coupling with a 80 kHz high pass filter.

DCNREJECT selects coupling with a noise rejection filter.

AC selects coupling with a 60 Hz high pass filter.

ACHFREJECT selects coupling with a 60 Hz to 30 kHz bandpass filter.

ACNREJECT selects coupling with a 60 Hz high pass filter and noise rejection.

Note

This command is relevant only to analog trigger sources, and has no effect on digital sources.

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DELAY <NRf>

The *<NRf>* parameter defines the position of the first point within the waveform record relative to the trigger point. A negative value for *<NRf>* indicates that points prior to the A trigger event are recorded, and represents an amount of pre-trigger. The value of *<NRf>* for pre-trigger can vary from -(*record length*) to 0. A 0 value indicates the A trigger point is the first point in the waveform.

A positive value of *<NRf>* indicates the degree of post-trigger (i.e., the number of samples taken before the start of the waveform record). This feature is used to introduce finite delays between the trigger point and the required record. This delay can be many times the record length value to increase the flexibility of this feature.

For *ATRIGGER:DUNIT TIME*, *<NRf>* ::= -(*record length time*) to (16,777,216 times the *sample interval* (in seconds)). The resolution on the setting is 16 times the *sample interval*.

For *ATRIGGER:DUNIT SAMPLE*, *<NRf>* ::= -(*record length* (in samples)) to 16,777,216 samples.

If the specified value for *<NRf>* is between two hardware settings, the nearest setting is used; if outside the range of hardware settings, the nearest range limit is used. A warning is issued if a value other than that specified value is used.

DUNIT {TIME|SAMPLE}

Specifies the unit of measure for the *ATRIGGER:DELAY* setting. *TIME* specifies the *DELAY* setting in seconds. *SAMPLE* specifies the *DELAY* setting in number of samples.

Note

For further information regarding export triggers, refer to Export Triggering in Section 3.

EXPORT:ECLTRG {<NRf>|NONE}

Determines whether or not an ECLTRG line reflects the signal selected by *EXPORT:SOURCE*.

<NRf> selects a specific ECLTRG line. *<NRf>* ::= 0 — 5.

NONE specifies that no trigger is exported to an ECLTRG line.

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EXPORT:SOURCE {TRIG|ACQCOM|TRIGL|ACQRDY} (TRIG)

Selects which trigger is exported to the lines selected by the other *EXPORT* commands.

TRIG selects all triggers that occur.

ACQCOM produces an event on the selected export line when an acquisition has completed.

TRIGL selects a latched trigger, which latches when the first trigger occurs, and remains latched until the acquisition cycle is rearmed or reset.

ACQRDY shows when the instrument has completed an acquisition and is armed and ready for the next acquisition. This is of significance when the instrument is in the ADVANCE mode, where multiple records can be taken in quick succession.

EXPORT:STARY {ON|OFF} (OFF)

Determines whether or not the STARY line is selected to receive the signal selected by *EXPORT:SOURCE*.

ON selects the STARY line to receive the signal selected by *EXPORT:SOURCE*.

OFF deselects the STARY line for receiving the signal selected by *EXPORT:SOURCE*.

EXPORT:TTLTRG {<NRf>|NONE}

Determines whether or not a TTLTRG line reflects the signal selected by *EXPORT:SOURCE*.

<NRf> selects a specific TTLTRG line. *<NRf>* ::= 0 — 7.

NONE specifies no trigger is exported to a TTLTRG line.

LEVEL <NRf>

Sets the A trigger level in volts when *ATRIGGER:SOURCE* is CH1 or CH2 (See *EXTRIG* when the A trigger source is EXT1 or EXT2). This command is relevant to analog trigger sources only, and has no effect on digital sources.

<NRf> ::= ±120% of full scale range in 0.25% increments when the trigger source is CH1 or CH2.

If *<NRf>* is between two hardware settings, the nearest hardware setting is used; if outside the range of hardware settings, the nearest range limit is used. A warning is issued if a value other than that entered is used.

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MODE {NORMAL|AUTOLEVEL|FREERUN}

Selects the trigger operating mode for both A trigger and B trigger.

NORMAL causes a trigger to occur when the trigger source signal reaches the level specified by *TRIGGER:LEVEL*.

AUTOLEVEL Same as *NORMAL*, except the digitizer automatically sets the *TRIGGER:LEVEL* to a point on the trigger source signal. *ATRIGGER:SOURCE* must be CH1 or CH2.

FREERUN causes a trigger to be generated automatically by the instrument as soon as it is armed. The digitizer starts acquiring data when enabled by the selected trigger protocol and stops acquiring data when the stop state of the selected protocol is reached.

SLOPE {PLUS|MINUS}

Selects which slope of the A trigger signal edge generates the trigger. This command is relevant to analog trigger sources only, and has no effect on digital sources.

SOURCE {CH1|CH2|EXT1|EXT2|STARX|SYNC100,<NR1>|TTLTRG,<NR1>|ECLTRG,<NR1>}

Selects the source of the A trigger signal.

CH1/CH2 provides the A trigger source from the selected channel.

EXT1/EXT2 provides the A trigger source from the selected external trigger input BNC on the front panel.

STARX provides the trigger source from the STARX line. Since the STARX line may be used as a source for the arming signal or sampling clock, an error message is issued if it is selected as the trigger source while being used for either of these other functions.

SYNC100,<NR1> specifies which ECLTRG line provides the SYNC100 trigger qualifier. *<NR1>* ::= 0 — 5.

TTLTRG,<NR1> selects which TTLTRG line provides the A trigger source. *<NR1>* ::= 0 — 7.

ECLTRG,<NR1> selects which ECLTRG line provides the A trigger source. *<NR1>* ::= 0 — 5.

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Query Syntax:

```
ATRIGGER?
ATRIGGER:<pm2>[;<pm2>]...
```

where *<pm2>* is any of the following:

```
ABSELECT?
COUPLING?
DELAY?
DUNIT?
EXPORT?
EXPORT:ECLTRG?
EXPORT:SOURCE?
EXPORT:STARY?
EXPORT:TTLTRG?
LEVEL?
MODE?
SLOPE?
SOURCE?
```

Query Parameters:

ABSELECT?

Returns the active trigger setting.

COUPLING?

Returns a string that indicates the *COUPLING* setting.

DELAY?

Returns a numeric value indicating the *DELAY* setting.

DUNIT?

Returns a string indicating the *DUNIT* setting.

EXPORT?

Returns the values for all *EXPORT* settings.

EXPORT:ECLTRG?

Returns an NR1 value,or a string, indicating the *EXPORT:ECL* setting.

EXPORT:STARY?

Returns a string indicating the *EXPORT:STARY* setting.

EXPORT:TTLTRG?

Returns an NR1 value, or a string, indicating the *EXPORT:ECL* setting.

LEVEL?

Returns a numeric value indicating the *LEVEL* setting.

MODE?

Returns the *MODE* setting.

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SLOPE?

Returns a string indicating the *SLOPE* setting.

SOURCE?

Returns a string, or a string plus a numeric value indicating the *SOURCE* setting.

Description: The *ATRIGGER:EXPORT* command allows the digitizer to export a selected trigger signal over the VXIbus to the VXI Slot 0 Module for synchronizing or controlling other modules or VXIbus instruments.

The exported trigger signal can be an analog trigger signal that has been conditioned as specified by the *ATRIGGER:COUPLING*, *LEVEL*, and *SLOPE* settings, a signal to denote when an acquisition completes, or a latched signal to indicate whether the instrument is triggered or not. The trigger may be exported to the STARY line, ECLTRG line, or TTLTRG line, or to all three simultaneously.

Example: Command:

```
ATRIGGER:SOURCE CH2;MODE NORMAL
```

Query:

```
ATRIGGER:SOURCE?;MODE?
ATRIGGER:SOURCE CH2;MODE NORMAL
```

Related Commands: **BTRIGGER, BTRIGGER?, EXTTRIG, EXTTRIG?**

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BTRIGGER, BTRIGGER? **BTRIGGER, BTRIGGER?**

Purpose: *BTRIGGER* selects the source and operating parameters for the B trigger.

BTRIGGER? queries for all *BTRIGGER* settings.

Command Syntax: `BTRIGGER:<pm2>[;<pm2>]...`

where *<pm2>* is any of the following:

```
COUPLING {DC|HFREJECT|LFREJECT|DCNREJECT|AC|
          ACHFREJECT| ACNREJECT} (DC)
LEVEL <NRf> (0.0)
SLOPE {PLUS|MINUS} (PLUS)
SOURCE {CH1|CH2|EXT1|EXT2} (CH1)
```

Command Parameters: `COUPLING {DC|HFREJECT|LFREJECT|DCNREJECT|AC|ACHFREJECT|ACNREJECT}`

Selects B trigger coupling filters as follows (Trigger coupling is relevant to analog trigger sources and has no effect on digital trigger sources):

DC selects direct coupling with no filter.

HFREJECT selects coupling with a 30 kHz low pass filter.

LFREJECT selects coupling with a 80 kHz high pass filter.

DCNREJECT selects coupling with a noise rejection filter.

AC selects coupling with a 60 Hz high pass filter.

ACHFREJECT selects coupling with a 60 Hz — 30 kHz bandpass filter.

ACNREJECT selects coupling with a 60 Hz high pass filter and noise rejection.

`LEVEL <NRf>`

Sets the B trigger level in volts when *BTRIGGER:SOURCE* is other than CH1 or CH2 (See *EXTRIG* when trigger source is EXT1 or EXT2). This command is relevant to analog trigger sources only, and has no effect on digital sources.

<NRf> :: = ±120% of full scale range in 0.25% increments when the B trigger source is CH1 or CH2.

If *<NRf>* is between two hardware settings, the nearest hardware setting is used; if outside the range of hardware settings, the nearest range limit is used. A warning is issued if a value other than that specified is used.

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SLOPE {PLUS|MINUS}

Selects which slope of the B trigger signal edge will generate the trigger. This command is relevant to analog trigger sources only, and has no effect on digital sources.

SOURCE {CH1|CH2|EXT1|EXT2}

Selects the source of the B trigger signal.

CH1/CH2 selects a specific input channel as the B trigger source..

EXT1/EXT2 selects an external trigger input BNC as the B trigger source.

Query Syntax:

BTRIGGER?
BTRIGGER:<pm2>[;<pm2]...

where *<pm2>* is any of the following:

COUPLING?
LEVEL?
SLOPE?
SOURCE?

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Query Parameters:

COUPLING?

Returns a string indicating the *COUPLING* setting.

LEVEL?

Returns a numeric value indicating the *LEVEL* setting.

SLOPE?

Returns the *SLOPE* setting.

SOURCE?

Returns a string, or a string plus a numeric value indicating the *SOURCE* setting.

Example: Command:

```
BTRIGGER:SOURCE CH2
```

Query:

```
BTRIGGER:SOURCE?
BTRIGGER:SOURCE CH2
```

Related Commands: **ATRIGGER, ATRIGGER?, EXTTRIG, EXTTRIG?**

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CAL? **CAL?**

Purpose: *CAL?* calibrates both channels using the mode and function specified. Upon completion, the command returns the number of functions it was not able to calibrate. The normal response is 0.

To protect against unauthorized alteration of calibration constants, some of the mode arguments and all of the function arguments require the password state to be unlocked.

Syntax:

CAL{?|:CH1?|:CH2?} [<mode>][,<fcnt>][,<data>][,M]

where:

<mode> ::= {INTC|EXTC|ACCHK|LOAD|SAVE} (INTC)

<fcnt> ::= {CALD|DCB|OFFS|ATTN|GAIN|TRIG|ETT|ALL} (ALL)

<data> ::= <NR1> in millivolts.

Parameters: **{?|CH1?|CH2?}**

Selects the channel to be calibrated; this is the only required entry for the *CAL* command.

? selects both Channel 1 and Channel 2 for calibration.

CH1? selects channel 1 for calibration.

CH2? selects channel 2 for calibration.

The *CAL?*, *CAL CH1?*, and *CAL CH2?* command are the same as *CAL? INTC,ALL*; *CAL CH1? INTC, ALL*; and *CAL CH2 INTC, ALL,* respectively.

Executing CAL?, CAL:CH1?, or CAL:CH2? without additional arguments will invoke instrument self-calibration. This allows the instrument to compensate for current ambient temperature, changes in power supply voltage, and so on. The self-calibration process requires less than one minute to execute.

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<mode>

Optionally selects the type of calibration to be performed.

INTC selects internal calibration. Requires password state to be UNLOCKED.

EXTC selects external calibration. Requires password state to be UNLOCKED.

ACCHK performs an AC confidence check. No other parameters are available with this selection.

LOAD reads user calibration constants from ID-ROM into RAM. No other parameters are available with this selection.

SAVE writes the user calibration constants from RAM into ID-ROM. The password state must be UNLOCKED prior to executing this command. No other parameters are available with this command.

<fcnt>

Optionally selects the function to be calibrated.

CALD verifies the output of a correct calibration voltage from the calibration DAC; it is measurable at the front-panel *CAL OUT* connector.

DCB verifies the nulling of the preamps internal error.

OFFS verifies that the Input Offset can be set from 0 — ±50% of full scale range.

ATTN verifies the accuracy of the attenuator ranges.

GAIN verifies the operation of the preamps five gain ranges.

TRIG verifies that the Trigger Level can be set from 0 — ±120% of full scale range.

ALL selects all of the above; it is not available in the *EXTC* mode.

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<data>

This parameter is used in the *EXTC* mode for entering calibration parameters. Refer to *Section 9, Calibration* for additional information.

{M}

M selects an option where calibration errors are returned as an English error message rather than an Error Code.

Description: See *Section 9, Calibration* for a complete description of the VX5260 calibration process, more detailed information about the *CAL* and *CAL?* command, command examples, and a list of calibration error messages.

Examples: See *Section 9, Calibration.*

Related Commands: ***CAL?, PASSWORD**

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CHANNEL, CHANNEL?

CHANNEL, CHANNEL?

Purpose: *CHANNEL* sets the parameters controlling input signal conditioning for a selected input channel.

CHANNEL? queries for all *CHANNEL* settings.

Command Syntax: `CHANNEL:<pm2>[;<pm2>]...`

where *<pm2>* is any of the following:

```
BWLIMIT {HUNDRED|FULL} (FULL)
COUPLING {1|2},{AC|DC|GND} (DC)
INVERT {1|2},{ON|OFF} (OFF)
OFFSET {1|2},<NRf> (0.0)
RANGE {1|2},<NRf> (200.0)
TERM {1|2},{1.0E+6|50} (1.0E+6)
```

Command Parameters:

`BWLIMIT {HUNDRED|FULL}`

Selects the bandwidth limit.

HUNDRED selects a nominal bandwidth limit of 100 MHz.

FULL selects full instrument bandwidth.

`COUPLING {1|2},{AC|DC|GND}`

Selects the input coupling for the specified channel.

If *AC* is selected while *CHANNEL:TERM* is set to 50, *CHANNEL:TERM* is set to 1.0E+6 and a warning message is issued.

`INVERT {1|2},{ON|OFF}`

Determines whether or not the input signal is inverted prior to digitizing for the selected channel. With *ON*, it is inverted; with *OFF*, it is not inverted.

`OFFSET {1|2},<NRf>`

Sets the ± input offset voltage for the channel specified. The absolute offset depends upon the current input voltage *RANGE*. (When *RANGE* is changed, *OFFSET* may need to be changed.)

After power-up or an *INIT INSTR* command, any *RANGE* settings are for *RANGE 200*. *RANGE* should then be set before setting *OFFSET* to get an *OFFSET* value appropriate to the new range.

<NRf> ::= ±50% of full scale range in increments of 2% of full scale range.

If *<NRf>* is between two hardware settings, the larger hardware setting is used; if outside the range of hardware settings, the nearest range limit is used. A warning message is issued if a value other than that entered is used.

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RANGE {1|2},<NRf>

Sets the ± full scale input voltage range in volts for the specified channel.

<NRf> ::= 0.040 — 200 (volts) for a 1X probe and 0.400 to 2000 (volts) for a 10X probe; these limits are automatically corrected for probe attenuation.

TERM {1|2},{1.0E+6|50}

Selects the input termination impedance in ohms for the selected channel.

If 50 is selected while *CHANNEL:COUPLING* is *AC*, *CHANNEL:COUPLING* is set to *DC* and a warning message is issued (50 Ω impedance is not allowed with AC coupling). If the probe requires 50 Ω termination, 50 should be selected.

If an overload condition occurs while 50 is selected, the selection is changed to 1.0E + 6, *CHANNEL:COUPLING* is switched to *GND*, and an execution error message is issued.

Query Syntax:

CHANNEL? {1|2}
CHANNEL:<pm2>[;<pm2]...

where *<pm2>* is any of the following:

BWLIMIT?
COUPLING? {1|2}
INVERT? {1|2}
OFFSET? {1|2}
RANGE? {1|2}
TERM? {1|2}

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Query Parameters:

BWLIMIT?

Returns *BWLIMIT* setting.

COUPLING? {1|2}

Returns the input coupling method for the channel specified.

INVERT? {1|2}

Returns *INVERT* setting for the channel selected.

OFFSET? {1|2}

Returns a numeric value indicating the input *OFFSET* voltage for the channel specified.

RANGE? {1|2}

Returns a numeric value that indicates the full scale input voltage *RANGE* for the specified channel.

TERM? {1|2}

Returns a numeric value indicating the input termination impedance.

Description: None

Example: Command:

```
CHANNEL:RANGE 1,5;INVERT 1,OFF
```

Query:

```
CHANNEL:RANGE? 1;INVERT? 1
CHANNEL:RANGE 1,5;INVERT 1,OFF
```

Related Commands: None

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CMDARM **CMDARM**

Purpose: Manually arms the digitizer asynchronously, overriding all other arm sources.

Syntax: **CMDARM**

Parameters: None

Description: If *ARM:MODE* is set to *AUTO*, this command has no effect.

Example: **CMDARM**

Related Commands: **ARM**

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CMDTRIG **CMDTRIG**

Purpose: Manually triggers the digitizer asynchronously, overriding all other trigger sources.

Syntax: `CMDTRIG`

Parameters: None

Description: If *ATRIGGER:MODE* is set to *FREERUN* , this command has no effect; use *STOP* to stop the digitizer.

Example: `CMDTRIG`

Related Commands: `ATRIGGER, BTRIGGER`

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CURVE, CURVE? **CURVE, CURVE?**

Purpose: *CURVE* transfers waveform data from an external source to a specified waveform memory segment.

CURVE? transfers waveform data from a specified waveform memory segment to an external destination.

Command Syntax:

```
CURVE <fixed length arbitrary block>
```

Command Parameters:

```
<fixed length arbitrary block> ::= #<byte count digit><byte
 count>[<contiguous 8-bit data byte>]...
```

where:

`<byte count digit>` ::= a non-zero digit in the range 1 — 9 that defines the number of digits (bytes) in *< byte count >*.

`<byte count>` ::= any number of digits in the range 0 — 9 that define how many bytes are in *< contiguous 8-bit data byte >*.

`<contiguous 8-bit data byte>` ::= a *< byte count >* number of contiguous 8-bit values in the range 0 — 255 that define the *CURVE* data.

Note

Data must be downloaded in either RIB or RPB format. Data cannot be downloaded in ASCII format.

Query Syntax:

```
CURVE?
```

Query Parameters: None

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Description: The waveform data format and memory segment associated with this command are specified by *DATA:COUNT, DATA:ENCDG*, and *DATA:LOC*, respectively.

When the *CURVE* (or *CURVE?*) and *WFMPRE?* (waveform preamble query) commands are combined, they completely specify a waveform. When the preamble is received for a specified segment, that segment's data is not valid until a *CURVE* (or *CURVE?*) command is received, or until an acquisition to that segment occurs. *CURVE?* is not legal when the waveform segment specified by *DATA:LOC* is empty, which is a conditions that exists directly after instrument power-up, reset, or initialization.

When envelope waveforms are read in ASCII format with the CURVE? command, the output consists of a series of numbers from 0 — 65536. These numbers represent the combined high byte associated with one curve, and the low byte associated with the other.

Example: The first example is a *CURVE?* query when *DATA:ENCDG* is *ASCII*; the second example is with *DATA:ENCDG* set to *RIB* or *RPB*.

```
CURVE?
CURVE 128,129,131,133,...

CURVE?
CURVE #3100ACKO'ai...
```

Related Commands: **WFMPRE, DATA**

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DATA, DATA? **DATA, DATA?**

Purpose: *DATA* specifies the location and size of the waveform memory segment associated with subsequent *WFMPRE*, *CURVE*, or *WAVFRM?* commands. It also specifies whether the data is in ASCII or binary form.

DATA? queries for all *DATA* settings.

Command Syntax: `DATA:<pm2>[;<pm2>]...`

where *<pm2>* is any of the following:

```
COUNT <NR1> (1024)
ENCDG {ASCII|RIB|RPB} (RIB)
LOC <wfm number> (1)
START <NR1> (0)
```

Command Parameters: `COUNT <NRf>`

Specifies the number of data points to be transferred.

`<NR1>` ::= 1 — 131072 (128K).

If *START <NR1> + COUNT <NR1>* exceeds record length, an error message occurs.

The waveform preamble contains a format that specifies the number of points in a waveform (*WFMPRE:NRPT?*). The relationship between this command and that format is:

a. When transferring a waveform to the digitizer, the count specified by the *DATA* command is used, and *WFMPRE:NPRT* is ignored if received as a command.

b. When transferring a waveform from the digitizer, the count specified by the *DATA* command is used, and any subsequent *WFMPRE:NPRT?* queries will reflect that count.

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ENCDG {ASCII|RIB|RPB}

Specifies the encoding format for *CURVE* data.

ASCII specifies that data is in ASCII form using decimal integer values separated by commas.

RIB specifies that data is in binary format consisting of right-justified, two's complement integers with the most significant bit interpreted as the sign bit.

RPB specifies that data is in binary format consisting of right-justified, positive integers.

The waveform preamble command has a data encoding query format (*WFMPRE:ENCDG?*). The relationship between that format and this one is:

a. When transferring a waveform to the digitizer, the format specified by the *DATA* command is used.

b. When transferring a waveform from the digitizer, the format specified by the *DATA* command is used, and any subsequent *WFMPRE?* query will reflect that format.

LOC <wfm number>

Specifies which waveform memory segment the *CURVE* (or *CURVE?*), *WFMPRE*, and *WAVFRM?* commands or queries pertain to.

<wfm number> ::= 1 to 128

An error message occurs if an illegal value for *<wfm number>* is specified.

START <NR1>

Specifies the data point within a waveform where the data transfer starts.

<NR1> ::= 0 — 131072 (128K)

If *<NR1>* exceeds the record length of the waveform acquisition an error message occurs.

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Query Syntax:

```
DATA?
DATA:<pm2>[;<pm2]...
```

where *<pm2>* is any of the following:

```
COUNT?
ENCDG?
LOC?
START?
```

Query Parameters:

COUNT?

Returns an NR1 value that indicates the *COUNT* setting.

ENCDG?

Returns the *ENCDG* setting.

LOC?

Returns a numeric value that indicates the *LOC* setting.

START?

Returns an NR1 value that indicates the *START* setting.

Description: None

Example: Command:

```
DATA:LOC 2;START 100;COUNT 100
```

Query:

```
DATA:LOC?;START?;COUNT?
DATA:LOC 2;START 100;COUNT 100
```

Related Commands: None

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DESE, DESE? **DESE, DESE?**

Purpose: *DESE* controls the setting and reading of the Device Event Status Register.

DESE? reads the Device Event Status Register.

Command Syntax: `DESE <register data>`

Command Parameters: `<register data>`

An integer in the range of 0 — 255. When expressed in binary, this integer represents the bit values of the Device Event Status Register.

Query Syntax: `DESE?`

Query Parameters: None

Description: The Device Event Status Register is an 8-bit register with bit definitions corresponding to the Standard Events Status Register. Bits in the Device Event Status Register (set using the *DESE* command) allow reporting through the Standard Events Status Register. Bits not set in the Device Event Status Register disable reporting of that event. See Figure 8-1.

The response to the *DESE?* query is an integer in the range of 0 — 255. When this integer is expressed in binary form, it corresponds to the bit values of the Device Event Status Register.

Related Commands: None

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ENVELOPE, ENVELOPE? **ENVELOPE, ENVELOPE?**

Purpose: *ENVELOPE* sets the parameters controlling the enveloping function, selects the channel input to be enveloped, and specifies where to store the enveloped data.

ENVELOPE? queries for all *ENVELOPE* settings.

Command Syntax: `ENVELOPE:<pm2>[<pm2>]*`

where *<pm2>* is any of the following:

```
CHANNEL {1|2},{ON|OFF} (1,ON  2,ON)
LOC {1|2},<wfm number> (1,3) (2,4)
MAXWFM {<NR1>|CONT} (1)
MODE {OFF|GEN|COMP},{IN|OUT},{ANY|ALL} (OFF)
```

Command Parameters: `CHANNEL {1|2},{ON|OFF}`

Selects a specific channel and enables/disables its envelope function; the envelope function can apply to either or both channels.

`LOC {1|2},<wfm number>`

Specifies the waveform memory segment to be used for the envelope function of the specified channel.

`<wfm number> ::=` 1 to 128

If *ENVELOPE:MODE COMP* is selected, *LOC* specifies the waveform memory segment that the acquired waveform is compared to. The specified segment must contain a waveform; otherwise an error message is issued.

If *ENVELOPE:MODE GEN* is selected, *LOC* specifies the waveform memory segment where the enveloped waveform created from the acquisition(s) is stored.

If acquisition recording is enabled (*ACQUIRE:CHANNEL* x is *ON*), the waveform segment specified by *ACQUIRE:LOC* is overwritten until the envelope function termination condition occurs.

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MAXWFM {<**NR1**>|**CONT**}

Specifies the maximum number of waveforms to be acquired in the selected envelope function, or selects continuous acquisitions until the selected *ENVELOPE:MODE* condition is satisfied, or a *STOP* command is issued.

<**NR1**> ::= 1 to 256. If *<NR1>* is greater than 256, it is set to 256 and a warning message is issued.

CONT specifies continuously acquired envelope waveforms until the *ENVELOPE:MODE* termination condition is met (*IN*, *OUT*, *ANY*, or *ALL*), or a *STOP* command is issued.

MODE {**OFF**|**GEN**|**COMP**},{**IN**|**OUT**},{**ANY**|**ALL**}

Selects the envelope function operating mode, and sets its parameters.

OFF disables the envelope function for both channels.

Note

Enveloping is not available when the record length exceeds 65536 (64K).

GEN selects a mode where the envelope waveform is generated from the number of acquired waveforms specified by *ENVELOPE:MAXWFM* and stored into the waveform segment specified by *ENVELOPE:LOC*.

COMP selects a mode where the number of acquired waveforms specified by *ENVELOPE:MAXWFM* are successively compared to the waveform specified by *ENVELOPE:LOC*. Only those points within the current *WINDOW* limits are actually compared to the reference envelope waveform.

The envelope comparison sequence termination conditions are specified by the last two *ENVELOPE:MODE* data elements (*IN* | *OUT* and *ANY* | *ALL*).

IN specifies that the comparison sequence stops whenever a waveform *inside* the envelope is detected; *OUT* specifies that the comparison sequence stops whenever a waveform *outside* the envelope is detected.

ANY specifies that the comparison sequence stops whenever any channel acquires a waveform that meets the termination condition specified by *IN* or *OUT*; *ALL* specifies that the comparison sequence continues until all channels have acquired a waveform that meets the termination condition.

Note

ENVELOPE:MAXWFM can be used to set an upper limit to the number of waveforms acquired and compared in the envelope function.

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Query Syntax:

```
ENVELOPE?
ENVELOPE:<pm2>
```

where *<pm2>* is any of the following:

```
CHANNEL? {1|2}
LOC? {1|2}
MAXWFM?
MODE?
NUMWFM? {1|2}
```

Query Parameters:

CHANNEL? {1|2}

Returns the *CHANNEL* setting.

LOC? {1|2}

Returns an NR1 value indicating the *LOC* setting for the specified channel.

MODE?

Returns the *MODE* settings.

MAXWFM?

Returns an NR1 value, or the word "*CONT*", indicating the *ENVELOPE:MAXWFM* setting.

NUMWFM? {1|2}

Returns an NR1 value indicating the number of waveforms acquired in the most recent acquisition sequence.

If *ENVELOPE:MODE OFF* was selected during the last acquisition, a 1 is returned; if *ENVELOPE:MODE GEN* was selected, the number of waveforms acquired in the envelope generation sequence is returned; if *ENVELOPE:MODE COMP* was selected, the value returned is the number of waveforms acquired before one met the termination conditions.

For example, if *ENVELOPE:MODE COMP,OUT,ANY* is selected, and *NUMWFM?* returns a 0, the first acquired waveform was outside the envelope. In the same example, if *ENVELOPE:NUMWFM?* returned the same value as *ENVELOPE:MAXWFM*, no waveform in the sequence passed outside the envelope.

Description: None

Example: Command:

```
ENVELOPE:MODE GEN,IN,ALL;CHANNEL 1,OFF;CHANNEL 2,ON
```

Query:

```
ENVELOPE:MODE?;CHANNEL? 1;CHANNEL? 2
ENVELOPE:MODE GEN;CHANNEL 1,OFF;CHANNEL 2,ON
```

Related Commands: None

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EVENT? **EVENT?**

Purpose: Recalls an error message.

Syntax: **EVENT?**

Parameters: None

Description: This command is used to obtain error messages from the VX5260. The message returned is not the complete error message but the number of the message (refer to the *EVMSG?* query for the list of error numbers and messages). To obtain the complete error message, use the *EVMSG?* query.

Related Commands: **EVMSG?**

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EVMSG? **EVMSG?**

Purpose: Recalls an error message.

Syntax: `EVMSG?`

Parameters: None

Description: This query returns error messages from the VX5260. The message returned is the exact error message, as issued by the VX5260 firmware. The possible error messages are as follows:

Miscellaneous Messages and Error Codes

220, "parameter error"
402, "acquisition complete"
402, "envelope event found"

Command Error Codes (1000 — 1999)

1000, "envelope function turned off"
1002, "envelope function not available"
1003, "channel 1 envelope function disabled"
1004, "channel 2 envelope function disabled"
1005, "invalid envelope waveform"

1010, "record length adjusted or limited"
1010, "channel input range limited"

1011, "number of advances limited"
1011, "termination set to 1 Mohm"

1012, "invalid waveform memory segment"
1012, "coupling set to DC"

1013, "number of averages adjusted"
1013, "invalid termination value"

1014, "arm source not used"
1014, "channel offset voltage adjusted"

1015, "invalid STARX line usage"
1016, "sample interval limited"
1018, "invalid channel"
1019, "invalid save setting"

1020, "data transfer settings adjusted"
1021, "transfer start adjusted"
1022, "transfer count adjusted"
1023, "maxwfm limited"
1024, "sample interval limited"
1025, "sample divisor not used"
1026, "clock divisor limited"

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1030, "BTRIGGER digital trigger invalid"
1031, "trigger delay unit set to fraction"
1032, "trigger source set to channel 1"
1033, "trigger level adjusted"
1034, "trigger delay limited"
1035, "trigger source not used"
1036, "trigger coupling not used"
1037, "trigger mode not used"
1038, "trigger level not used"
1039, "trigger slope not used"

1040, "trigger delay not available"
1041, "trigger delay unit time not available"
1042, "external trigger level limited"

1050, "wfid truncated"
1051, env record too long"
1052, "waveform length truncated"
1053, waveform record zero filled"

1054, "BTRIGGER unavailable with external clock"
1054, "source waveform is empty"

1055, "ascii waveform download is not allowed"
1055, envelope waveform not valid as source"

1056, "WFMPRE:BYTNR default setting to 1"
1056, "envelope or average waveform not valid"

1500, "invalid number of parameters"
1501, "invalid parameter(s)"
1502, "invalid waveform record number"
1503, "invalid window start/stop value"
1504, "invalid cross direction — use either 1 or -1"
1505, "invalid reference point"
1506, "invalid units"
1507, "invalid topline — baseline values"
1508, "invalid reference values"

Execution Errors (2000 — 2999)

2000, "digitizer not started"
2001, "target waveform is empty"
2002, ID-ROM header error"
2003, acquisition incomplete"
2004, "power supply out of range"
2005, "Ch1 attenuator overload"
2006, "Ch2 attenuator overload"
2007, "acquisition pending"

Related Commands: `EVENT?`

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EXTTRIG, EXTTRIG? **EXTTRIG, EXTTRIG?**

Purpose: *EXTTRIG* selects the external trigger input BNC and sets its trigger level. (If *SAMPLE:CLOCK* is *EXTERNAL*, then *EXTTRIG* sets the clock level.)

EXTTRIG? queries for the trigger level of either, or both, external trigger inputs.

Command Syntax:

```
EXTTRIG:LEVEL {1|2},{TTL|ECL|<NR3>} (TTL)
```

Command Parameters:

`{1|2}`

Selects external trigger input 1 or 2.

`{TTL|ECL|<NR3>}`

Sets the trigger level for the trigger input selected.

`TTL` sets the trigger level at 1.4 V.

`ECL` sets the trigger level at -1.29 V.

<NR3> sets the trigger level in the range -4 — +4 V. If set outside the range, an error message is generated, and the setting remains at its last setting.

Query Syntax:

```
EXTTRIG?
EXTTRIG:LEVEL? {1|2}
```

Parameters: `{1|2}`

Selects external trigger input 1 or 2.

Description: The trigger level for the external trigger input BNCs is set with this command rather than the *TRIGGER:LEVEL* command.

Example: Command:

```
EXTTRIG:LEVEL 1,TTL
```

Query:

```
EXTTRIG:LEVEL? 1
EXTTRIG:LEVEL 1,1.4
```

Related Commands: `ATRIGGER, BTRIGGER`

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INIT **INIT**

Purpose: Initializes the digitizer to its power-up state, and resets default values.

Syntax: `INIT {INSTR|REPORT|ALL}`

Parameters: `INSTR`

Initializes programmable instrument settings (except those set by the *REPORT* command) to their default values (listed at the beginning of this section under the Power-Up Default Control Settings topic), and clears all waveform memory segments.

`REPORT`

Initializes all *REPORT* command settings to their default values.

`ALL`

Initializes all programmable instrument and *REPORT* command settings as if *INIT INSTR* and *INIT REPORT* were executed.

Description: If the *INIT* command is used without arguments, an error message is issued.

Note

The Digitizer must be stopped before using the INIT command. Any setting changes will be made at the next acquisition (i.e., the next START command).

Example: `INIT INSTR`

Related Commands: None

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REPORT, REPORT? **REPORT, REPORT?**

Purpose: *REPORT* enables or disables individual message reporting functions.

REPORT? queries for the enabled/disabled status of all *REPORT* settings.

Command Syntax:

```
REPORT:<message category>[;<message category>]...
```

where *<message category>* is one of the following:

```
CMDERR {ON|OFF} (ON)
CMDEVENT {ON|OFF} (ON)
CMDWARN {ON|OFF} (ON)
EXERR {ON|OFF} (ON)
EXEVENT {ON|OFF} (ON)
EXEWARN {ON|OFF} (ON)
```

Command Parameters:

`CMDERR {ON|OFF}`

Enables/disables reporting of command errors.

`CMDEVENT {ON|OFF}`

Enables/disables reporting of command events.

`CMDWARN {ON|OFF}`

Enables/disables reporting of command warnings.

`EXERR {ON|OFF}`

Enables/disables reporting of execution errors.

`EXEVENT {ON|OFF}`

Enables/disables reporting of execution events.

`EXEWARN {ON|OFF}`

Enables/disables reporting of execution warnings.

Query Syntax:

```
REPORT?
REPORT:<pm2>
```

where *<pm2>* is any of the following:

```
CMDERR?
CMDEVENT?
CMDWARN?
EXERR?
EXEVENT?
EXEWARN?
```


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Query Parameters:

CMDERR?

Returns the enabled/disabled status of the *CMDERR* function.

CMDEVENT?

Returns the enabled/disabled status of the *CMDEVENT* function.

CMDWARN?

Returns the enabled/disabled status of the *CMDWARN* function.

EXERR?

Returns the enabled/disabled status of the *EXERR* function.

EXWARN?

Returns the enabled/disabled status of the *EXWARN* function.

EXEVENT?

Returns the enabled/disabled status of the *EXEVENT* function.

Description: The digitizer reports various status and error condition messages to the VXI Slot 0 Module, which can be queried for the content of the messages. These messages are divided into three categories (Errors, Warnings, and Events) based on the source of the condition reported and its impact on continued operation of the instrument.

Error messages are typically generated by syntactic and semantic errors in commands. These messages may occur when the command is not recognized as a command (spelling error), when parameters are not correct (entered a 3 when only 1 and 2 were available), when the command can't be executed (not allowable based on other selected parameters), and so on.

Warnings messages are typically generated in response to a specific command, and are information only to the user. These messages may occur when execution of a specific command could cause loss of previous data, or when the user selected an out of range setting and the instrument set it to a maximum limit, and so on.

Event messages are typically generated from conditions that occur outside the normal *command-response* cycle, or are caused by any unexpected hardware or software conditions arising during normal operation. These messages may occur to report the completion of a concurrent data acquisition, to report a response to a trigger event, to report an aborted data acquisition operation because the input signal went away.

Example:

```
REPORT:CMDERR OFF
```

Related Commands: **INIT:REPORT**

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SAMPLE, SAMPLE? **SAMPLE, SAMPLE?**

Purpose: *SAMPLE* selects the sampling clock source and sets the sampling rate for the waveform acquisition.

SAMPLE? queries for all *SAMPLE* settings.

Command Syntax: `SAMPLE:<pm2>[;<pm2>]...`

where *<pm2>* is any of the following:

`CLOCK {EXT1|EXT2|STARX|INT} (INT)`

Note

If you change the setting of CLOCK from INT to EXT or STARX, you must also change the trigger delay unit to FRAC. If you fail to do so, the VX5260 will set the units to FRAC and issue a warning message.

`DIVISOR <NRf> (1)`
`INTERVAL <NRf> (1E-8)`

Command Parameters: `CLOCK {EXT1|EXT2|STARX|INT}`

Selects the source of the sampling clock.

`EXT1` selects external clock input 1.

`EXT2` selects external clock input 2.

Note

The external clock levels are set by the EXTTRIG command.

`INT` selects the internal system clock. Selection of this source requires the sample rate value to be set with the *SAMPLE:INTERVAL* command.

`STARX` selects the STARX line. Selection of this source requires a clock source divisor to be set with the *SAMPLE:DIVISOR* command. The STARX clock source is then divided by this *DIVISOR* to generate the sampling interval. Since the STARX line also may be selected as an arming or trigger source, an error message occurs if it is selected as the clock source when it is currently being used for the source of another function.

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DIVISOR <NRf>

Specifies the sample interval clock divisor when the source of the sampling clock is the STARX, EXT1, or EXT2 line.

<NRf> ::= 1 — 1E+6, in increments of 1.

If *<NRf>* is between two hardware settings, the larger hardware setting is used; if outside the range of hardware settings, the nearest range limit is used. A warning message is issued if a value other than the one specified is used.

INTERVAL <NRf>

Sets the time interval between sample points when *SAMPLE:CLOCK* INT is selected.

<NRf> ::= 1E-2 — 5E-9 seconds/sample; valid sample rates are as follows:

Sample Interval	<NRf> Value
5 ns	5E-9
10 ns	1E-8
15 ns	1.5E-8
20 ns	2E-8
30 ns	3E-8
40 ns . . . Additional 10 ns steps up to 10 ms limit. . . . 9.999990 ms	4E-8 to 9.999990E-3
10 ms	1E-2

If *<NRf>* is between two hardware settings, the smaller hardware setting is used; if outside the range of hardware settings, the nearest range limit is used. A warning message is issued if a value other than the one selected is used.

Query Syntax:

SAMPLE?
SAMPLE<pm2>

where *<pm2>* is any of the following:

CLOCK?
DIVISOR?
INTERVAL?

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Query Parameters:

CLOCK?

Returns the *CLOCK* source setting.

DIVISOR?

Returns a numeric value indicating the *DIVISOR* setting.

INTERVAL?

Returns a numeric value indicating the *INTERVAL* setting.

Description: None

Example: Command:

```
SAMPLE:INTERVAL 5E-9
```

Query:

```
SAMPLE:INTERVAL?
SAMPLE:INTERVAL 5E-9
```

Related Commands: None

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SEQPROTO, SEQPROTO? **SEQPROTO, SEQPROTO?**

Purpose: *SEQPROTO* selects the digitizer triggering protocol.

SEQPROTO? queries for the *SEQPROTO* selection.

Command Syntax: `SEQPROTO {AUTO|ESTST,<ttl>,<ecl>} (AUTO)`

Command Parameters: `AUTO`

Selects a standard START/STOP (STST) protocol where the digitizer acquisition sequence starts on receipt of the *START* command.

`ESTST,<ttl>,<ecl>`

Selects an Extended Start/Stop (ESTST) protocol where the digitizer acquisition sequence is delayed until after an ESTST protocol sequence occurs. This sequence is initiated by the *START* command.

<ttl> ::= 0 — 7; specifies which TTLTRIG line indicates the START/STOP state.

<ecl> ::= 0 — 5; specifies which ECLTRIG line qualifies SYNC100.

Query Syntax: `SEQPROTO?`

Query Parameters: None

Description: Extended Start/Stop (ESTST) protocol provides a method for synchronizing the operation of various modules to a particular CLK100 rising edge. This protocol guarantees a fixed and repeatable delay between the controlled modules over a series of ESTST operations. In the ESTST protocol sequence, the occurrence of the Start/Stop state on a specified TTLTRIG line starts/stops the ESTST sequence. Then after a fixed delay, the specified ECLTRIG line indicates the Start/Stop state. All modules participating in the ESTST protocol respond synchronously to the state of this line on the next rising edge of CLK100.

The ESTST protocol can start or stop the VX5260 multiple times during an acquisition. Its operation is independent of trigger events.

Example: `SEQPROTO AUTO`

Related Commands: `START`

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START **START**

Purpose: Enables the digitizer to start a waveform acquisition sequence.

Syntax: `START`

Parameters: None

Description: If *SEQPROTO:AUTO* is selected, the instrument is enabled to accept an arm signal.

If *SEQPROTO:ESTST* is selected, the instrument is enabled for the ESTST sequence.

Once an acquisition sequence is started, it continues until a termination condition defined by the *ACQUIRE* or *ENVELOPE* command occurs, or a *STOP* command is sent.

Example: `START`

Related Commands: `ACQCOM?, ACQUIRE, ENVELOPE, STOP, SEQPROTO`

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STERR? **STERR?**

Purpose: Selectively performs the following ID-ROM actions: 1) returns the error codes and messages from the most recent self-test, or 2) returns the error codes and messages from a previously executed self-test, or 3) clears the ID-ROM error message buffer.

Syntax: `STERR? [CLEAR|PREV]`

Parameters: `CLEAR`

An optional argument that clears all error codes and messages from the ID-ROM error message buffer.

`PREV`

An optional argument that returns self-test error codes and messages previously stored in the ID-ROM.

Results: When this command finishes executing, there are no values left on the data stack.

Description: The *STERR?* command without optional arguments allows the user to query the ID-ROM for the error codes and messages, if any, that resulted from the most current execution of the VX5260 self-test routines.
When the *CLEAR* argument is added to the command, all error codes and messages are cleared from the ID-ROM error code and message buffer.
When the *PREV* argument is added to the command, the error codes and messages from previous self-tests can be queried.

Example: The first example queries for current errors, while the second example queries for previous errors.

```
STERR?
301, DUART FAILURE

STERR? PREV
0, NONE
```

Related Commands: `TST?`

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STOP **STOP**

Purpose: Immediately terminates a waveform acquisition sequence.

Syntax: `STOP`

Parameters: None

Description: *STOP* immediately terminates any acquisition. It is typically used when the instrument is operating in a mode without an inherent stop condition, such as continuous envelope mode.

For continuous enveloping acquisition modes, the STOP command causes termination of the current acquisition sequence.

Example: `STOP`

Related Commands: `ACQCOM?, START`

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WAVFRM? **WAVFRM?**

Purpose: Query only. Performs the same command function as sending a *WFMPRE?* query followed by a *CURVE?* query.

Syntax: **WAVFRM?**

Parameters: None

Description: None

Example: **WAVFRM?**

Related Commands: None

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WFMPRE, WFMPRE? **WFMPRE, WFMPRE?**

Purpose: *WFMPRE* specifies the waveform preamble for an acquired, created, or downloaded waveform memory segment.

WFMPRE? queries for all of the waveform preamble items for the waveform residing in the memory segment specified by the most recent *DATA:LOC* command.

Command Syntax: **WFMPRE:<pm2>[<pm2>]***

where *<pm2>* is any of the following:

```
BNFMT {RI|RP|ASCII} (RI)
BYTNR <NRf> (1)
ENCDG {BINARY|ASCII} (BINARY)
NRPT <NR1> (1024)
PTFMT {NORM|ENV} (NORM)
PTOFF <NRf> (0)
WFID <ascii string> ("")
XINCR <NRf> (1E-08)
XUNIT {SEC|CLKS} (SEC)
YMULT <NRf> (0.78125)
YUNIT VOLTS (VOLTS)
YZERO <NRf> (0)
```

Command Parameters: **BNFMT {RI|RP|ASCII}**

This command is accepted, but ignored.

The *DATA:ENCDG* command specifies the binary encoding format for *CURVE* data. The relationship between that command and this one is: When transferring waveform data *to* the digitizer (*CURVE*), the format specified by *DATA:ENCDG* is used. When transferring data *from* the digitizer (*CURVE?*), the format specified by *DATA:ENCDG* is used, and subsequent *WFMPRE:BNFMT?* queries will reflect that format.

BYTNR <NRf>

Sets the number of bytes in each binary data field.

A 1 sets the number of bytes for non-envelope type waveforms.

A 2 sets the number of bytes for envelope and averaged type waveforms.

ENCDG {ASCII|BINARY}

This command is accepted, but ignored.

NRPT <NR1>

This command is accepted, but ignored.

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PTFMT {NORM|ENV}

Sets the format for the waveform data when used as a command. Does not affect waveform preambles for acquired waveforms when used for downloading.

NORM format is one 8-bit value (of 16 bits, see **BYTNR**) per sample point.

ENV format is two 8-bit values per sample point defined as a min/max pair in time order. When *ENV* is selected, *DATA:COUNT* must not exceed the maximum envelope record length; otherwise, an error message is issued.

PTOFF <NRf>

This command is accepted, but ignored.

WFID <ascii string>

Specifies a user-defined waveform identification string for an acquired, created, or downloaded waveform.

<ascii string> ::= an ascii string of not more than 20 characters delimited by double quotation symbols, such as: "CH1 5 MV".

XINCR <NRf>

Specifies the time interval between sample points for downloaded waveforms. Does not affect waveform preambles for acquired waveforms when used for downloading.

If *XUNIT* is set to *SEC*, *<NRf>* specifies the time interval between sample points.

If *XUNIT* is set to *CLKS*, *<NRf>* specifies the number of clock cycles per sample. For example, if *SAMPLE:CLOCK STARX* is selected, the *XINCR* value can be divided by the *SAMPLE:DIVISOR* value to obtain the time interval between sample points.

<NRf> ::= 10 ms (1E-2) to 5 ns (5E-9) (see table under *SAMPLE:INTERVAL*).

XUNIT {SEC|CLKS}

Specifies the unit of measure for *XINCR*. Does not affect waveform preambles for acquired waveforms when used for downloading.

SEC sets the units to seconds.

CLKS sets the units to clock cycles.

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YMULT <NRf>

Specifies the value of the least significant bit of a *CURVE* data point. To convert the *CURVE* data to volts, multiply it by the *<NRf>* value. Does not affect waveform preambles for acquired waveforms when used for downloading.

<NRf> ::= <full scale range>/256.

YUNIT VOLTS

This command is accepted, but ignored.

YZERO <NRf>

Specifies the input offset value in volts.

<NRf> ::= ±50% of full scale range in increments of: $\frac{\textit{full scale range}}{256}$.

Query Syntax:

WFMPRE?
WFMPRE:<pm2>

where *<pm2>* is any of the following:

BNFMT?
BYTNR?
ENCDG?
NRPT?
PTFMT?
PTOFF?
WFID?
XINCR?
XUNIT?
YMULT?
YUNIT?
YZERO?

Query Parameters:

BNFMT?

Returns the *BNFMT* setting of the *CURVE* (or *CURVE?*) data specified by the most recent *DATA:ENCDG* command. The *DATA:ENCDG?* command also queries for this data. For the relationship between that command and this one, see the comment for the *BNFMT* command above.

BYTNR?

Returns an NR1 value of 1 or 2 to indicate the number of bytes in each binary data field.

A 1 is returned for non-envelope type waveforms.

A 2 is returned for envelope and averaged type waveforms.

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ENCDG?

Returns the word "ASCII" or "BINARY" to identify the type of *CURVE* data.

NRPT?

Returns an NR1 value indicating the number of waveform data points that will be transferred on a *CURVE?* query

The *DATA:COUNT?* command also queries for this data. The relationship between that command and this one is that when transferring data *from* the digitizer (*CURVE?*), the number specified by *DATA:COUNT* is used, and subsequent *WFMPRE:NRPT?* queries will reflect that count.

PTFMT?

Returns the *PTFMT* setting for waveforms to be transferred out of waveform memory.

PTOFF?

Returns a numeric value indicating the trigger delay in seconds.

WFID?

Returns an ASCII string containing the waveform identification of the waveform specified by the most recent *DATA:LOC* command.

XINCR?

Returns an NR3 value indicating the current *XINCR* setting.

XUNIT?

Returns the *XUNIT* setting.

If *SAMPLE:CLOCK* is set to *INT*, *SEC* is returned.

If *SAMPLE:CLOCK* is set to *STARX*, *EXT1*, *or EXT2; CLKS* is returned.

YMULT?

Returns an NR1 value that indicates the *YMULT* setting.

YUNIT?

Returns the string "VOLTS" that indicates the unit of measure for the *YMULT* command.

YZERO?

Returns a numeric value indicating the *YZERO* input offset value in volts.

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Description: When used together, a waveform preamble (*WFMPRE* command) and curve data (*CURVE* or *CURVE?*, command) completely specify a waveform. Once an acquisition is made into a waveform memory segment, the next preamble query (*WFMPRE?*) for that segment will reflect the acquisition settings in place when the acquisition occurred, and the *DATA* transfer settings in place at the time of the query.

When the *WFMPRE?* query is received for a segment, that segment's data is not valid until a *CURVE* (or *CURVE?*) command is received, or until an acquisition to the specified segment occurs. If an acquisition does occur, the acquisition settings will override the previously sent preamble values. A *WFMPRE?* query is not legal if the waveform segment selected by the *DATA:LOC* command is empty. Waveform segments are empty after power-up, reset, or initialization.

Example: Query:

```
WFMPRE?
WFMPRE WFMPRE:WFID "";ENCDG BINARY;BNFMT RI;NRPT
1024;PTFMT NORM;XUNIT SEC; XINCR 10.0e-09;PTOFF 0;YUNIT
VOLTS;YMULT 3.1250e-02;YZERO 0.00e+00;BYTNR 2;
```

Related Commands: None

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PASSWORD, PASSWORD? **PASSWORD, PASSWORD?**

Purpose: The command *PASSWORD* followed by the correct user password will unlock all calibration restrictions, thus allowing the calibration constants to be saved and external calibration to be performed.

Command Syntax:
```
PASSWORD [<ascii string>] (VX5260)
PASSWORD:NEW [<ascii string>]
```

Command Parameters: *PASSWORD [<ascii string>]* enters the user calibration password. If the correct password is entered, external calibration and selected internal calibration can be performed. Calibration constants can also be saved. An invalid password will cause a password error message to be placed in the event message queue. Passwords are not case-sensitive.

The *INIT ALL* command will relock the password protection.

PASSWORD:NEW [<password>] allows a new password to be placed in the VX5260 NVRAM. Entering a new password will not relock the password protection. This command will return an error if the password protection has not been unlocked. An error will be generated for any password over 12 characters and the new password will be rejected. All passwords must begin with an alpha character.

PASSWORD? will return the current password if the protection has been unlocked. This is useful for verifying a new password. An error is generated if the password protection is locked.

Example:
```
PASSWORD VX5260
PASSWORD:NEW NEWPASS
```

Related Commands: `CAL?`

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Section 7
Signal Analysis Command Dictionary

Introduction

Signal analysis commands provide the user with a command set to perform acquired waveform manipulation and parametric analysis.

Alphabetical Command Listing

Following is an alphabetical listing and a purpose statement for each signal analysis command.

ADD	Algebraically adds two waveforms and stores the result.
BMODE	Selects a mode to determine the Base value (minimum) of a waveform.
BTLINES	Specifies the Base (or Top) value for a waveform when the determination method is ABSOLUTE.
EXTMODE	Provides horizontal windowing of waveform data when computing PLSEXTEND parameters (Mean, RMS, Area, and Energy).
MULT	Algebraically multiplies two waveforms and stores the result.
PLSEXTEND?	Queries for the Mean, RMS, Area, or Energy value of a waveform.
PLSMAG?	Queries for the Base, Top, Minimum, Maximum, Top Overshoot, Base Overshoot, Mid Point, or Peak-to-Peak value of a waveform.
PLSTIME?	Queries for the Rise Time, Fall Time, Width, Period, Frequency, or Duty Cycle of a waveform.
REFCRS?	Queries for the Proximal, Mesial, or Distal value on the rising or falling edge of a waveform.
REFLINES	Sets the Proximal, Mesial, or Distal value of a waveform at other than their respective 10%, 50%, or 90% default values.
REFUNITS	Selects the unit of measure for REFCRS? and REFLINES.

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REFVALUES?	Queries for the waveform value at the Proximal, Mesial, and Distal crossing points.
SETTLETIME	Sets the parameters for making a settling time measurement on a waveform, and queries for the settling time value.
SMOOTH	Applies a two-point, low-pass filter to a specified waveform.
SUB	Algebraically subtracts two waveforms, and stores the result.
TIMEAB	Sets the parameters for making a Time-A-to-B measurement between two events, and queries for the time value.
TMODE	Selects the mode used to determine the Top value (maximum) of a waveform.
WINDOW	Selects a waveform record and defines how much of it is to be analyzed.

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ADD **ADD**

Purpose: Algebraically adds two waveforms and stores the result.

Syntax: `ADD <source1>,<source2>,<destination>`

Parameters: `<source1>`

Specifies the waveform segment location of the first waveform to be added.

<source 1> ::= 1 — 128

`<source2>`

Specifies the waveform segment location of the second waveform to be added.

<*source 2*> ::= 1 — 128

`<destination>`

Specifies the waveform segment location where the result is to be stored.

<*destination*> ::= 1 — 128

Description: A warning message is issued if an attempt is made to add waveforms with different sample rates.

Example: `ADD 1,2,3`

Related Commands: `SUB, MULT`

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BMODE

BMODE

Purpose: Selects the mode used to determine the Base value (minimum value) of a waveform.

Syntax: `BMODE:<pm2>[;<pm2>]...`

where *<pm2>* is any of the following:

```
ABSOLUTE
HISTOGRAM {MEAN|MODE} (MODE)
MINMAX
```

Parameters: `ABSOLUTE`

Selects a mode where the Base value is specified by the user using the *BTLINES* command.

`HISTOGRAM {MEAN|MODE}`

Selects the histogram distribution method to determine the Base value of a waveform.

MEAN sets the Base value of the waveform at the mean value of the histogram distribution.

MODE sets the Base value of the waveform at the mode value of the histogram distribution.

`MINMAX`

Selects the minimum waveform point to determine the Base value of a waveform.

Description: The histogram method builds a Probability Density Histogram (PDH) that indicates the number of times a sample input signal occurred at a particular voltage. The Base is determined by splitting the PDH at its midpoint and determining the mean or mode of each half.

When using the minmax method, Top Overshoot (*PLSMAG? TOVER*) and Base Overshoot (*PLSMAG? BOVER*) will always be zero (0).

Example: `BMODE:HISTOGRAM MEAN`

Related Commands: `TMODE`

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BTLINES **BTLINES**

Purpose: Specifies the Base (or Top) value for a waveform when the *BMODE* (or *TMODE*) determination method is *ABSOLUTE*.

Syntax: `BTLINES:<pm2>[;<pm2>]...`

where *<pm2>* is one of the following:

`BASELINE <NRf>`
`TOPLINE <NRf>`

Parameters: `BASELINE <NRf>`

Specifies the Base value in volts or percent (units are set with *REFUNITS*) for a specified waveform measurement.

`<NRf>` ::= ±200 V (1X probe) or ±2000 V (10X probe).

`TOPLINE <NRf>`

Specifies the Top value in volts or percent (units are set with *REFUNITS*) for a specified waveform measurement.

`<NRf>` ::= ±200 V (1X probe) or ±2000 V (10X probe).

Description: None

Example: `BTLINES:BASELINE 10`

Related Commands: `BMODE:ABSOLUTE, REFUNITS, TMODE:ABSOLUTE`

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EXTMODE **EXTMODE**

Purpose: Provides horizontal windowing of waveform data for the *PLSEXTEND* parameters (Mean, RMS, Area, and Energy).

Syntax: **EXTMODE {PERIOD|WINDOW|RECORD} (PERIOD)**

Parameters: **PERIOD**

Selects one period of the windowed waveform as defined by its Mesial crossings. The mesial crossing point may be a default value (50%), or be set by the user with the *REFLINES* command.

WINDOW

Selects that portion of the windowed waveform defined by its *START* and *COUNT* parameters.

RECORD

Selects the entire waveform defined by its *WINDOW:LOC* parameter.

Description: None

Example: **EXTMODE WINDOW**

Related Commands: **PLSEXTEND**

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MULT **MULT**

Purpose: Algebraically multiplies two waveforms and stores the result.

Syntax: `MULT <source 1>,<source 2>,<destination>`

Parameters: `<source1>`

Specifies the waveform segment location of the first waveform to be multiplied.

< source 1 > :: = 1 — 128

`<source2>`

Specifies the waveform segment location of the second waveform to be multiplied

< source 2 > :: = 1 — 128

`<destination>`

Specifies the waveform segment location where the result is to be stored.

< destination > :: = 1 — 128

Description: A warning message is issued if an attempt is made to multiply waveforms with different sample rates.

Example: `MULT 1,2,3`

Related Commands: `ADD, SUB`

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PLSEXTEND? **PLSEXTEND?**

Purpose: Query only. Returns a value in the units shown for the selected extended pulse measurement on the waveform defined by *EXTMODE*.

Syntax::

```
PLSEXTEND?
PLSEXTEND:<pm2>[;<pm2>]...
```

where *<pm2>* is one of the following:

```
AREA?
ENERGY?
MEAN?
RMS?
```

Parameters:

AREA?

Returns the *area* value (volts*seconds) of the waveform in NR3 format.

ENERGY?

Returns the *energy* value (volts^2*second) of a waveform in NR3 format..

MEAN?

Returns the algebraic *mean* value (volts) of the waveform in NR3 format.

RMS?

Returns the *rms* value (volts) of the waveform in NR3 format.

Description: If *EXTMODE WINDOW* command is used, and the window is set for less than one waveform period, the *PLSEXTEND?* parameter is computed and a warning message is issued.

If *PLSEXTEND? RMS* is requested on a window that does not contain an integer number of periods, a warning message is issued.

PLSEXTEND parameters are susceptible to low peak-to-peak amplitudes since the reference parameters would have a low degree of resolution. A warning message is issued if the peak-to-peak amplitude is less than 12 digitizer levels.

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Horizontal pulse parameters are calculated as follows. In the formulae, *n* represents the number of samples, *w* represents the waveform amplitude at the sample point, and *SI* represents the sample interval. Other representations are shown below their respective formula.

Duty Cycle = (Width/Period) • 100

$$Mean = \frac{1}{n}\sum_{i=1}^{n} w(i)$$

$$RMS = \left(\frac{a^2}{n}\sum_{j=1}^{n} w^2(j) + \frac{2ab}{n}\sum_{j=1}^{n} w(j) + b^2\right)^{\frac{1}{2}}$$

where *a* is the vertical scale factor (to convert to volts) and *b* is the vertical offset in volts.

$$Area = \frac{SI}{2}\sum_{i=1}^{n-1}[w(i) + w(i+1)] = SI\left[\sum_{i=2}^{n-1} w(i) + \frac{w(1) + w(n)}{2}\right]$$

$$Energy = \frac{SI^2}{2}\sum_{i=1}^{n-1}[w^2(i+1) + w^2(i) = SI^2\left[\sum_{i=2}^{n-1}[w^2(i)] + \frac{w^2(1) + w^2(n)}{2}\right]$$

where w(i) must be scaled such that the ground reference is at digitizer level zero for both the Area and Energy calculations.

Example: `PLSEXTEND:MEAN?;AREA?`

Related Commands: None

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PLSMAG? **PLSMAG?**

Purpose: Query only. Returns a value in the units shown for the selected waveform pulse magnitude measurement on the waveform defined by *WINDOW*.

Syntax:

```
PLSMAG?
PLSMAG:<pm2>[;<pm2>]...
```

where *<pm2>* is one of the following:

```
BASE?
BOVER?
MAX?
MID?
MIN?
PK2PK?
TOP?
TOVER?
```

Parameters:

BASE

Returns the Base value (Volts only). The method of determining the Base is selected with the *BMODE* command. When *BMODE:ABSOLUTE* is selected, the value set by *BTLINES:BASELINE* is returned.

BOVER

Returns the Base Overshoot value (% only) in nr3 format.

MAX

Returns the Maximum value (Volts only) in NR3 format.

MID

Returns the Midpoint value (Volts only) in NR3 format.

MIN

Returns the Minimum value (Volts only) in NR3 format.

PK2PK

Returns the Peak-to-Peak value (Volts only) in NR3 format.

TOP

Returns the Top value (Volts only). The method of determining the Top is selected with the *TMODE* command. When *TMODE:ABSOLUTE* is selected, the value set by *BTLINES:TOPLINE* is returned.

TOVER

Returns the Top Overshoot value (% only) in NR3 format.

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Description: Once the value for Base and Top are determined with the *HISTOGRAM* or *MINMAX* method, or set to an *ABSOLUTE* value with *BTLINES*, the remaining Vertical Pulse parameters (Top Overshoot, Base Overshoot, Mid Point, or Peak-to-Peak) can be calculated as follows:

$$\text{Top Overshoot} = \frac{Maximum - Top}{Top - Base} \times 100$$

$$\text{Base Overshoot} = \frac{Minimum - Base}{Top - Base} \times 100$$

$$\text{Mid Point} = \frac{Top + Base}{2}$$

$$\text{Peak-to-Peak} = Maximum - Minimum$$

Example: `PLSMAG:BASE?;TOP?`

Related Commands: `WINDOW, BMODE:ABSOLUTE, BTLINES, TMODE:ABSOLUTE`

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PLSTIME? **PLSTIME?**

Purpose: Query only. Returns the value in the units shown for the selected waveform pulse time measurement on the waveform defined by WINDOW.

Syntax:
```
PLSTIME?
PLSTIME:<pm2>[;<pm2>]...
```
where *<pm2>* is one of the following:

```
DUTY?
FALL?
FREQUENCY?
PERIOD?
RISE?
WIDTH?
```

Parameters:

DUTY

Returns the duty cycle value (%) in NR3 format.

FALL

Returns the fall time value (seconds) in NR3 format.

FREQUENCY

Returns the frequency value (hertz) in NR3 format.

PERIOD

Returns the period value (seconds) in NR3 format.

RISE

Returns the rise time value (seconds) in NR3 format.

WIDTH

Returns the width value (seconds) in NR3 format.

Description: Rise time is computed as the difference between the distal and proximal locations on the rising edge.

Fall time is computed as the difference between the proximal and distal locations on the falling edge.

Width is computed as the difference between the rising edge of the mesial point and the next falling edge of the mesial point.

Period is computed as the difference between the third and first mesial crossings.

Frequency is computed as the reciprocal of Period.

Example:
```
PLSTIME:RISE?;FALL?
```

Related Commands: None

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REFCRS? **REFCRS?**

Purpose: Query only. Returns the location in points for the selected crossing point type on a waveform specified by *WINDOW*. The percentage value for the selected type of crossing may be a default percentage value, or be a percentage value set by *REFLINES*.

Syntax:

```
REFCRS?
REFCRS:<pm2>[;<pm2>]...
```

where *<pm2>* is one of the following:

```
FDISTAL?
FMESIAL?
FPROXIMAL?
PMESIAL?
RDISTAL?
RMESIAL?
RPROXIMAL?
```

Parameters:

FDISTAL?

Returns a numeric value indicating the sample point location of the falling edge distal crossing.

FMESIAL?

Returns a numeric value indicating the sample point location of the falling edge mesial crossing.

FPROXIMAL?

Returns the sample point location of the falling edge proximal crossing in NR1 format.

PMESIAL?

Returns the sample point location of the third qualified mesial crossing in NR1 format. The number of points between the first and third qualified crossings define one period of the waveform.

RDISTAL?

Returns a numeric value indicating the sample point location of the rising edge distal crossing.

RMESIAL?

Returns a numeric value indicating the sample point location of the rising edge mesial crossing.

RPROXIMAL?

Returns a numeric value indicating the sample point location of the rising edge proximal crossing.

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Description: Unless otherwise set with the *REFLINES* command, the Proximal, Mesial, and Distal crossings are computed as 10%, 50%, and 90% of the Top value.

Example: `REFCRS:RPROXIMAL?;RMESIAL?`

Related Commands: `REFLINES`

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REFLINES **REFLINES**

Purpose: Allows the user to define the Distal, Mesial, and Proximal crossing points as an absolute voltage or percentage of waveform value other than the standard defaults (10%-50%-90%) when determining the sample point location of a selected crossing using *REFCRS?*.

Syntax: `REFLINES:<pm2>[;<pm2>]...`

where *<pm2>* is any of the following:

```
DISTAL <NRf>
MESIAL <NRf>
PROXIMAL <NRf>
```

Parameters: `DISTAL <NRf>`

Specifies the voltage or percentage value of the distal crossing point. *<NRf>* ::= 0 — 100% or ± maximum input voltage, but greater than *MESIAL <NRf>*.

`MESIAL <NRf>`

Specifies the voltage or percentage value of the mesial crossing point. *<NRf>* ::= 0 — 100% or ± maximum input voltage, but less than *DISTAL <NRf>* and greater than *PROXIMAL <NRf>*.

`PROXIMAL <NRf>`

Specifies the voltage or percentage value of the proximal crossing point. *<NRf>* ::= 0 — 100% or ± maximum input voltage, but less than *MESIAL*.

Description: If the proper relationship of *DISTAL*, *PROXIMAL*, and *MESIAL* is not maintained (*DISTAL <NRf>* must be greater than *MESIAL <NRf>*, and *MESIAL <NRf>* must be greater than *PROXIMAL <NRf>*), an Error message is issued.

Example: `REFLINES:MESIAL 50`

Related Commands: `REFCRS?, REFUNITS`

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REFUNITS **REFUNITS**

Purpose: Selects the unit of measure applied to the *BTLINES* and *REFLINES* commands.

Syntax: `REFUNITS {PERCENT|VOLTS} (PERCENT)`

Parameters: `PERCENT`

Crossing reference points are defined as a percentage of the waveform Base and Top voltage values. Base is defined as 0% and Top as 100%.

`VOLTS`

Crossing reference points are defined as an absolute voltage level.

Description: None

Example: `REFUNITS VOLTS`

Related Commands: `REFCRS?, REFLINES`

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REFVALUES? **REFVALUES?**

Purpose: Query only. Returns the voltage value of the waveform at the selected crossing point.

Syntax:
```
REFVALUES?
REFVALUES:<pm2>[;<pm2>]...
```
where *<pm2>* is one of the following:

```
DISTAL?
MESIAL?
PROXIMAL?
```

Parameters:

`DISTAL?`

Returns the waveform voltage value of the Distal crossing point in NR3 format.

`MESIAL?`

Returns the reference value of the Mesial crossing point in NR3 format.

`PROXIMAL?`

Returns the reference value of the Proximal crossing point in NR3 format.

Description: None

Example:
```
REFVALUES:DISTAL;MESIAL?
```

Related Commands: None

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SETTLETIME **SETTLETIME**

Purpose: *SETTLETIME* sets specific parameters for making a settling time measurement on a waveform selected by the *WINDOW* command, and queries for the measurement.

Command Syntax: `SETTLETIME:<pm2>[;<pm2>]...`

where *<pm2>* is any of the following:

```
BASEMODE :{HISTOGRAM {MEAN|MODE}|MINMAX|ABSOLUTE}
          (HISTOGRAM  MODE)
LOWERBAND <NRf>
REFPOINT {<NRf>|TRIGGER} (TRIGGER)
TOPMODE :{HISTOGRAM  {MEAN|MODE}|MINMAX|ABSOLUTE}
          (HISTOGRAM  MODE)
UPPERBAND <NRf>
VALUE?
```

Parameters: `BASEMODE:{HISTOGRAM {MEAN|MODE}|MINMAX|ABSOLUTE}`

Selects the Base determination mode for the waveform whose settling time is being calculated.

MEAN sets the Top value of the waveform at the mean value of the histogram distribution.

MODE sets the Top value of the waveform at the mode value of the histogram distribution.

`LOWERBAND <NRf>`

Sets the lower signal limit for determining the settling time of a waveform signal.

<NRf> ::= 0 — 100% when *BANDUNITS* is *PERCENT*.

<NRf> ::= 0 — ± maximum input voltage when *BANDUNITS* is *VOLTS*.

`REFPOINT {<NRf>|TRIGGER}`

Sets the point on the waveform where the settling time calculation starts.

<NRf> ::= 0 — *<record length>*, where *<record length>* is defined by the *ACQUIRE:MODE* command.

TRIGGER specifies that the settling time calculation starts at the Trigger Point.

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TOPMODE:{HISTOGRAM{MEAN|MODE}|MINMAX|ABSOLUTE}

Selects the Top determination mode for the waveform whose settling time is being calculated.

MEAN sets the Top value of the waveform at the mean value of the histogram distribution.

MODE sets the Top value of the waveform at the mode value of the histogram distribution.

UPPERBAND <NRf>

Sets the upper signal limit for determining the settling time of a waveform signal.

<NRf> ::= 0 — 100% when *BANDUNITS* is *PERCENT*.

VALUE?

Returns the settling time based on the waveform selected by *WINDOW* and parameters selected above.

Description: Settling time is defined as the time between some reference point set by *SETTLETIME:REFPOINT* and the point where the waveform maintains a level between an upper limit (*UPPERBAND*) and lower limit (*LOWERBAND*) before the next transition.

Pulse boundaries for this command are determined with the midpoint qualification method.

If the waveform fails to settle within the upper and lower limits, a warning message is issued.

Example:
```
SETTLETIME:VALUE?
SETTLETIME:VALUE 30E-9
```

Related Commands: None

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SMOOTH **SMOOTH**

Purpose: Applies a two-point, low-pass filter to a specified waveform.

Syntax: `SMOOTH <source>,<destination>`

Parameters: `<source>`

Specifies the waveform segment location of the waveform to be filtered.

`<source> ::= 1 — 128`

`<destination>`

Specifies the waveform segment location where the filtered waveform is to be stored.

`<destination> ::= 1 — 128`

Description: None

Example: `SMOOTH 1,5`

Related Commands: None

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SUB

SUB

Purpose: Algebraically subtracts two waveforms and stores the result.

Syntax: `SUB <source1>,<source2>,<destination>`

Parameters: `<source1>`

Specifies the waveform segment location of the first waveform to be subtracted.

`<source 1>` ::= 1 — 128

`<source2>`

Specifies the waveform segment location of the second waveform to be subtracted.

`<source 2>` ::= 1 — 128

`<destination>`

Specifies the waveform segment location where the result is to be stored.

`<destination>` ::= 1 — 128

Description: A warning message is issued if an attempt is made to subtract waveforms with different sample rates.

Example: `SUB 1,2,3`

Related Commands: `ADD, MULT`

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TIMEAB **TIMEAB**

Purpose: *TIMEAB* selects two Events (A and B), sets the specific parameters for determining the time between them, and queries for the time between them.

Command Syntax:

```
TIMEAB:<pm2>[;<pm2>]...
```

where *<pm2>* is any of the following:

```
A <NR1>
A:BASEMODE:{HISTOGRAM {MEAN|MODE}|MIMMAX|ABSOLUTE}
            (HISTOGRAM  MODE)
AEDGENUM <NR1> (1)
AREFCROSS <NR1> (50%)
A:SLOPE {POS|NEG|EITHER}
A:TOPMODE {HISTOGRAM {MEAN|MODE}|MINMAX|ABSOLUTE}
           (HISTOGRAM  MODE)
B <NR1>
B:BASEMODE:{HISTOGRAM {MEAN|MODE}|MINMAX|ABSOLUTE}
              (HISTOGRAM  MODE)
BEDGENUM <NR1> (1)
BREFCROSS <NR1> (50%)
B:SLOPE {POS|NEG|EITHER}
B:TOPMODE {HISTOGRAM {MEAN|MODE}|MINMAX|ABSOLUTE}
            (HISTOGRAM  MODE)
CROSSUNITS {PERCENT|VOLTS} (PERCENT)
VALUE?
```

Parameters:

A <NR1>

Selects the waveform segment location for Event A.

<NR1> ::= 1 — 128

A:BASEMODE {HISTOGRAM|MINMAX|ABSOLUTE}

Selects the Base determination mode for the Event A measurement.

AEDGENUM <NR1>

Selects the number of edges after the Trigger Point where the time measurement for Event A is made.

<NR1> ::= 1 — *max record length*, where *max record length* ::= 16K (standard memory) or 128K (optional memory).

AREFCROSS <NRf>

Selects the crossing level on Event A where the *TIMEAB* measurement is made.

<NRf> ::= 0 — 100% when *CROSSUNITS* is *PERCENT*.

<NRf> ::= 0 — ±maximum input voltage when *CROSSUNITS* is *VOLTS*.

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A:SLOPE {POS|NEG|EITHER}

Selects whether the *TIMEAB* measurement is made on the positive, negative, or either slope of the Event A waveform.

A:TOPMODE {HISTOGRAM|MINMAX|ABSOLUTE}

Selects the Top determination mode for the Event A measurement.

B <NR1>

Selects the waveform segment location for Event B.

<NR1> ::= 1 — *max segments*, where *max segments* ::= 64 for 16K memory or 512 for 128K memory.

B:BASEMODE {HISTOGRAM|MINMAX|ABSOLUTE}

Selects the Base determination mode for the Event B measurement.

BEDGENUM <NR1>

Selects the number of edges after the Trigger Point where the time measurement for Event B is made.

<NR1> ::= 1 — *max record length*, where *max record length* ::= 16K (standard memory) or 128K (optional memory).

BREFCROSS <NRf>

Selects the crossing level on Event B where the *TIMEAB* measurement is made.

<NRf> ::= 0 — 100% when *CROSSUNITS* is *PERCENT*.

<NRf> ::= 0 — ± maximum input voltage when *CROSSUNITS* is *VOLTS*.

B:SLOPE {POS|NEG|EITHER}

Selects whether the *TIMEAB* measurement is made on the positive, negative, or either slope of the Event B waveform.

B:TOPMODE {HISTOGRAM|MINMAX|ABSOLUTE}

Selects Top determination mode for the Event B measurement.

CROSSUNITS {PERCENT|VOLTS}

Selects whether the crossing level will be expressed in a percentage of the base or in volts.

VALUE?

Returns the time from Event A to Event B based on the waveform and parameters described previously.

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Description: The *TIMEAB* measurement is the time from some event A to an event B. Each event is defined with four parameters: crossing level, slope indicator, edge number, and waveform selection.

Crossing level is specified with *AREFCROSS* and *BREFCROSS*, and can be specified in volts or percentage of Base/Top magnitude. Slope is specified with *ASLOPE* and *BSLOPE* and can be set for a positive or negative slope. Edge number is specified with *AEDGENUM* and *BEDGENUM*. The edge number is the number of edges of the specified slope that have occurred since the beginning of the waveform record. For example if the slope indicator is positive, and the edge number is set to 3, then the event is located on the third positive slope edge. Waveform selection is specified with A and B.

Mid point qualification is used to determine event locations, thus they occur on fully qualified edges.

Example: Command:

```
TIMEAB:A 1;B 1;ASLOPE POS;BSLOPE POS
```

Query:

```
TIMEAB:VALUE?
TIMEAB:VALUE 25E-9
```

Related Commands: None

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TMODE **TMODE**

Purpose: Selects mode used to determine the Top value (maximum value) of a waveform.

Syntax: `TMODE:<pm2>[;<pm2>]...`

where *<pm2>* is any of the following:

```
ABSOLUTE
HISTOGRAM {MEAN|MODE}
MINMAX
```

Parameters: **ABSOLUTE**

Selects a mode where the Top value is specified by the user using the *BTLINES* command.

HISTOGRAM {MEAN|MODE}

Selects the histogram distribution method to determine the Top value of a waveform.

MEAN sets the Top value of the waveform at the mean value of the histogram distribution.

MODE sets the Top value of the waveform at the mode value of the histogram distribution.

MINMAX

Selects the maximum waveform points to determine the Top value of a waveform.

Description: The histogram method builds a Probability Density Histogram (PDH) to indicate the number of samples that an input signal was at a particular voltage. The Top is determined by splitting the PDH at the midpoint and finding the mean or mode of the upper half.

Example: `TMODE:MINMAX`

Related Commands: **BMODE**

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WINDOW **WINDOW**

Purpose: Selects the waveform record and defines how much of it is to be analyzed by the available signal analysis commands.

Syntax: **WINDOW:<pm2>**

where *<pm2>* is any of the following:

LOC <NR1>
START <NR1>
STOP <NR1>

Parameters: **LOC <NR1>**

Selects the waveform record to be analyzed.

<NR1> ::= 1 — 128

START <NR1>

Selects the starting point in the waveform for a particular waveform measurement.

<NR1> ::= 1 — 131072

STOP <NR1>

Selects the stopping point in the waveform for a particular waveform measurement.

<NR1> ::= 1 — 131072

Description: The target data for pulse analysis is specified with the *WINDOW* command. It allows the user to specify a window within a waveform record.

Example: **WINDOW:COUNT 1024**

Related Commands: **EXTMODE, PLSEXTEND?, PLSMAG?, PLSTIME?, REFCRS?, SETTLETIME:VALUE?**

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Section 8
System Command Dictionary

Introduction

Since the VX5260 is a VXI instrument module, all commands are received over the VXIbus from a VXIbus Interface Device, or an embedded controller, and all responses are sent to or through the same devices. If the VX5260 is operated in an environment where the Host-to-VXI Subsystem interface is an IEEE 488 (GPIB) Interface, the VXIbus Interface Device (such as a Tektronix VX5520 Slot 0 Resource Manager), or embedded controller, must be prepared to intercept and communicate any IEEE 488 commands intended for the VX5260. Also, any other commands, such as VX5520 Slot 0 Resource Manager commands, must send the VX5260 a command that it understands.

Table 8-1 indicates the command sent to the VX5260 by the VX5520 when it receives an IEEE 488 command. The command dictionary included later in this section describes the action taken by the VX5260 upon receipt of the command from the VX5520.

Table 8-1. IEEE 488 Commands Supported by the VX5260

IEEE 488 Command Sent to the VX5520	Command Sent over the VXIbus to the VX5260 by the VX5520
*CLS	Rebroadcasts *CLS. The VX5260 accepts the command, but performs no action.
*ESE	[1]
*ESE?	[1]
*OPC	Sends *OPC?.
*OPC?	Rebroadcasts *OPC?.
*RCL	[1]
*RST	Rebroadcasts *RST.
*SRE	[1]
*SRE?	[1]
*STB?	[1]
*TRG	Rebroadcasts *TRG.
*TST?	Rebroadcasts *TST? plus any arguments.

[1] IEEE 488.2 prohibits the prepending of a header to a common (*) command. Therefore, common commands targeted at a specific instrument can be sent to the VX5520 only through the *LOGADRRSEND* command.

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The VX5520 commands supported by the VX5260, and the command communicated over the VXIbus to it are listed in Table 8-2. The command dictionary included later in this section describes the action(s) taken by the VX5260 upon receipt of the IEEE 488 commands (prefixed with *), and the Tektronix WSP Halt command. Word Serial Protocol commands are implemented as defined in the VXIbus System Specification.

Table 8-2 VX5520 Commands Supported by the VX5260

Command Received by the VX5520	Command Sent over the VXIbus to the VX5260 by the VX5520
ABORT	WSP *Clear* + Tek WSP *Halt*
CLEAR "<device name>"	*CLS
DOWNGRADE? "<device name>"	Sends ASCII DOWNGRADE message, which is executed in instrument firmware.
FAILCLEAR "<device name>"	Asserts the SYSFAIL* inhibit bit in the VX5260s Control Register
HALT "<device name>"	WSP *Clear* + WSP *Abort Normal Operations*
HALTALL	WSP *Clear* + WSP *Abort Normal Operations*
ID?	ID?
IDENTIFY? "<device name>"	*IDN?
RECALL "<device name>", "<location>"	*RCL <NR1>; <NR1> ::= 1-8
RESET "<device name>"	*RST
RESTART "<device name>"	WSP *Clear* + *RST
RESTARTALL	WSP *Clear* + *RST
SELFTEST? "<device name>"	*TST?
STORE <device name>", "<location>"	*SAV <NR1>; <NR1> ::= 1-8
UPGRADE? "<device name>"	Sends ASCII UPGRADE message, which is executed in instrument firmware.

To support the embedded addressing capability of the VX5520, each of the IEEE 488 Common Commands implemented by the VX5260 also has a version that is not prefixed with an asterisk (*). This non-prefixed version can be addressed directly to the VX5260 at any time. The action by the VX5260 is identical for both versions.

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Alphabetical Listing

Following is an alphabetical listing and a purpose statement for each System Command implemented by the VX5260.

***CLS, CLS**	Clears all instrument event registers and queues, except the output queue.
***ESE, ESE**	Sets the Event Status Register bits.
***ESE?, ESE?**	Queries the setting of the Event Status Register bits.
***ESR?, ESR?**	Reads the contents of the Event Status Register.
***IDN?, IDN?**	Returns the unique identification for the instrument.
***OPC?, OPC?**	Places a "1" in the output queue when current operations are complete.
***RCL, RCL**	Restores control settings from a copy stored in a specified location in local memory.
***RST, RST**	Initializes the instrument to its power-up state, but doesn't alter the VXIbus interface data.
***SAV, SAV**	Stores current control settings to a specified location in local memory.
***SRE, SRE**	Sets the bits in the Service Request Enable Register.
***SRE?, SRE?**	Queries the bit settings of the Service Request Enable Register.
***STB?, STB?**	Reads the Status Byte Register.
***TRG, TRG**	Triggers the instrument asynchronously.
***TST?, TST?**	Causes the instrument to execute its power-up self-test routines, except the kernel verification tests, and report any failures that occur.

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DOWNGRADE? A Tektronix ASCII message sent from VX5520 firmware to instrument firmware to cause the instrument to change its communications protocol to Word Serial Protocol.

HALT A Tektronix defined Word Serial Protocol command that asynchronously halts current operations.

ID? An older Tektronix GPIB command that returns the unique identification for the instrument.

UPGRADE? A Tektronix ASCII message sent from VX5520 firmware to instrument firmware to cause the instrument to set its communications protocol to Shared Memory.

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***CLS, CLS** ***CLS, CLS**

Purpose: Clears all instrument event status registers, clears all queues, except the output queue, and places a "1" in the output queue to indicate the *OPC?* idle state. These actions are as defined in the *IEEE 488.2 Specification.*

Syntax:
```
*CLS
 CLS
```

Parameters: None

Description: The **CLS* command is received from the slot 0 device whenever it receives an IEEE 488 **CLS* command.

Related Commands: None

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***ESE, ESE, *ESE?, ESE?** ***ESE, ESE, *ESE?, ESE?**

Purpose: **ESE* sets the Event Status Enable Register bits.
**ESE?* queries the setting of the Event Status Enable Register bits.

Command Syntax:
```
*ESE <integer>
 ESE <integer>
```

Query Syntax:
```
*ESE?
 ESE?
```

Command Parameters: `<integer>`

An integer in the range of 0 — 255 that represents the desired setting of the Event Status Enable Register bits.

Query Parameters: None

Description: If an out-of-range integer is entered for the value of *<integer>*, an execution error is generated.

The **ESE?* query generates an NR1 integer response (in the range of 0 — 255) that corresponds to the bits set in the Event Status Enable Register.

Note

For further information regarding the bit definitions of the Event Status Enable Register, refer to Figure 8-1 on the last page of this section.

Command Example: In the following example, the **ESE* command sets bits 1 and 2:

```
*ESE 3
```

Query Example: In the following example, the **ESE?* query determines that bits 1, 2, and 6 are set:

```
*ESE?
9
```

Related Commands: None

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***ESR?, ESR?** ***ESR?, ESR?**

Purpose: Reads the contents of the Event Status Register.

Syntax:
```
*ESR?
 ESR?
```

Parameters: None

Description: The **ESR?* query clears the Event Status Register after reading. The response to this query is identical to that of **ESE?*.

Note

For further information regarding the bit definitions of the Event Status Register, refer to Figure 8-1 on the last page of this section.

Example: In the following example, the **ESR?* query determines that bits 1, 2, and 6 are set:

```
*ESR?
9
```

Related Commands: None

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***IDN?, IDN?** ***IDN?, IDN?**

Purpose: Returns the unique identification of the instrument.

Syntax:
```
*IDN?
 IDN?
```

Parameters: None

Description: The VX5260 response to this command is organized into four fields identifying the Manufacturer, Model, Serial Number, and Firmware Level (or equivalent) of the instrument. This data is obtained from the ID ROM (NVRAM), and is reported in the form:

```
TEKTRONIX,<model>,<serial #>,<firmware version>
```

such as:

```
*IDN TEKTRONIX,VX5260,B010000,CF:88.1CN RM:1.0
```

Related Command: None

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***OPC?, OPC?** ***OPC?, OPC?**

Purpose: Sets the operation complete bit in the Standard Event Status Register when the current operation is complete.

Syntax:
```
*OPC?
 OPC?
```

Parameters: None

Description: This **OPC?* command is received from the slot 0 device whenever it receives a **OPC* or **OPC?* command.

Note

For further information regarding the bit definitions of the Standard Event Status Register, refer to Figure 8-1 on the last page of this section.

Related Commands: None

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***RCL, RCL** ***RCL, RCL**

Purpose: Recalls instrument setup.

Syntax:
```
*RCL <number>
 RCL <number>
```

Parameters: `<number>`

A numeric value, 1 — 8.

Description: This command recalls the previously saved instrument setup identified by *<number>*. *<number>* is NR1 formatted with a step size of 1 and a range of 1 — 8.

Related Commands: `*RST, *SAV`

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***RST, RST** ***RST, RST**

Purpose: Initializes the instrument to its power-up state, but does not alter VXIbus interface data.

Syntax:
```
*RST
 RST
```

Parameters: None

Description: This command causes the VX5260 to reset to its power-up default settings as defined under the Power-up Defaults Control Settings topic in Section 6, Instrument Control Command Dictionary.

Related Commands: `INIT`

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***SAV, SAV** ***SAV, SAV**

Purpose: Saves the current state.

Syntax:
```
*SAV <number>
 SAV <number>
```

Parameters: `<number>`

A numeric value, 1 — 8; the destination location for the instrument setup information.

Description: This command saves the current state of the VX5260. Note that, when power is interrupted, all saved setups are lost. Setups are also lost when the Digitizer is reconfigured. *<number>* is NR1 formatted with a step size of 1 and a range of 1 — 8. It is user selectable; the default is no-save.

Related Commands: `*RCL, *RST`

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***SRE, SRE, *SRE?, SRE?** ***SRE, SRE, *SRE?, SRE?**

Purpose: **SRE* sets the bits in the Service Request Enable Register.

**SRE?* queries the bit settings of the Service Request Enable Register.

Command Syntax:
```
*SRE <number>
 SRE <number>
```

Command Parameters:

`<number>`

Decimal numeric program data in the range of 0 — 255. This number, when rounded to an integer value and expressed in binary, represents the desired bit values of the Service Request Enable Register.

Query Syntax:
```
*SRE?
 SRE?
```

Query Parameters: None

Description: When using the **SRE* command, the value specified for Bit 6 will be ignored. (Bit 6 is always 0.)

The response to the **SRE?* query is an NR1 in the ranges of 0 — 63 or 128 — 191. When converted to binary, this number represents the current bit values of the Service Request Enable Register. Bit 6 of the Service Request Enable Register bit values will always be 0.

Note

For further information regarding the bit definitions of the Service Request Enable Register, refer to Figure 8-1 on the last page of this section.

Related Commands: None

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***STB?, STB?** ***STB?, STB?**

Purpose: Reads the status byte from the Status Byte Register.

Syntax:
```
*STB?
 STB?
```

Parameters: None

Description: The response to the **STB?* query is an NR1 that corresponds to the bits set in the Status Byte Register.

Note

For further information regarding the bit definitions of the Status Byte Register, refer to Figure 8-1 on the last page of this section.

Example: In the following example, the **STB?* query indicates that bits 1 and 2 of the Status Byte Register are set:

```
*STB?
3
```

Related Commands: None

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***TRG, TRG** ***TRG, TRG**

Purpose: Triggers the instrument asynchronously.

Syntax:
```
*TRG
 TRG
```

Parameters: None

Description: The **TRG* command provides the same function as *CMDTRIG.*

Related Commands: None

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***TST?, TST?** ***TST?, TST?**

Purpose: Invokes the instrument self-test.

Syntax:
```
*TST?
 TST?
```

Parameters: None

Description: Causes the instrument to execute its power-up self-test routines (excludes the power-up kernel verification tests), and return the number of failures found.

Related Commands: None

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DOWNGRADE? **DOWNGRADE?**

Purpose: Changes the module communications protocol from Shared Memory Protocol to Word Serial Protocol.

Parameters: None

Description: Some VXIbus modules have the capability of operating in either a Word Serial or a Shared Memory communications protocol (this capability is defined in the device's Protocol Register). When the VXIbus Slot 0 Resource Manager is a Tektronix VX5520, the communication capability of each device in the VXIbus system is known by the VX5520.

When the Tektronix VX5520 is the VXIbus Slot 0 Resource Manager, its power-up default communications protocol is Word Serial. For modules that have both protocols, the VX5520 provides an *UPGRADE?* and *DOWNGRADE?* command that can be used to change the communications protocol of specified devices. These command functions are implemented by Tektronix in the firmware of the VX5520 and other VXIbus modules. When either of these commands is received by the VX5520, and addressed to an appropriate Tektronix VXIbus module, the function is implemented by a message from the VX5520 firmware to the addressed device's firmware to change its communications protocol.

When the VX5520 receives a *DOWNGRADE?* command addressed to the VX5260, the VX5520 firmware sends a message to the VX5260 firmware to change its communications protocol to Word Serial.

Related Commands: **UPGRADE?**

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HALT **HALT**

Purpose: Causes an asynchronous halt to all current operations.

Parameters: None

Description: This command is received from the VX5520 as part of a two command sequence (WSP *CLEAR* + Tek WSP *HALT*), when that device receives an *ABORT* command.

When this command is received by the VX5260, it immediately stops current operations.

Related Commands: None

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ID? **ID?**

Purpose: Returns the unique identification of the instrument.

Parameters: None

Description: This is an older Tektronix GPIB command used in previous software programs to query for the unique identification of an instrument. In newer instruments, it has been replaced with the IEEE 488.2 **IDN?* command. This command is implemented for compatibility with older Tektronix software.

The returned value is:

```
ID TEK/<instrument name>, 0, Vx.y
```

where x.y is the firmware version number.

Example:

```
ID?
ID? TEK/VX5260, 0, V2.0
```

Related Commands: None

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UPGRADE? **UPGRADE?**

Purpose: Changes the module communications protocol from Word Serial Protocol to Shared Memory Protocol

Parameters: None

Description: Some VXIbus modules have the capability of operating in either a Word Serial or a Shared Memory communications protocol (this capability is defined in the device's Protocol Register). When the VXIbus Slot 0 Resource Manager is a Tektronix VX5520, the communication capability of each device in the VXIbus system is known by the VX5520.

When the Tektronix VX5520 is the VXIbus Slot 0 Resource Manager, its power-up default communications protocol is Word Serial. For modules that have both protocols, the VX5520 provides an *UPGRADE?* and *DOWNGRADE?* command that can be used to change the communications protocol of specified devices. These command functions are implemented by Tektronix in the firmware of the VX5520 and other VXIbus modules. When either of these commands is received by the VX5520, and addressed to an appropriate Tektronix VXIbus module, the function is implemented by a message from the VX5520 firmware to the addressed device's firmware to change its communications protocol.

When the VX5520 receives an *UPGRADE?* command that is addressed to the VX5260, the VX5520 firmware sends a message to the VX5260 firmware to change its communications protocol to Shared Memory.

Related Commands: **DOWNGRADE?**

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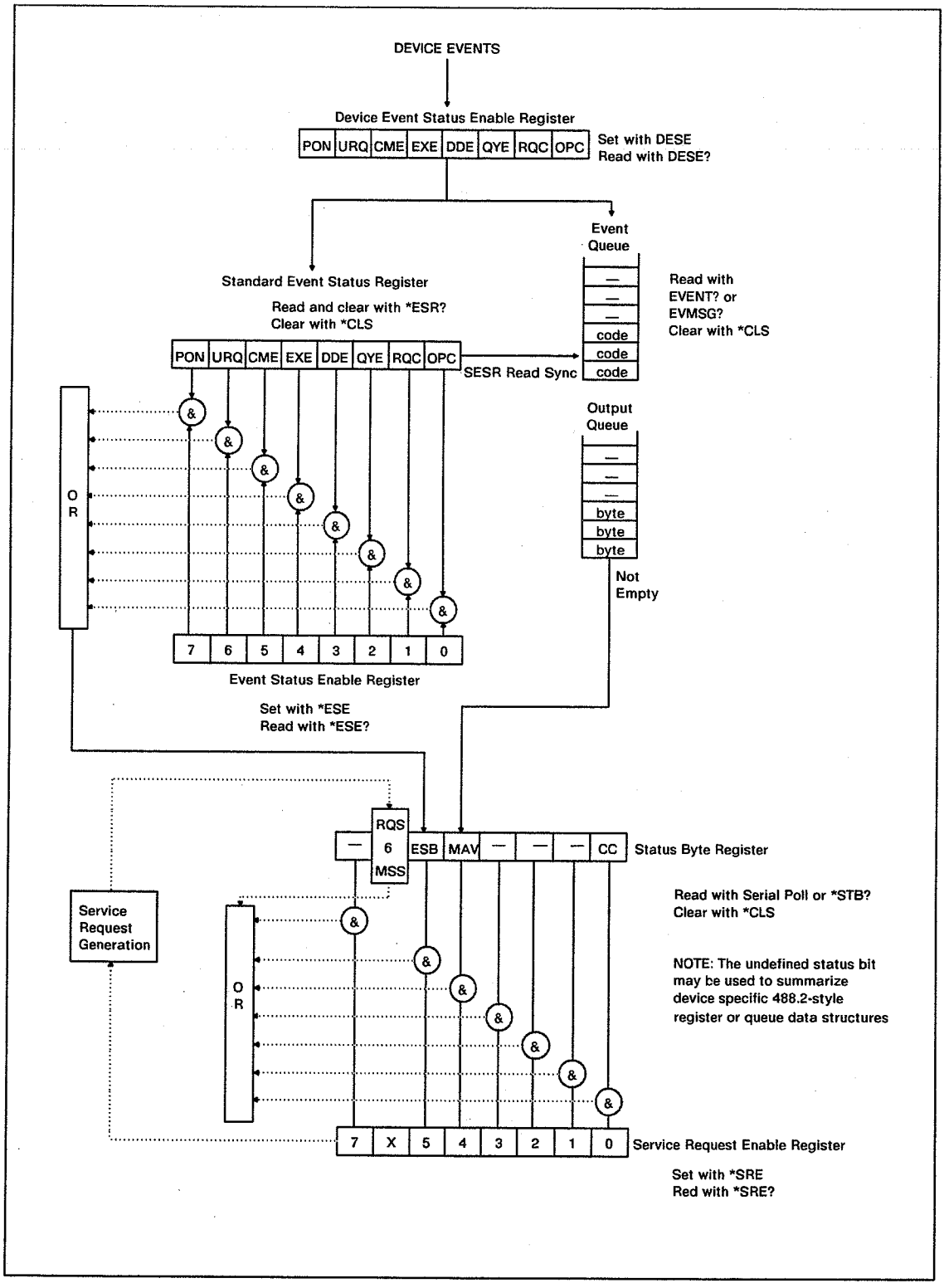


Figure 8-1. Register Bit Definitions

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Section 9
Calibration

Introduction

The VX5260 contains hardware and firmware to perform self-calibration on command. The self-calibration function utilizes internal references to verify the analog calibration of the instrument. Self-calibration will generate new calibration constants which compensate for changes in system variables, such as temperature, power supply variations, and component drift. Once performed, these new calibration constants will remain in effect until another self-calibration is performed, or the instrument is powered down. Whenever the instrument is powered up, it uses the calibration constants stored during the last external calibration. These constants are stored in nonvolatile RAM and are protected by a password.

External calibration performs additional steps which utilize external references. These steps are in addition to and not a substitute for those performed automatically during self-calibration. Hence, performing a self-calibration will never reduce the accuracy of the instrument.

Self-calibration can be invoked at anytime using the *CAL?* command. Self-calibration executes in less than one minute.

Although the Digitizer will have performance equal to or better than the specifications without using self-calibration, using the self-calibration will optimize the performance to give the best possible results. The self-calibration should be performed only after a minimum 20-minute warm-up period, and repeated as often as the best possible performance is desired, typically at the start of every day.

Note

It is recommended that the CAL? command pages from Section 6, Instrument Control Command Dictionary, be available for reference while reading this section.

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Functional Overview

The calibration function has six modes, which are listed with their command/text acronyms below, and described in more detail under the *Calibration Modes* topic.

- Internal Calibration (INTC). Requires password state to be UNLOCKED.
- External Calibration (EXTC) Requires password state to be UNLOCKED.
- AC Confidence Check (ACCHK)
- Load (LOAD)
- Save (SAVE) Requires password state to be UNLOCKED.

The calibration function calibrates the following digitizer functions:

- Calibration DAC
- DC Balance
- Input Offset
- Attenuator
- Analog Gain
- Trigger Level

and performs the following check to verify the accuracy of the instrument:

- AC Confidence Check (ACCHK)

When the command to calibrate all functions is issued, they are calibrated in the order shown above.

Calibration Constants

The module ID-ROM provides non volatile storage for the calibration constants. At power-up, the instrument copies all of the calibration constants from the ID-ROM into RAM. During settings changes, the instrument uses the calibration constants stored in RAM to calculate values for the new hardware settings. When a self-calibration is performed, internal references will be used by the instrument to generate new values for some of the constants. These new values are then written over the old values in RAM. This process will improve instrument accuracy by compensating for current ambient conditions. The calibration constants which are stored in the ID-ROM can be reloaded into RAM at any time by entering the *CAL? LOAD* command.

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Three steps take place when performing a total instrument calibration. First, a self-calibration is performed step by step. Additional arguments are added to the *CAL* command to cause generation of the additional calibration constants not generated by self-test. (These functions require external calibration stimulus to be applied to the module). Once all of the calibration constants in RAM are updated, they are written into the ID-ROM with the SAVE argument. All three of these steps require the password status to be UNLOCKED.

Calibration Modes

If no *<mode>* or *<fcnt>* is specified in the *CAL:CHx?* or *CAL?* command, the instrument will perform self-calibration. After calibration is finished, an AC Confidence Check is executed to verify that the channel(s) is (are) calibrated. If an error occurs during calibration, an error message is sent to the Slot 0 Module, and recorded in the ID-ROM.

INTC: This is the fundamental calibration mode used in all instrument calibration procedures. Calibration is based on a highly accurate laser trimmed band gap voltage reference which is built into the instrument. Internal calibration covers all stages in the analog signal path with the exception of the input passive attenuator networks, and the external trigger input. Because individual function arguments could be executed out of sequence, this mode requires the password state to be UNLOCKED.

EXTC: This mode generates the constants which are not generated by internal (INTC) calibration These steps calibrate the input attenuator networks, the external trigger input gain, and the sample clock duty cycle. The input attenuator calibration requires three external calibration reference voltages. The reference for calibrating the external trigger inputs is provided by connecting a cable from the CAL OUT connector on the front of the instrument. Sample clock duty cycle is calibrated while applying a 211 MHz sine wave to the Channel 1 input. EXTC mode requires the password state to be UNLOCKED.

ACCHK: This mode executes the AC Confidence Check routine to check the calibrated accuracy of the instrument. The Calibration DAC generates a sine wave, which is digitized to check the amplitude error. This routine is automatically executed after each calibration to ensure the overall instrument error is within limits.

LOAD: This mode loads the user calibration constants from the ID-ROM to RAM.

SAVE: This mode takes the calibration constants currently in RAM and stores them into the calibration constant space in ID-ROM. This mode requires the password state to be UNLOCKED.

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Password State

In order to safeguard instrument accuracy, arguments for modes and functions which could potentially reduce instrument accuracy or void traceability to recognized standards are protected by a password. It is intended for the owner's calibration lab or other authorized personnel to maintain the password. A global flag, referred to as "password state" must be set to UNLOCKED in order for these special arguments to execute. Attempts to execute a restricted argument with the password state LOCKED will be ignored and generate an error. The password state is set to UNLOCKED by entering the command *PASSWORD* (user password). The password can be returned to lock by initializing the instrument with *INIT ALL* or **RST* commands or by cycling instrument power. While in the UNLOCKED state, the password can be changed by entering *PASSWORD:NEW* (new user password) and queried with the *PASSWORD?* command. When changing the password, it is highly recommended that the new password be queried for verification before returning the password state to LOCKED.

Calibrated Functions

The following paragraphs briefly describe the purpose of calibrating a function and/or an overview of how the calibration occurs. Each calibration results in the generation of one or more calibration constants for each function. These calibration constants are then used by function control DACs during normal operation to accurately set instrument functions.

Calibration DAC

An internal calibration DAC is dedicated to providing all of the reference voltages necessary for internal calibration. It is therefore calibrated first. Gain and offset constants for the calibration DAC are determined by comparing its output; first with 0 V, then 0.2 V provided by the band gap reference. In both steps, the firmware varies the DAC input until its output exactly matches the reference. Once these two constants are determined, the firmware can accurately produce any voltage needed for the remainder of the calibration from the DAC.

The output of the Calibration DAC is always available from the front panel CAL OUT connector. The signal on this connector has the same magnitude but opposite polarity to the calibration DAC output.

DC Balance

DC Balance calibration nulls the internal error of the channel Preamps. For each of the five Preamp gain ranges, there is a corresponding DC Balance Control DAC voltage (calibration constant) to minimize the Preamp internal error. The input attenuator is switched to ground. Several acquisitions are then made, with the polarity of the Preamp alternating after each one. The DC Balance DAC shifts its output until there is no change in the digitized level when the Preamp is switched between inverting and non-inverting gain modes. The resulting DC Balance DAC value is retained as a calibration constant for that gain range.

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Input Offset

Two calibration compensations take place during this test. First, the offset generated in the Normal/Cal switch is nulled out. The input attenuator is set to ground. Then several acquisitions are made, alternating the position of the cal/normal switch between each. The input to the calibration DAC is changed until there is no difference in the digitized DC levels. The value in the calibration DAC at this point represents the offset of the cal/normal switch. This value is used to compensate the calibration DAC for the attenuator and analog gain calibrations.

To calibrate the offset DAC, the attenuator is set to ground. The DAC is set to several values which cover its full range. An acquisition is made at each setting of the offset DAC. This builds a table relating percent of ADC full scale relative to offset DAC input. A curve fitting algorithm determines the coefficients for the resulting equation. These coefficients are saved as calibration constants.

Attenuator Ratio

To compensate for offset in the Cal/Normal switch, the input offset routine must be executed before calibrating the Attenuator. The attenuators are calibrated only during the EXTC procedure using external references. There are three attenuation ratios, /1, /10, and /100. For each ratio, an external reference voltage is applied (.2 V, 2 V, and 20 V respectively). Two acquisitions are made for each range. First the input signal is digitized, then a 0.2 V signal from the calibration DAC is substituted for the attenuator output. By comparing the digitized levels, the exact attenuation ratio for each range is determined. This ratio is retained as a calibration constant. When only an internal (self) calibration is being performed, the attenuation ratio constants stored in nonvolatile RAM from the last external calibration are used for the rest of the procedure.

Analog Gain

There are five Preamp gain ranges in each Preamp (*2.5, /1, /2, /5, and /10), and within each gain range there is a vernier analog gain range of X1 to X4.5. Calibration establishes several calibration constants for each gain range. During calibration, a known voltage from the calibration DAC is applied to the input of the pre-amp. Several acquisitions are made at each range, varying the vernier before each acquisition. By comparing calibration voltage to percentage of ADC full scale, the preamp gain can be determined. For each of the five gain ranges, a table is built relating preamp gain to vernier input. A curve fitting algorithm computes the coefficients for the equation that describes the relationship. These coefficients are stored as calibration constants.

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Trigger Level

The Analog Gain *must* be calibrated before calibrating the Trigger Level. The Internal Trigger Level can be set to any value within ±120% of full scale range. To calibrate Internal Trigger Level, the Cal/Normal switch is set to Calibrate. Several calibrated voltages are applied with the preamp set to a known gain. At each calibration voltage step, the trigger level DAC is set to slowly sweep its output voltage until a trigger occurs. A table is built relating trigger level DAC setting to percentage of full scale. This table is used to produce a segmented line that is averaged. The offset and gain terms of the equation describing the relationship are saved as calibration constants.

During external calibration, the EXTERNAL TRIGGER INPUT path is calibrated. A cable is connected between the CAL OUT connector and the EXTERNAL TRIGGER INPUT connector. The path is calibrated by the same method used for internal trigger level calibration, with the calibration DAC supplying known voltages to the External Trigger Input.

Sample Clock Duty Cycle

The VX5260 utilizes a clock rate doubler to generate the 5 ns and 15 ns sample intervals from the VXI backplane CLK100 clock. To maintain a consistent sample interval at these two sample rates, the duty cycle of the CLK100 is adjusted to 50 percent. In order to compensate for timing variables throughout the circuit, this calibration is performed by optimizing the distortion products of a digitized sine wave. This calibration step is optional. Performing it will optimize the effective bits when sampling at 5 ns/S and 15 ns/S. It has no effect on other sample rates. Because CLK100 is generated by the slot 0 module and buffered by the mainframe, this calibration should be performed in the same mainframe / slot 0 combination in which the module will be used.

A 211 MHz high purity sine wave is applied to the Channel 1 Input. The signal is undersampled at 200 MS/s producing an 11 MHz intermodulation product. The result from the acquisition are analyzed by routines stored in instrument firmware for distortion content. The process is repeated while small changes are made to programmable delay generators in the clock circuitry. The process is repeated until the minimum distortion results in the digitized waveform. The values which control the delay generator are stored as calibration constants.

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AC Confidence Check

The AC Confidence Check is primarily designed to check the overall amplitude error of the Preamp and A/D Converter after calibration; however, it can be executed on command at anytime. It is performed automatically whenever a **CAL?* or *CAL?* command is executed. It can be executed on command with the *CAL? ACCHK*, *CAL:CH1? ACCHK*, or *CAL:CH2 ACCHK* commands.

During the check, the Calibration DAC provides a low-frequency sine wave (approximately 1 kHz) to the input Preamp at the various Preamp gain ranges and Preamp analog gain steps, makes acquisitions, and measures the amplitude error of the digitized data. If the Amplitude Error is greater than specified in the A/D Electrical Specifications, an error code or error message (when the optional *ERRM* parameter is selected) is issued to the Slot 0 Module over the communications channel.

Error Codes and Error Messages

There are basically two type of calibration failures: 1) the function being calibrated cannot be calibrated within the range specified, or the AC Confidence Check failed. When a failure occurs, an error code (or error message if the optional *ERRM* parameter is selected) is returned to the Slot 0 Module through the communications channel. The error codes and messages are listed below.

Table 9-1. Calibration Error Codes

Error Code	Error Message
5000	Calibration DAC Calibration: Failed
5010	Channel 1 DC Balance Calibration: Failed
5020	Channel 1 Input Offset Calibration: Failed
5030	Channel 1 Preamp Analog Gain Calibration: Failed
5040	Trigger Level Calibration: Failed
5050	ET Timing Calibration: Failed
5080	Channel 1 Attenuator Calibration: Failed
5200	Channel 1 AC Confidence Check: Failed
6010	Channel 2 DC Balance Calibration: Failed
6020	Channel 2 Input Offset Calibration: Failed
6030	Channel 2 Preamp Analog Gain Calibration: Failed
6080	Channel 1 Attenuator Calibration: Failed
6200	Channel 2 AC Confidence Check: Failed

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Calibration Command Examples

A number of calibration command examples follow, along with the action they generate.

```
CAL?
```

This command internally calibrates all Channel 1 and Channel 2 functions and performs an AC Confidence Check. The resulting calibration constants will remain in effect until the next *CAL?* command is executed, the instrument is powered down, or the default settings are loaded from the ID-ROM with the *CAL? LOAD* command.

```
CAL:CH1? M
```

This command internally calibrates all Channel 1 functions and returns error messages instead of error codes.

```
CAL:CH1? ACCHK
```

This command performs an AC Confidence Check on Channel 1.

```
CAL:CH2? SAVE
```

This command internally calibrates Channel 2, and if the state is UNLOCKED, it saves the new calibration constants into the ID-ROM.

```
CAL? LOAD
```

This command reloads the calibration constants from ID-ROM to the instrument RAM.

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External Calibration Procedure

Description

The external calibration procedure uses a series of internal software routines stored in ROM in conjunction with external calibration signals. There are no mechanical adjustments to be made. Hence, the instrument can be calibrated without removing it from its mainframe. During calibration, all changes to the calibration constants are automatically made. Upon completion, the updated calibration constant will be stored into nonvolatile RAM (ID-ROM). Unauthorized access to the RAM is protected by a password lock.

Recommended Test Equipment

The requirements of the test instrumentation necessary for calibration are listed below. Recommended examples of specific equipment are given. The procedure is based on the use of the equipment recommended. Equipment substitution may require appropriate changes to the procedure.

VXI D SIZE MAINFRAME

The mainframe must provide the minimum power and cooling required by the VX5260. These requirements are listed in the specifications at the end of Section 1. Recommended Mainframe: Tektronix VX1500.

VXI SLOT 0 / INTERFACE DEVICE

A slot 0 / interface device or embedded VXI controller must support the VXI required P3 functions, particularly CLK100. A means of supporting interactive message based communication with the instrument is required. Recommended Embedded Controller: VX5530 with BusProbe software.

DC VOLTAGE CALIBRATOR

A stable DC voltage source capable of generating 0.2 V, 2 V, and 20 V. Minimum accuracy is 0.25%. Means of adapting output to a BNC cable is required. An adjustable power supply verified with a DMM is adequate. Recommended Calibrator: Tektronix PS 5004 with TM 5003 or TM 5006 mainframe.

SINE WAVE GENERATOR

Note

This instrument is only needed if 5 ns clock duty cycle is being calibrated. The generator must be capable of generating 211 MHz with 4 volt PP output into 50 ohms. Second harmonic content must be at less than –46 dBm. Output frequency must be set to 211 MHz within 900 kHz. Amplitude accuracy is not critical. A suitable RF generator set with a frequency counter is adequate.

Recommended Generator: Tektronix SG503 with suitable mainframe.

BNC CABLE

50 Ohm
Recommended: Tektronix 012-0482-00

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System Set-Up

Install the VX5530 controller into Slot 0 of the VXI mainframe. Connect the monitor, keyboard and mouse to the VX5530 controller. Install the VX5260 into any convenient mainframe slot. It is recommended that all other VXI modules be removed from the mainframe to prevent possible interference to this test procedure. Apply power to the VXI mainframe and the monitor and allow them to warm up.

Call the "BusProbe" utility, which is resident in the VX5530 controller. Refer to the VX5530/5535 Users Manual for a full description of the "BusProbe" utility.

This procedure assumes that it will be run in sequence from start to finish. Calibration steps build upon constants obtained in previous steps. Calibration accuracy can only be guaranteed if the entire procedure is performed in the order listed.

Before starting the Adjustment Procedure, it is strongly recommended that the VX5260 self-test be run first. Using the "BusProbe" utility, send the following command from the VX5530 to the VX5260:

```
TST?
```

This test will take approximately one minute. The expected response is **0**. Any another response indicates a failure was detected. If a failure is indicated, refer the VX5260 to a qualified service technician for repairs.

In order to perform the following calibration, the VX5260 must have the password state changed to UNLOCKED. To do this, enter the command:

PASSWORD <user password>

Where <user password> is the user supplied password. Refer to the *PASSWORD* command in Section 6 of this manual for more information. Each calibration step has both Setup and Command entries. If none is entered in the Setup description, then all cables and terminators should be removed from the VX5260 connectors. All commands in the Command description are sent to the VX5260 using BusProbe.

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Table 9-2. Calibration Step Setup and Command Entries

Test Name	Setup	Command
Calibration DAC	None	`CAL? INTC,CALD`
DC Balance DAC's	None	`CAL? INTC,DCB`
Offset DAC's	None	`CAL? INTC,OFFS`
Attenuators	Using the BNC cable, connect the output of the calibrator to Channel 1 input.	
	Set the calibrator to 200 mV.	`CAL:CH1? EXTC,ATTN,200`
	Set the calibrator to 2.0 V.	`CAL:CH1? EXTC,ATTN,2000`
	Set the calibrator to 20.0 V.	`CAL:CH1? EXTC,ATTN,20000`
	Move the cable from the calibrator to the Channel 2 input connector.	
	Set the calibrator to 200 mV.	`CAL:CH2? EXTC,ATTN,200`
	Set the calibrator to 2.0 V.	`CAL:CH2? EXTC,ATTN,2000`
	Set the calibrator to 20.0 V.	`CAL:CH2? EXTC,ATTN,20000`
Gain DAC	None	`CAL? INTC,GAIN`
Trigger DAC	None	`CAL? INTC,TRIG`
	Connect the BNC cable from the CAL OUT connector to the EXT CLOCK/TRIG 1 connector.	`CAL:CH1? EXTC,TRIG,1000`
	Move the BNC cable to the EXT CLOCK/TRIG 2 connector.	`CAL:CH2? EXTC,TRIG,1000`
5 ns Sample Clock Duty Cycle (optional)		

Note

This calibration will optimize the effective bits performance when a 5 ns or 15 ns sample interval is used. Other sample rates are not affected. The largest factor which influences this calibration is the duty cycle of the CLK100 signal which originates from the Slot 0 module. To realize the greatest benefit from this calibration, it should be performed with the VX5260 installed in the mainframe, with the slot 0 device that it will be normally used with. The VX5260 will meet all of its published specifications without performing this calibration step.

To calibrate the Sample Rate Duty Cycle, connect the sine wave generator to the Channel 1 input connector. Set the generator to output 211 MHz at 4 V PP, and enter the command:

```
CAL? EXTC,CKDB,0
```

This step takes about 75 seconds to complete.

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Saving the New Calibration Constants

After performing the above calibration, the new calibration constants are initially stored in volatile RAM. In order to store the new constants in nonvolatile ROM to retain them after power-down, it is necessary to issue a *SAVE* command. The *SAVE* command requires the correct password and is entered as:

```
CAL? SAVE,ALL
```

This completes the VX5260 Calibration procedure.

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Section 10
Performance Verification

Introduction

This procedure allows manual verification of key specifications of the VX5260 Waveform Digitizer. Upon successful completion of this procedure, the VX5260 can be used with confidence that its performance meets the specifications listed in Section 1 of this manual. If some part of this procedure fails to meet the limits described in this procedure, perform the Calibration Procedure described in Section 9 of this manual, and re-check with this procedure. If problems still exist, refer this product to a qualified service person for repairs.

The VX5260 ROMs must be version 1.2.2 or higher for this verification procedure to be valid. The ROM version can be checked by issuing the `ID?` query from the VXI controller. The number following the "V" in the response (i.e., V1.2.2) indicates the ROM version. If your ROM version is below 1.2.2, contact your Tektronix Sales Representative and request the free VX5260 Firmware Upgrade Kit.

Recommended Test Equipment

This Performance Verification procedure has been written incorporating the test equipment listed below. If it is necessary to substitute test equipment, it is the user's responsibility to ensure the equipment is adequate for the task and to make the necessary changes to the verification procedure.

Table 10-1 that follows lists the minimum requirements and recommended test equipment required for performance verification. The procedure is based on the use of the equipment listed. Equipment substitution may require appropriate changes to the procedure.

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Table 10-1. Recommended Test Equipment

Description	Qty.	Minimum Performance Requirements	Recommended	
			Manufacturer	Model/Part Number
VXI D-size Mainframe	1	Meets module power and cooling requirements. Refer to specifications in Section 1.	Tektronix	VX1500
VXI Slot 0 / Interface Device	1	Must support VXI word serial communication and provide an interactive "talker-listener" interface.	Tektronix	VX5530 with EPConnect Software
TM5000 Series Mainframe	1		Tektronix	TM 5006A
Calibration Generator	1	Precision square ware, 0.5% or better amplitude accuracy.	Tektronix	CG 5010 or CG 5011
Leveled Sine Wave Generator; SG 503 recommended	1	Frequency range 80–250 MHz with 50 kHz reference. Output ≥ 5 V into 50 Ω, Amplitude Flatness ≤ 3%.	Tektronix	SG 503
Low Frequency Oscillator	1	Frequency 30 kHz, Amplitude 240 mV into 50 Ω	Tektronix	SG 505
Oscilloscope	1	Vertical bandwidth, DC ≥ 200 MHz, Sweep speed 10 ns/div	Tektronix	2465B
AC voltage calibrator	1	Amplitude 1.4142 V, Amplitude accuracy 0.1%, Frequency 30 kHz	John Fluke	5200 A
BNC to Dual Male Banana adaptor	1		Tektronix	103-0090-00
BNC to BNC 50Ω Coaxial Cables	2		Tektronix	012-0482-00
50Ω feedthrough Termination	2		Tektronix	011-0049-01

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System Set-Up

Install the VX5530 controller into Slot 0 of the VXI mainframe. Connect the monitor, keyboard and mouse to the VX5530 controller. Install the VX5260 into any convenient mainframe slot. Make sure that the backplane jumpers are configured correctly. Refer to Section 2 for information on jumper configuration. It is recommended that all other VXI modules be removed from the mainframe to prevent possible interference to this test procedure. Apply power to the VXI mainframe and the monitor and allow them to warm up.

Install the CG 5010/5011 and the SG 503 into the TM5006 mainframe. Apply power to all calibration instruments and allow them to reach operating temperature.

Call the "BusProbe" utility, which is resident in the VX5530 controller. All performance verification commands to the VX5260 are sent from the VX5530 through this utility. Refer to the VX5530/VX5535 Users Manual for a full description of the "BusProbe" utility.

When performing a complete performance verification of the VX5260, it is recommended that all the following tests be performed in the order presented. However, since each test is self-contained, a partial performance verification can be accomplished by performing just the desired tests.

Preliminary Operations

Before starting the Performance Verification, it is strongly recommended that the VX5260 self-test be run first. Using the "BusProbe" utility, send the following command to the VX5260:

```
TST?
```

This test will take approximately one minute. The expected response is `0;`. Any other response indicates a failure was detected in the VX5260. If a failure is indicated, refer the VX5260 to a qualified service technician for repairs.

If desired, additional failure information can be obtained by sending the command:

```
STERR?
```

This information may be helpful in determining the nature of the failure.

Note

The specifications require that autocalibration be performed both within the past four weeks and within ± 5°C of the current ambient temperature. If these conditions are not met, perform a self-calibration procedure by entering the command:

```
CAL?
```


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1. DC Gain Accuracy

Test Description

In this test, low frequency (100 Hz) square waves of accurate amplitude are applied to channels 1 and 2 of the VX5260. Digitizer accuracy is verified by measuring the square wave amplitude using the pulse parameter function of the VX5260 to measure the top and bottom levels of the square wave. While accuracy can be verified at any full scale range, those chosen verify a point in each gain range in the instrument.

Test Procedure

1. Make sure the CG 5010/5011 OUTPUT is OFF. Connect the CG 5010/5011 Output Head to the CHANNEL 1 input of the VX5260.

2. Connect a 50Ω cable from the CG 5010/5011 TRIGGER OUTPUT to the EXT CLOCK/TRIG 1 input of the VX5260.

3. Set up the VX5260 by sending the following commands:

```
INIT INSTR
ATRIGGER:SOURCE EXT1
EXTTRIG:LEVEL 1,1.0
TMODE:HISTOGRAM MEAN
BMODE:HISTOGRAM MEAN
SAMPLE:INTERVAL 1E-5
WINDOW:STOP 1024
ACQUIRE:CHANNEL 2,OFF
```

4. Set up the CG 5010/5011 as follows, using the front panel controls:

AMPLITUDE MODE	VOLT
FREQ	100 Hz
UNITS/DIV	10 mV
NUMBER OF DIV	2
OUTPUT	ON
USE FOR 50Ω LOAD	OFF
TRIGGER	ON, NORMAL

5. Set the VX5260 range by sending the following command:

```
CHANNEL:RANGE 1,.045
```

These settings reflect the first line values shown in Table 10-2.1.

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Table 10-2.1: Channel 1 DC Gain Accuracy

CG 5010/5011		VX5260 Range	Measured Data		Calculated (Top - Base)	(Top-Base) Limits	
UNITS/DIV	NUMBER OF DIV		Top	Base		Lower	Upper
10mV	2	0.045				.0155	.0245
20mV	2	0.0916				.0350	.0450
50mV	2	0.220				.0935	.107
20mV	8	0.340				.152	.168
0.2V	2	0.85				.386	.414
0.2V	4	1.70				.776	.824
0.5V	3	3.20				1.46	1.54
1.0V	5	10.5				4.87	5.13
5.0V	2	21.0				9.75	10.3
5.0V	3	33.0				14.6	15.47
5.0V	8	85.0				39.0	41.0
10V	8	200.0				77.9	82.1

6. Acquire a waveform by sending the following command to the VX5260:

   ```
   START
   ```

7. Measure the top and base of the square wave by sending the following command to the VX5260:

   ```
   PLSMAG:TOP?;BASE?
   ```

   Record the returned values into the columns marked **Top** and **Base** in Table 10-2.1.

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8. Repeat steps 4 through 7 for each line in Table 10-2.1. For step 4, use the values shown in the table for the **UNITS/DIV** and **NUMBER OF DIV** values to be entered into the CG 5010/5011. For step 5, use the value shown in the table for the **VX5260 RANGE** value to be entered into the VX5260.

9. Set the CG 5010/5011 OUTPUT to OFF.

10. For each line in Table 10-2.1, subtract the **Base** reading from the **Top** reading and enter the result in the **Calculated (Top – Base)** column.

11. CHECK — that the **Calculated (Top – Base)** value falls within the **(Top-Base) Limits** shown on the corresponding line of Table 10-2.1.

12. Disconnect the CG 5010/5011 Output Head from the CHANNEL 1 input of the VX5260 and connect it to the CHANNEL 2 input.

13. Set the VX5260 to test CHANNEL 2 by sending these commands:

```
ACQUIRE:CHANNEL 1,OFF
ACQUIRE:CHANNEL 2,ON
WINDOW:LOC 2
```

Table 10-2.2: Channel 2 DC Gain Accuracy

CG 5010/5011		VX5260 Range	Measured Data		Calculated (Top – Base)	(Top-Base) Limits	
UNITS/DIV	NUMBER OF DIV		Top	Base		Lower	Upper
10mV	2	0.045				.0155	.0245
20mV	2	0.0916				.0350	.0450
50mV	2	0.220				.0935	.107
20mV	8	0.340				.152	.168
0.2V	2	0.85				.386	.414
0.2V	4	1.70				.776	.824
0.5V	3	3.20				1.46	1.54
1.0V	5	10.5				4.87	5.13
5.0V	2	21.0				9.75	10.3
5.0V	3	33.0				14.53	15.47
5.0V	8	85.0				39.0	41.0
10V	8	200.0				77.9	82.1

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14. Set the CG 5010/5011 to **NUMBER OF DIV: 2**, **UNITS/DIV: 10 mV** and set the **OUTPUT** to **ON.** Set the **VX5260 RANGE** to 45 mV by sending this command:

    ```
    CHANNEL:RANGE 2,.045
    ```

    These values represent the first line of Table 10-2.2.

15. Acquire a waveform by sending the following command to the VX5260:

    ```
    START
    ```

16. Measure the top and base of the square wave by sending the following command to the VX5260:

    ```
    PLSMAG:TOP?;BASE?
    ```

    Record the returned values into the columns marked **Top** and **Base** in Table 10-2.2.

17. Repeat steps 14 through 16 for each line in Table 10-2.2. For step 14, use the values shown in the table for the **UNITS/DIV** and **NUMBER OF DIV** values to be entered in the CG 5010/5011, and the **VX5260 RANGE** command.

18. For each line in Table 10-2.2, subtract the **Base** reading from the **Top** reading and enter the result in the **Calculated (Top – Base)** column.

19. CHECK — that the **Calculated (Top – Base)** value falls within the **(Top-Base) Limits** shown on the corresponding line of Table 10-2.2.

20. Turn the CG 5010/5011 OUTPUT to OFF. Remove all cables from the VX5260.

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2. Input Offset DC Accuracy

Test Description

In this test, the Input Offset is set near the limits of the input range. An acquisition is then made and the DC voltage is queried. The results are compared to the specification limits listed in the table.

Test Procedure

1. Connect a 50 ohm termination to the VX5260's CHANNEL 1 INPUT connector.

2. Set up the VX5260 by entering the following commands:

```
INIT INSTR
EXTMODE RECORD
SAMPLE:INTERVAL 1E-5
WINDOW:LOC 1
WINDOW:STOP 1024
ACQUIRE:CHANNEL 2,OFF
```

3. Set the VX5260 range to 2 volts and the input offset to –1 volt by entering these commands:

```
CHANNEL:RANGE 1,2;OFFSET 1,.96
```

   These represent the values in the first line of Table 10-3.1.

4. Make a single acquisition by entering the following two commands in succession:

```
CMDTRIG
START
```

5. Make a measurement of the acquired signal by entering the command:

```
PLSEXTEND:MEAN?
```

   Then query the VX5260 for both results.

6. CHECK — that the value falls within the limits of the column labeled **Test Limit** in Table 10-3.1

7. For each line in Table 10-3.1, repeat steps 3 through 6 substituting the VX5260 range and offset listed for step 3.

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Table 10-3.1. Input Offset DC Accuracy

VX5260		
OFFSET	**RANGE**	**TEST LIMIT**
.96	2	±0.022
.768	1.6	±0.018
.288	.6	±0.008
-.288	.6	±0.008
-.768	1.6	±0.018
-.96	2	±0.022

8. Move the 50 ohm termination to the VX5260 CHANNEL 2 INPUT connector.

9. Change the VX5260 settings as follows:

```
ACQUIRE:CHANNEL 1,OFF
ACQUIRE:CHANNEL 2,ON
WINDOW:LOC 2
```

10. Set the VX5260 range to 2 volts and the input offset to –1 volt by entering these commands:

```
CHANNEL:RANGE 2,2;OFFSET 2,.96
```

    These represent the values in the first line of Table 10-3.1.

11. Make a single acquisition by entering these two commands in succession:

```
CMDTRIG
START
```

12. Make a measurement of the acquired signal by entering the command:

```
PLSEXTEND:MEAN?
```

    Then query the VX5260 for both results.

13. CHECK — that the value falls within the limits of the column labeled **Test Limit** in Table 10-3.1.

14. For each line in Table 10-3.1, repeat steps 10 through 13 substituting the VX5260 range and offset listed for step 10.

15. Remove the 50 ohm termination from the VX5260.

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3. DC Zero Volt Shift

Description

In this test, the VX5260 inputs are grounded, and zero offset is programmed in. The pulse parameter function is then used to measure the deviation from 0.0 V for all the attenuator ranges.

Test Procedure

1. Set up the VX5260 by entering the following commands:

```
INIT INSTR
EXTMODE RECORD
SAMPLE:INTERVAL 1E-5
CHANNEL:COUPLING 1,GND
CHANNEL:COUPLING 2,GND
WINDOW:STOP 1024
ACQUIRE:CHANNEL 2,OFF
```

2. Set the VX5260 range to 40 mV by entering this command:

```
CHANNEL:RANGE 1,.04
```

   This setting reflects the first line value shown in Table 10-4.1.

3. Acquire a waveform by sending the following two commands:

```
CMDTRIG
START
```

4. Measure the DC level of the acquire waveform by sending the command:

```
PLSEXTEND:MEAN?
```

5. CHECK — that the returned value falls within the range shown in the **Test Limit** column of Table 10-4.1.

6. Repeat steps 2 through 5 for each of the lines in Table 10-4.1. For step 2, use the values shown in the **Range** column.

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Table 10-4.1: DC Zero Volt Shift

VX5260 Range	Test Limit
.04	±.0015
.0916	±.0021
.201	±.0034
.340	±.0051
.929	±.0121
1.59	±.0201
3.44	±.0423
9.56	±.1157
20.1	±.2422
36.1	±.4342
92.9	±1.116
150.0	±1.801
200.0	±2.401

7. To test channel 2 of the VX5260, send the following commands:

```
ACQUIRE:CHANNEL 1,OFF
ACQUIRE:CHANNEL 2,ON
WINDOW:LOC 2
WINDOW:STOP 1024
```

8. Set the VX5260 range by sending this command:

```
CHANNEL:RANGE 2,.04
```

   This setting reflects the first line value shown in Table 10-4.1.

9. Acquire a waveform by sending the following commands:

```
CMDTRIG
START
```

10. Measure the DC level of the acquired waveform by sending this command:

```
PLSEXTEND:MEAN?
```

11. CHECK — that the returned value falls within the range shown in the **Test Limit** column of Table 10-4.1.

12. Repeat steps 8 through 11 for each of the lines in Table 10-4.1. For step 8, use the values shown in the **Range** column.

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4. Frequency Response

Description

Both the full bandwidth and bandwidth limit frequency responses are checked in these tests. For both tests, a reference amplitude reading at 50 kHz is taken, then the SG 503 is adjusted to the test frequency and another amplitude reading is taken. The ratio of the two readings is calculated, and verified to be greater than 0.707. This process is repeated for all tested attenuator ranges of the VX5260. The 250 MHz signal will alias the 200 MS/s sample rate. The result will appear as a 50 MHz difference frequency. Sufficient sample window is chosen to allow accurate amplitude measurements of the undersampled waveform.

Full Bandwidth Test Procedure

This procedure will test for all ranges up to 10 volts. Testing ranges above 10 volts requires a signal generator with higher output amplitude. Input signals greater than 14 V p-p (5 Vrms) will trip the input overload protection. If the higher input ranges are going to be tested with higher amplitude generators, external termination must be used.

1. Set up the VX5260 by sending the following commands:

```
INIT INSTR
TMODE:HISTOGRAM MEAN
BMODE:HISTOGRAM MEAN
CHANNEL:TERM 1,50
CHANNEL:TERM 2,50
WINDOW:STOP 4096
ACQUIRE:MODE SINGLE,4096
ACQUIRE:CHANNEL 2,OFF
```

2. Set the SG 503 to 0.030 V output by dialing the AMPLITUDE control to 3.0 and the multiplier to X.01. Connect a precision 50 ohm BNC cable (Tektronix P/N 012-0482-00 from the output of the SG 503 to the CHANNEL 1 Input connector.

3. Set the VX5260 to 40 mV full scale by entering the commands:

```
CHANNEL:RANGE 1,.04
SAMPLE:INTERVAL 2E-8
```

4. Set the SG 503 frequency range to REF (50 kHz).

5. Acquire a waveform by sending the VX5260 this command:

```
START
```


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6. Query the amplitude measurement from the VX5260 by sending this command:

   ```
   PLSMAG:PK2PK?
   ```

   Record the value that was returned in the column marked **PK2PK Reading 50 kHz** of Table 10-5.1.

7. Change the frequency range of the SG 503 to the 100 – 250 band. If necessary, adjust the Frequency Variable control for a reading of 250 in the display. Be careful not to disturb the Amplitude controls while making this adjustment.

8. Change the sample interval in the VX5260 by entering this command:

   ```
   SAMPLE:INTERVAL 5E-9
   ```

9. Acquire the 250 MHz waveform by entering this command:

   ```
   START
   ```

10. Obtain the amplitude measurement from the VX5260 by entering the command:

    ```
    PLSMAG:PK2PK?
    ```

    Record the value returned in the column marked **PK2PK Reading 250 MHz** in Table 10-5.1.

Table 10-5.1: Channel 1 Full Bandwidth

VX5260 Range	SG 503A		PK2PK Reading		PK2PK Ratio 250Rdg/50 Rdg	Test Limit
	Output Amplitude	Amplitude Multiplier	50 kHz	250 MHz		
.04	3.0	X.01				≥0.707
.0916	0.7	X.1				≥0.707
.201	1.5	X.1				≥0.707
.340	2.6	X.1				≥0.707
.929	0.7	X1				≥0.707
1.59	1.2	X1				≥0.707
3.44	2.6	X1				≥0.707
9.56	5.5	X1				≥0.707

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11. Repeat steps 2 through 10 for each line of Table 10-5.1, setting the Output Amplitude and Amplitude Multiplier as indicated.

12. For each line in Table 10-5.1, divide the **PK2PK 250 MHz** reading by the **PK2PK 50 kHz** reading and enter the result in the **PK2PK Ratio** column.

13. CHECK — to see that the **PK2PK Ratio** value is greater than 0.707 (–3 dB).

14. Return the SG 503 output amplitude to 30 mV by setting the Output Amplitude to 3.0 and the Amplitude Multiplier to X.01.

15. Move the output cable from the VX5260 CHANNEL 1 Input connector to the CHANNEL 2 connector.

16. Set the VX5260 to test CHANNEL 2 by entering these commands:

```
ACQUIRE:CHANNEL 1,OFF
ACQUIRE:CHANNEL 2,ON
ATRIGGER:SOURCE CH2
WINDOW:LOC 2
WINDOW:STOP 4096
```

17. Set the VX5260 range and sample interval by entering these commands:

```
CHANNEL:RANGE 2,.04
SAMPLE:INTERVAL 2E-8
```

18. Repeat step 17 followed by steps 4 through 10, entering the measurement values in Table 10-5.2 instead of Table 10-5.1.

19. Calculate the ratios and perform the tests indicated in steps 12 and 13 on the results entered in Table 10-5.2.

Table 10-5.2: Channel 2 Full Bandwidth

VX5260 Range	SG 503A		PK2PK Reading		PK2PK Ratio 250Rdg/50 Rdg	Test Limit
	Output Amplitude	Amplitude Multiplier	50 kHz	250 MHz		
.04	3.0	X.01				≥0.707
.0916	0.7	X.1				≥0.707
.201	1.5	X.1				≥0.707
.340	2.6	X.1				≥0.707
.929	0.7	X1				≥0.707
1.59	1.2	X1				≥0.707
3.44	2.6	X1				≥0.707
9.56	5.5	X1				≥0.707

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Bandwidth Limit Test Procedure

This procedure will spot test some attenuator ranges. If desired, the procedure can be used on any range up to 10 Volts. Testing ranges above 10 volts require a signal generator with higher output amplitude. Input signals greater than 14 V p-p (5 Vrms) will trip the input overload protection. If the higher input ranges are going to be tested with higher amplitude generators, external termination must be used.

1. Set up the VX5260 by sending these commands:

```
INIT INSTR
TMODE:HISTOGRAM MEAN
BMODE:HISTOGRAM MEAN
CHANNEL:TERM 1,50
CHANNEL:TERM 2,50
CHANNEL:BWLIMIT HUNDRED
WINDOW:STOP 4096
ACQUIRE:MODE SINGLE,4096
ACQUIRE:CHANNEL 2,OFF
```

2. Set the SG 503 to 0.030 V output by dialing the AMPLITUDE control to 3.0 and the multiplier to X.01. Connect a precision 50 ohm BNC cable (Tektronix P/N 012-0482-00 from the output of the SG 503 to the CHANNEL 1 Input connector.

3. Set the VX5260 range and sample interval by entering these commands:

```
CHANNEL:RANGE 1,.04
SAMPLE:INTERVAL 2E-8
```

4. Set the SG 503 frequency range to REF (50 kHz).

5. Acquire a waveform by sending the VX5260 the command:

```
START
```

6. Perform an amplitude measurement by sending this command to the VX5260:

```
PLSMAG:PK2PK?
```

   Record the value that was returned in the column marked **PK2PK Reading 50 kHz** of Table 10-5.3.

7. Set the SG 503 TO 95 MHz:

8. Change the VX5260 sample interval by sending this command:

```
SAMPLE:INTERVAL 5E-9
```

9. Acquire a waveform by sending the following command to the VX5260:

```
START
```


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10. Perform an amplitude measurement by sending this command to the VX5260:

    ```
    PLSMAG:PK2PK?
    ```

    Record the value that was returned in the column marked **PK2PK Reading 95 MHz** of Table 10-5.3.

11. Change the SG 503 to 144 MHz.

12. Acquire a waveform by sending the following command to the VX5260:

    ```
    START
    ```

13. Perform an amplitude measurement by sending the following command to the VX5260:

    ```
    PLSMAG:PK2PK?
    ```

    Record the value that was returned in the column marked **PK2PK Reading 144 MHz** of Table 10-5.3.

Table 10-5.3: Channel 1 Bandwidth Limit

VX5260 Range	SG 503A		PK2PK Reading			PK2PK Ratio 95Rdg/50Rdg (limit ≥0.707)	PK2PK Ratio 144Rdg/50Rdg (limit ≤0.707)
	Output Amplitude	Amplitude Multiplier	50 kHz	95 MHz	144 MHz		
.04	3.0	X.01					
1.59	1.2	X1					
9.56	5.5	X1					

14. Repeat steps 3 through 13 for each line of Table 10-5.3. For step 3, use the values shown in the table for the Range value to be entered into the VX5260. For step 4, use the values shown in the table for the amplitude value to be entered into the SG 503.

15. For each line of Table 10-5.3, divide the **PK2PK 95 MHz** value by the **PK2PK 50 kHz** value and enter the result into the column marked **PK2PK Ratio 95Rdg/50Rdg**.

16. CHECK — to ensure that the **PK2PK Ratio 95Rdg/50Rdg** value is greater than 0.707.

17. For each line of Table 10-5.3, divide the **PK2PK 144 MHz** value by the **PK2PK 50 kHz** value and enter the result into the column marked **PK2PK Ratio 144Rdg/50Rdg**.

18. CHECK — to be sure the **PK2PK Ratio 144Rdg/50Rdg** value is less than 0.707.

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19. Return the SG 503 output amplitude to 30 mV. Move the output cable from the CHANNEL 1 connector to the CHANNEL 2 connector.

20. To test channel 2 of the VX5260, send the following commands:

```
ACQUIRE:CHANNEL 1,OFF
ACQUIRE:CHANNEL 2,ON
ATRIGGER:SOURCE CH2
WINDOW:LOC 2
WINDOW:STOP 4096
```

21. Set the VX5260 range and sample interval by sending these commands:

```
CHANNEL:RANGE 2,.04
SAMPLE:INTERVAL 2E-8
```

22. Repeat step 22 followed by steps 4 through 20, entering the measurement values into Table 10-5.4 instead of Table 10-5.3. Continue until all the lines in Table 10-5.4 are completed.

Table 10-5.4: Channel 2 Bandwidth Limit

VX5260 Range	SG 503A		PK2PK Reading			PK2PK Ratio 95Rdg/50Rdg (limit ≥0.707)	PK2PK Ratio 144Rdg/50Rdg (limit ≤0.707)
	Output Amplitude	Amplitude Multiplier	50 kHz	95 MHz	144 MHz		
.04	3.0	X.01					
1.59	1.2	X1					
9.56	5.5	X1					

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5. Interchannel Crosstalk

Description

A sine wave signal is applied to one channel of the VX5260. The other channel remains unconnected. A waveform from the unconnected channel is acquired to check for evidence of signal crosstalk from the first channel.

Test Procedure

1. Set up the VX5260 by sending the following commands:

```
INIT INSTR
SAMPLE:INTERVAL 5E-9
CHANNEL:TERM 1,50
CHANNEL:TERM 2,50
CHANNEL:RANGE 1,4
CHANNEL:RANGE 2,.05
WINDOW:LOC 2
WINDOW:START 1
WINDOW:STOP 4096
CHANNEL:COUPLING 2,GND
```

2. Set the SG 503 to 4.0 V output by dialing the AMPLITUDE control to 4.0 and the multiplier to X1. Set the output frequency to 250 MHz.

3. Connect a precision 50 ohm BNC cable (Tektronix P/N 012-0482-00) from the output of the SG 503 to the CHANNEL 1 Input connector.

4. Acquire a waveform by sending this command to the VX5260:

```
START
```

5. Obtain the amplitude of the signal on channel 2 by entering the command:

```
PLSMAG:PK2PK?
```

6. CHECK — to see if the PK2PK value is less than 4.000E-02.

7. Change the SG 503 output frequency to 100 MHz.

8. Repeat steps 4 and 5.

9. CHECK — The PK2PK value is less than 1.265E-02.

10. Return the SG 503 frequency to 250 MHz. Move the output cable from the VX5260 CHANNEL 1 connector to CHANNEL 2 Input.

11. To test CHANNEL 2 of the VX5260, send the following commands:

```
WINDOW:LOC 1
WINDOW:STOP 4096
ATRIGGER:SOURCE CH2
CHANNEL:RANGE 1,.05
CHANNEL:RANGE 2,4
CHANNEL:COUPLING 1,GND
CHANNEL:COUPLING 2,DC
```


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12. Repeat steps 4 through 9.

13. Disconnect all cables from the VX5260.

6. Internal Trigger Sensitivity

Description

A sine wave signal is applied to the input of the VX5260. The TRIG OUT signal from the VX5260 is viewed on an oscilloscope. VX5260 triggering stability can then be determined by watching for a stable oscilloscope display.

Test Procedure

1. Set up the VX5260 by sending the following commands:

```
INIT INSTR
CHANNEL:TERM 1,50
CHANNEL:RANGE 1,1.0
ACQUIRE:CHANNEL 2,OFF
ENVELOPE:MODE GEN;MAXWFM CONT
ATRIGGER:EXPORT:SOURCE TRIGL
```

2. Connect one end of a precision 50Ω cable (Tektronix 012-0482-00) to the output of the SG 503. Connect the other end, through a 50Ω terminator into the oscilloscope input. (If the oscillocope has a 50Ω input, do not use the terminator.)

3. Set the oscilloscope to:

Vertical	20 mV/Div
Time Base	50 µs/Div
Trigger Source	Int
Trigger Level	0 V
Trigger Coupling	DC
Trigger Mode	Normal

4. Set the SG 503 to output 50 kHz REF, 1.2 X.1 V.

5. Using the vertical position control on the oscilloscope, line up the display to measure it accurately. Record the exact number and fraction of divisions of displayed amplitude.

6. Move the output cable from the SG 503 to the output of the low frequency oscillator (SG 505).

7. Adjust the SG 505 to output a 30 kHz sine wave. Adjust the SG 505 attenuators and output variable for a waveform display with exactly the same number of divisions as recorded in step 6. Be careful not to change the amplitude for the remainder of the procedure.

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8. Set the oscilloscope to:

Vertical	1 V/Div
Time Base	50 µs/Div
Trigger Level	+1.5 V

9. Move the cable from the input of the oscilloscope to the VX5260 CHANNEL 1 Input connector. Move the other end of the cable from the SG 505 to the SG 503 Output. Keep the terminator (if used) on the input of the oscilloscope. Connect a second BNC cable from the VX5260 TRIG OUT connector to the 50Ω terminated oscilloscope input.

10. Set the SG 503 to output 100 MHz, 1.0 X1 Volt Amplitude.

11. Start the VX5260 acquisition by sending the command:

```
START
```

12. Adjust the oscilloscope external trigger level for a stable display. This is best done by finding the two points where triggering becomes unstable and returning the level to a position in the middle of these points. When triggered properly, there should be a clean positive pulse approximately 45 µs wide. The second pulse will appear to have jitter. This is caused by the variable amount of re-arm time due to internal software processing.

13. Set the amplitude of the SG 503 to 120 mV (1.2 X.1).

14. Send the following commands to the VX5260:

```
STOP
ATRIGGER:COUPLING DC
START
```

These settings reflect the first line values shown in Table 10-6.1.

15. CHECK — A pulse from the TRIG OUT connector is displayed on the oscilloscope.

Note

One pulse is generated with every TRIGGERED acquisition. The time between pulses results from internal firmware waveform processing between digitizer re-arm. Because the amount of processing varies, it is normal for the pulse train to have jitter. This does not indicate unstable triggering.

16. Send the following command to the VX5260:

```
STOP
```

17. Repeat steps 13 through 16, using the VX5260 settings shown in Table 10-6.1.

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18. To test the B trigger, enter the command:

```
ATRIGGER:ABSELECT B
```

19. Reconnect the generator cable to the SG 503.

20. Set the output of the SG 503 to 1.2 X.1 V.

21. Enter the commands:

```
BTRIGGER:COUPLING DC
START
```

This represents the first line in Table 10-6.1.

Table 10-6.1: Internal Trigger Sensitivity

VX5260 Settings	Sine Wave Generator Settings	
Trigger Coupling	Frequency	Amplitude
DC	100 MHz	1.2 X.1
	250 MHz	2.0 X.1
AC	60 MHz	1.2 X.1
	100 MHz	1.2 X.1
	250 MHz	2.0 X.1
LFREJECT	80 MHz	1.2 X.1
	100 MHz	1.2 X.1
	250 MHz	2.0 X.1
DCNREJECT	100 MHz	1.2 X.1
	250 MHz	2.0 X.1
ACNREJECT	100 MHz	1.2 X.1
	200 MHz	2.0 X.1
HFREJECT	30 kHz (SG 505)	1.2 X.1
ACHFREJECT	30 kHz (SG 505)	1.2 X.1

22. CHECK — A pulse from the TRIG OUT connector is displayed on the oscilloscope.

23. Enter the command:

```
STOP
```

24. Repeat steps 20 through 23 using the values in Table 10-6.1.

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7. Internal Trigger Level Accuracy

Description

In this test, a low frequency sine wave is acquired using internal triggering. The level of the first sample point acquired represents the triggering level. The actual value returned from the VX5260 is scaled from 0 to 255, with 0 representing the bottom of the display and 255 representing the top, and 128 being the center line. Therefore, symmetrical positive and negative trigger slopes will not return symmetrical values, but will return values centered around 128.

Test Procedure

1. Set up the VX5260 by sending the following commands:

```
INIT INSTR
ACQUIRE:CHANNEL 2,OFF
SAMPLE:INTERVAL 1E-6
DATA:ENCDG ASCII
DATA:COUNT 1
```

2. Set the AC Calibrator to output 1.4142 Vrms (4.0 V p-p) at 100 Hz.

3. Using the male banana of BNC adaptor and a BNC cable, connect the output of the calibrator to the VX5260 CHANNEL 1 input connector.

4. Send the following commands to the VX5260:

```
CHANNEL:RANGE 1,4
ATRIGGER:LEVEL 1.414
START
STOP
CURVE?
```

5. CHECK — The returned value falls within the limits of 210 – 227.

6. Send the following commands to the VX5260:

```
ATRIGGER:LEVEL -1.414
START
STOP
CURVE?
```

7. CHECK — The returned value falls within the limits of 29 – 46.

8. To check the accuracy with Noise Reject on, enter the following commands:

```
ATRIGGER:COUPLING DCNREJECT
START
STOP
CURVE?
```

9. CHECK — The returned value falls within the limits of 14 – 61.

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10. Send the following commands to the VX5260:

```
ATRIGGER:LEVEL 1.414
START
STOP
CURVE?
```

11. CHECK — The returned value falls within the limits of 195 – 242.

12. To check the B Trigger, send the following commands to the VX5260:

```
ATRIGGER:ABSELECT B
BTRIGGER:LEVEL 1.414
START
STOP
CURVE?
```

13. CHECK — The returned value falls within the limits of 210 – 227.

14. Send the following commands to the VX5260:

```
BTRIGGER:LEVEL -1.414
START
STOP
CURVE?
```

15. CHECK — The returned value falls within the limits of 29 – 46.

16. To check the accuracy with Noise Reject on, enter the following commands:

```
BTRIGGER:COUPLING DCNREJECT
START
STOP
CURVE?
```

17. CHECK — The returned value falls within the limits of 14 – 61.

18. Send the following commands to the VX5260:

```
BTRIGGER:LEVEL 1.414
START
STOP
CURVE?
```

19. CHECK — The returned value falls within the limits of 195 – 242.

20. Remove all cables from the VX5260.

This completes the VX5260 Performance Verification.

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Appendix A
ASCII/GPIB Code Chart

B7 B6 B5 / BITS / B4 B3 B2 B1	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
	CONTROL		NUMBERS SYMBOLS		UPPER CASE		LOWER CASE	
0 0 0 0	0 NUL 0	20 DLE 16	40 SP 32	60 0 48	100 @ 64	120 P 80	140 ` 96	160 p 112
0 0 0 1	1 GTL SOH 1	21 LLO DC1 17	41 ! 33	61 1 49	101 A 65	121 Q 81	141 a 97	161 q 113
0 0 1 0	2 STX 2	22 DC2 18	42 " 34	62 2 50	102 B 66	122 R 82	142 b 98	162 r 114
0 0 1 1	3 ETX 3	23 DC3 19	43 # 35	63 3 51	103 C 67	123 S 83	143 c 99	163 s 115
0 1 0 0	4 SDC EOT 4	24 DCL DC4 20	44 $ 36	64 4 52	104 D 68	124 T 84	144 d 100	164 t 116
0 1 0 1	5 PPC ENQ 5	25 PPU NAK 21	45 % 37	65 5 53	105 E 69	125 U 85	145 e 101	165 u 117
0 1 1 0	6 ACK 6	26 SYN 22	46 & 38	66 6 54	106 F 70	126 V 86	146 f 102	166 v 118
0 1 1 1	7 BEL 7	27 ETB 23	47 ' 39	67 7 55	107 G 71	127 W 87	147 g 103	167 w 119
1 0 0 0	10 GET BS 8	30 SPE CAN 24	50 (40	70 8 56	110 H 72	130 X 88	150 h 104	170 x 120
1 0 0 1	11 TCT HT 9	31 SPD EM 25	51) 41	71 9 57	111 I 73	131 Y 89	151 i 105	171 y 121
1 0 1 0	12 LF A 10	32 SUB 1A 26	52 * 42	72 : 3A 58	112 J 74	132 Z 90	152 j 106	172 z 122
1 0 1 1	13 VT B 11	33 ESC 1B 27	53 + 43	73 ; 3B 59	113 K 75	133 [91	153 k 107	173 { 123
1 1 0 0	14 FF C 12	34 FS 1C 28	54 , 44	74 < 3C 60	114 L 76	134 \ 92	154 l 108	174 | 124
1 1 0 1	15 CR D 13	35 GS 1D 29	55 - 45	75 = 3D 61	115 M 77	135] 93	155 m 109	175 } 125
1 1 1 0	16 SO E 14	36 RS 1E 30	56 . 46	76 > 3E 62	116 N 78	136 ^ 94	156 n 110	176 ~ 126
1 1 1 1	17 SI F 15	37 US 1F 31	57 / 2F 47	77 UNL ? 3F 63	117 O 4F 79	137 UNT _ 5F 95	157 o 6F 111	177 DEL (RUBOUT) 7F 127
	ADDRESSED COMMANDS	UNIVERSAL COMMANDS	LISTEN ADDRESSES		TALK ADDRESSES		SECONDARY ADDRESSES OR COMMANDS (PPE)	(PPD)

KEY

octal	25 PPU	GPIB code
	NAK	ASCII character
hex	15 21	decimal

Tektronix
COMMITTED TO EXCELLENCE

REF: ANSI STD X3. 4-1977
IEEE STD 488-1978
ISO STD 646-1973

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Appendix B
VXIbus GLOSSARY

Note

This glossary contains terms that are defined according to their use in the VXIbus System.

ACCESSED Indicator

An amber LED indicator that illuminates when the module identity is selected by the Resource Manager module, and flashes during any I/O operation for the module.

ACFAIL*

A VXIbus backplane line asserted under these conditions: 1) by the Mainframe Power Supply when a power failure has occurred (either ac line source or power supply malfunction) or 2) by the front panel ON/STANDBY switch when it is switched to STANDBY.

A-Size Card

A VXIbus instrument module 100.0 x 160 x 20.32 mm (3.9 x 6.3 x 0.8"); it is the same size as a VMEbus single-high, short module.

Asynchronous Communication

Communications occurring outside the normal "command-response" cycle. Such communications may have a higher priority than synchronous communication.

Backplane

The printed circuit board mounted in a VXIbus Mainframe to provide the interface between VXIbus modules, and between the Mainframe power supplies and the modules.

B-Size Card

A VXIbus instrument module 233.4 x 160 x 20.32 mm (9.2 x 6.3 x 0.8"); it is the same size as a VMEbus double-high, short module.

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Bus Arbitration

In the VMEbus interface, a system for resolving contention for service among VMEbus Master devices on the VMEbus.

Bus Timer

A functional module that measures the duration of each data transfer on the Data Transfer Bus (DTB) and terminates the DTB cycle if the duration is excessive. Without the termination capability of this module, a Bus Master attempt to transfer data to or from a non-existent Slave location could result in an infinitely long wait for the Slave response.

Client

In shared memory protocol (SMP), that half of an SMP channel that does not control the shared memory buffers.

CLK10

A 10 MHz, individually buffered, differential ECL system clock sourced from Slot 0 and distributed to each slot (1-12) through P2. It is distributed to each module as a single source, single destination signal with a matched delay of under eight (8) nanoseconds total.

CLK100

A 100 MHz, individually buffered, differential ECL system clock sourced from Slot 0 and distributed to each slot (1-12) through P3. It is synchronized to CLK10 and distributed to each module as a single source, single destination signal with a maximum timing skew of two (2) nanoseconds, and a matched delay of under eight (8) nanoseconds total.

Commander

A device that controls another device (a servant). A commander may be a servant of another commander.

Command

Any communication from a commander to a message based servant, consisting of a write to the servant's Data Low register, possibly preceded by a write to the data register.

Communication Registers

A set of device registers accessible to the commander of the device. Such registers are used for inter-device communications, and are required on all VXIbus message-based devices.

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Configuration Registers

A set of registers allowing the system to identify a (module) device type, model, manufacturer, address space, and memory requirements. In order to support automatic system and memory configuration, the VXIbus Specification requires all VXIbus devices to have a set of such registers, all accessible from P1 on the VXIbus.

C-Size Card

A VXIbus instrument module 340.0 x 233.4 x 30.48 mm (13.4 x 9.2 x 1.2").

Data Transfer Bus

One of four buses on the VMEbus backplane. The Data Transfer Bus allows Bus Masters to direct the transfer of binary data between Masters and Slaves.

DC FAIL Indicator

A red LED indicator that illuminates when a power fault is detected on the backplane.

Device Specific Protocol

A protocol for communication with a device not defined in the VXIbus specification.

D-Size Card

A VXIbus instrument module 340.0 x 366.7 x 30.48 mm (13.4 x 14.4 x 1.2").

DTB

See Data Transfer Bus.

DTB Arbiter

A functional module accepting bus requests from Requester modules and granting control of the DTB to one Requester at a time.

DUT

Device Under Test.

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ECLTRG

Six single-ended ECL trigger lines (two on P2 and four on P3) functioning as inter-module timing resources, and bussed across the VXIbus subsystem backplane. Any module, including the Slot 0 module, may drive and receive information from these lines. These lines have an impedance of 50 Ω (they are terminated by 50 Ω at each end of the backplane); the asserted state is logical High.

Embedded Address

An address in a communications protocol in which the destination of the message is included in the message.

ESTST

Extended STart/STop protocol; used to synchronize VXIbus modules.

Extended Device

A device that has VXIbus configuration registers and a subclass register. This category of device is intended to allow for definition of additional device types.

Extended Self Test

Any self test or diagnostic power-up routine executing after the initial kernel self-test program.

External System Controller

The host computer or other external controller exerting overall control over VXIbus operations.

FAILED Indicator

A red LED indicator that illuminates when a device on the VXIbus has detected an internal fault. This might result in the assertion of the SYSFAIL* line.

IACK Daisy Chain Driver

The circuit that drives the VXIbus Interrupt Acknowledge daisy chain line running continuously through all installed modules or through jumpers across the backplane.

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ID-ROM

An NVRAM storage area that provides for non-volatile storage of various module attributes, such as device name, serial number, error codes, and calibration data, and so on.

Instrument Module

A plug-in printed circuit board, with associated components and shields, that may be installed in a VXIbus mainframe. An instrument module may contain more than one logical device, and/or may occupy more than one mainframe slot.

Interface Device

A VXIbus device providing an interface to external equipment.

Interrupt Handler

A functional module detecting interrupt requests generated by Interrupters and responds to those requests by requesting status and identity information.

Interrupter

A device capable of asserting VMEbus interrupts and performing the interrupt acknowledge sequence.

IRQ

(Interrupt ReQuest) A VXIbus interrupt line that is asserted by an Interrupter to signify to the controller that a device on the bus requires service by the controller.

Local Bus

A daisy-chained bus connecting adjacent VXIbus slots.

Local Controller

The instrument module that performs system control and external interface functions for the instrument modules in a VXIbus Mainframe or several Mainframes. See Resource Manager.

Local Processor

The processor on an instrument module.

Logical Address

An 8-bit number that uniquely identifies each VXIbus Device in a system. It defines a device's A16 register address, and indicates Commander/Servant relationships.

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Mainframe

A rigid framework providing mechanical support for modules inserted into a VXIbus backplane. It ensures connectors mate properly, adjacent modules do not contact each other, and that modules do not disengage from the backplane due to vibration or shock. It also may provide mechanical support and housing for power supplies and their distribution wiring to the backplane.

Memory Device

A storage element (such as bubble memory, RAM, and ROM) that has configuration registers and memory attributes (such as type and access time).

Message

A series of data bytes treated as a single communication element, with a well defined message body and terminator.

Message Based Device

A VXIbus device supporting VXI configuration and communication registers. Such devices support the word serial protocol, and possibly other message-based protocols.

MODID Lines

Module/system identity lines.

Physical Address

The address assigned to a backplane slot during an access.

Power Monitor

A device that monitors backplane power and reports fault conditions.

P1

The top-most backplane connector for a given module slot in a vertical Mainframe such as the Tektronix VX1500. The left-most backplane connector for a given slot in a horizontal Mainframe.

P2

The middle backplane connector for a given slot in a Mainframe.

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P3

The bottom backplane connector for a given module slot in a vertical Mainframe such as the Tektronix VX1500. The right-most backplane connector for a given slot in a horizontal Mainframe.

Query

A form of command allowing for inquiry to obtain status or data.

READY Indicator

A green LED indicator that illuminates when the power-up diagnostic routines have been completed successfully. An internal failure or failure of +5-volt power will extinguish this indicator.

Register Based Device

A VXIbus device supporting VXI register maps, but not high level VXIbus communication protocols.

Requester

A functional module residing on the same module as a Master or Interrupt Handler and requesting use of the DTB whenever its Master or Interrupt Handler requires it.

Resource Manager

A VXIbus device providing configuration management services such as address map configuration, determining system hierarchy, allocating shared system resources, performing system self-test diagnostics, and initializing system commanders.

Self Calibration

A routine verifying the basic calibration of the instrument module circuits, and adjusting this calibration to compensate for variables such as temperature, power supply variations, and line losses..

Self Test

A set of routines that test the operational functionality of the instrument module. These routines are performed on power-up, and on command.

Servant

A device controlled by a Commander. There are message-based and register-based servants.

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Server

A shared memory device that controls the shared memory buffers used in a given Shared Memory Protocol (SMP) channel.

Shared Memory Protocol

A communications protocol that uses a block of memory that is accessible to both client and server. The memory block operates as a message buffer for communications.

Slot O Controller

See Slot 0 Module. Also see Resource Manager.

Slot O Module

A VXIbus device providing the minimum VXIbus slot 0 services to slots 1 -12 (CLK10 and the MODID module identity lines). This device may provide other VXIbus services such as CLK100, SYNC100, STARBUS, and trigger control.

SMP

See Shared Memory Protocol.

STARX

Two bidirectional 50 Ω ECL lines used differentially to provide inter-module asynchronous communication. These pairs of time-delay matched lines connect Slot 0 to each of Slots 1 -12 in a Mainframe. These lines have a well matched timing skew and less than five (5) nanoseconds of total timing delay.

STARY

Two bidirectional 50 Ω ECL lines used differentially to provide inter-module asynchronous communication. These pairs of time-delay matched lines connect Slot 0 to each of Slots 1 -12 in a Mainframe. These lines have a well matched timing skew and less than five (5) nanoseconds of total timing delay.

STST

STart/STop protocol; used to synchronize modules.

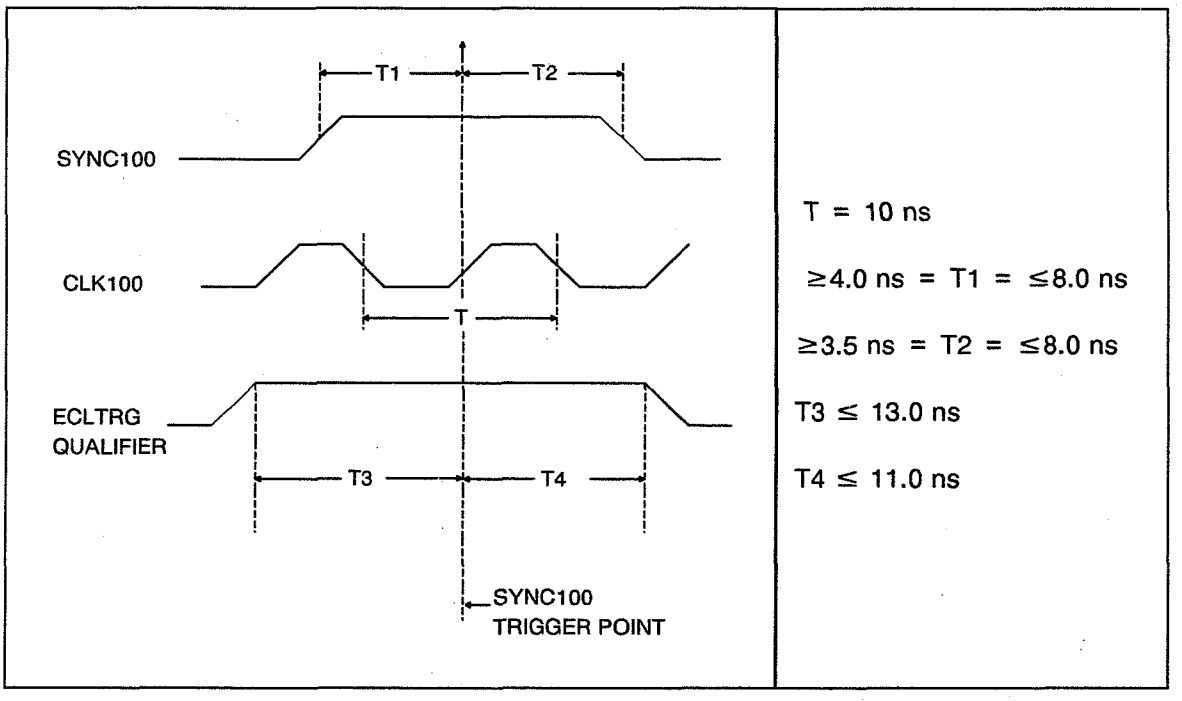
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SYNC100

SYNC100 is a Slot 0 signal used to synchronize multiple VXI devices with respect to a given rising edge of CLK100. The signal distributed to the devices is individually buffered to each slot, and is matched to less than 2 ns of skew between slots.

SYNC100 Trigger Protocol

SYNC100 trigger is a Tektronix designed protocol allowing multiple devices to receive a trigger on the same edge of the 100 MHz System Clock (CLK100). It utilizes the VXI SYNC100 signal to select the particular clock edge and an ECLTRG line as a qualifier to allow multiple groups of modules within the same Mainframe to participate in SYNC100 protocol. See timing diagram below to distinguish SYNC100 trigger protocol from ESTST protocol.



Synchronous Communications

A communications system following the "command-response" cycle model. In this model, a device issues a command to another device; the second device executes the command; then returns a response. Synchronous commands are executed in the order received.

SYSFAIL*

A signal line on the VMEbus used to indicate a failure by a device. The failing device asserts this line.

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System Clock Driver

A functional module providing a 16 MHz timing signal on the Utility Bus.

System Hierarchy

The tree structure of the commander/servant relationships of all devices in the system at a given time. In the VXIbus structure, each servant has a commander. A commander may also have a commander.

Test Monitor

An executive routine responsible for executing the self tests, storing any errors in the ID-ROM, and reporting such errors to the Resource Manager.

Test Program

A program, executed on the system controller, controlling the execution of tests within the test system.

Test System

A collection of hardware and software modules operating in concert to test a target DUT.

TTLTRG

Open collector TTL lines used for inter-module timing and communication.

VXIbus Subsystem

One Mainframe with modules installed. The installed modules include one module in slot 0 to perform the slot 0 functions and a given complement of instrument modules in slots 1-12. The subsystem also may include a Resource Manager.

Word Serial Protocol

A word oriented, bidirectional, serial protocol for VXIbus communications between message-based devices (that is, devices that include communication registers in addition to configuration registers).

Word Serial Communications

Inter-device communications using the Word Serial Protocol.

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WSP

See Word Serial Protocol.

10 MHz Clock

A 10 MHz timing reference. Also see CLK10.

100 MHz Clock

A 100 MHz clock synchronized to CLK10. Also see CLK100.

488-To-VXIbus Interface

A message based device that provides for communication between the IEEE 488 bus and VXIbus instrument modules.

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