VM2164

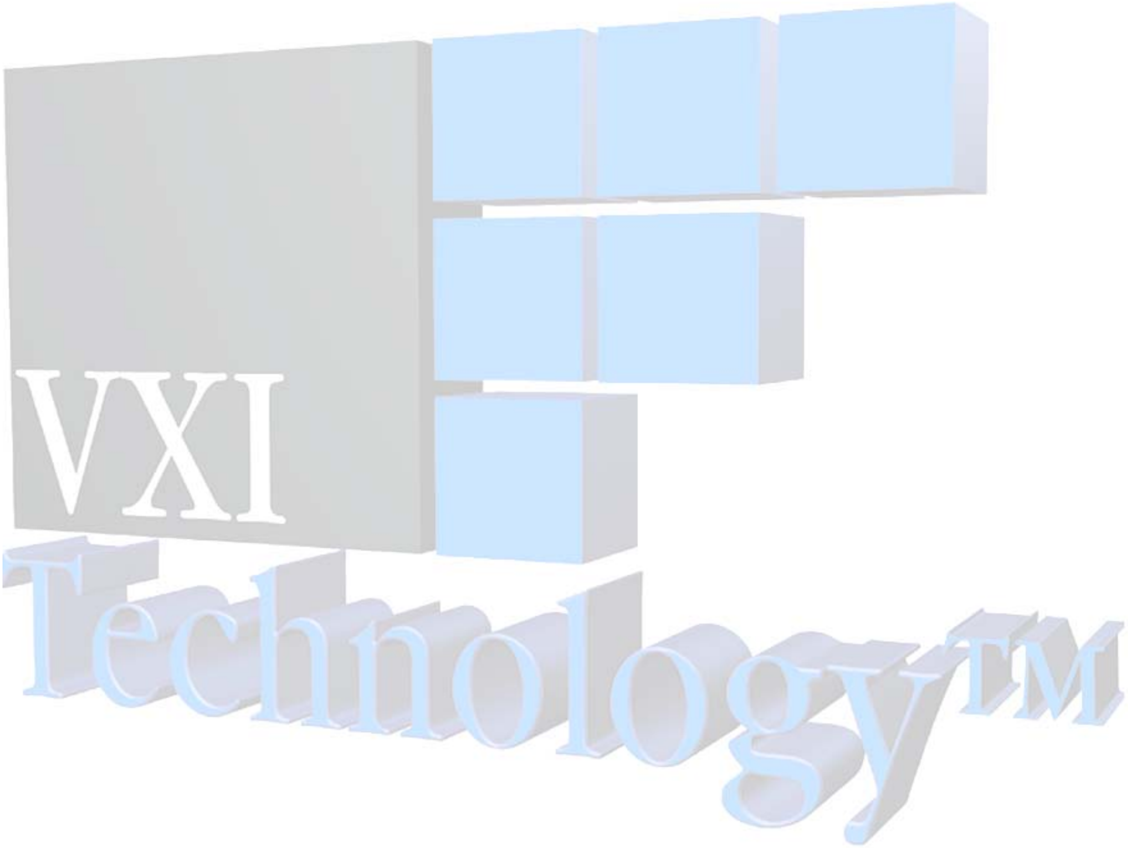
COUNTER / TIMER

USER'S MANUAL

P/N: 82-0059-000
Rev. June 29, 2010

VXI Technology, Inc.

2031 Main Street
Irvine, CA 92614-6509
(949) 955-1894


VXI
Technology™

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INTRODUCTION

CERTIFICATION

VXI Technology, Inc. (VTI) certifies that this product met its published specifications at the time of shipment from the factory. VTI further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology (formerly National Bureau of Standards), to the extent allowed by that organization's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

The product referred to herein is warranted against defects in material and workmanship for a period of three years from the receipt date of the product at customer's facility. The sole and exclusive remedy for breach of any warranty concerning these goods shall be repair or replacement of defective parts, or a refund of the purchase price, to be determined at the option of VTI.

For warranty service or repair, this product must be returned to a VXI Technology authorized service center. The product shall be shipped prepaid to VTI and VTI shall prepay all returns of the product to the buyer. However, the buyer shall pay all shipping charges, duties, and taxes for products returned to VTI from another country.

VTI warrants that its software and firmware designated by VTI for use with a product will execute its programming when properly installed on that product. VTI does not however warrant that the operation of the product, or software or firmware will be uninterrupted or error free.

LIMITATION OF WARRANTY

The warranty shall not apply to defects resulting from improper or inadequate maintenance by the buyer, buyer-supplied products or interfacing, unauthorized modification or misuse, operation outside the environmental specifications for the product, or improper site preparation or maintenance.

VXI Technology, Inc. shall not be liable for injury to property other than the goods themselves. Other than the limited warranty stated above, VXI Technology, Inc. makes no other warranties, express or implied, with respect to the quality of product beyond the description of the goods on the face of the contract. VTI specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

RESTRICTED RIGHTS LEGEND

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VXI Technology, Inc.
2031 Main Street
Irvine, CA 92614-6509 U.S.A.

DECLARATION OF CONFORMITY

Declaration of Conformity According to ISO/IEC Guide 22 and EN 45014

MANUFACTURER'S NAME	VXI Technology, Inc.
MANUFACTURER'S ADDRESS	2031 Main Street Irvine, California 92614-6509
PRODUCT NAME	Counter/Timer
MODEL NUMBER(S)	VM2164
PRODUCT OPTIONS	All
PRODUCT CONFIGURATIONS	All

VXI Technology, Inc. declares that the aforementioned product conforms to the requirements of the Low Voltage Directive 73/23/EEC *and the* EMC Directive 89/366/EEC *(inclusive* 93/68/EEC*) and carries the "CE" mark accordingly. The product has been designed and manufactured according to the following specifications:*

SAFETY	EN61010 (2001)
EMC	EN61326 (1997 w/A1:98) Class A CISPR 22 (1997) Class A VCCI (April 2000) Class A ICES-003 Class A (ANSI C63.4 1992) AS/NZS 3548 (w/A1 & A2:97) Class A FCC Part 15 Subpart B Class A EN 61010-1:2001

The product was installed into a C-size VXI mainframe chassis and tested in a typical configuration.

I hereby declare that the aforementioned product has been designed to be in compliance with the relevant sections of the specifications listed above as well as complying with all essential requirements of the Low Voltage Directive.

May 2003

CE

Jerry Patton

Jerry Patton, QA Manager

GENERAL SAFETY INSTRUCTIONS

Review the following safety precautions to avoid bodily injury and/or damage to the product. These precautions must be observed during all phases of operation or service of this product. Failure to comply with these precautions, or with specific warnings elsewhere in this manual, violates safety standards of design, manufacture, and intended use of the product.

Service should only be performed by qualified personnel.

TERMS AND SYMBOLS

These terms may appear in this manual:

WARNING Indicates that a procedure or condition may cause bodily injury or death.

CAUTION Indicates that a procedure or condition could possibly cause damage to equipment or loss of data.

These symbols may appear on the product:

⚠ ATTENTION - Important safety instructions

⏚ Frame or chassis ground

WARNINGS

Follow these precautions to avoid injury or damage to the product:

Use Proper Power Cord To avoid hazard, only use the power cord specified for this product.

Use Proper Power Source To avoid electrical overload, electric shock, or fire hazard, do not use a power source that applies other than the specified voltage.

Use Proper Fuse To avoid fire hazard, only use the type and rating fuse specified for this product.

WARNINGS (CONT.)

Avoid Electric Shock

To avoid electric shock or fire hazard, do not operate this product with the covers removed. Do not connect or disconnect any cable, probes, test leads, etc. while they are connected to a voltage source. Remove all power and unplug unit before performing any service. ***Service should only be performed by qualified personnel.***

Ground the Product

This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground.

Operating Conditions

To avoid injury, electric shock or fire hazard:

- Do not operate in wet or damp conditions.
- Do not operate in an explosive atmosphere.
- Operate or store only in specified temperature range.
- Provide proper clearance for product ventilation to prevent overheating.
- DO NOT operate if any damage to this product is suspected. ***Product should be inspected or serviced only by qualified personnel.***

Improper Use

The operator of this instrument is advised that if the equipment is used in a manner not specified in this manual, the protection provided by the equipment may be impaired. Conformity is checked by inspection.

SUPPORT RESOURCES

Support resources for this product are available on the Internet and at VTI Instruments customer support centers.

VTI Instruments Corp.
World Headquarters

VTI Instruments Corp.
2031 Main Street
Irvine, CA 92614-6509

Phone: (949) 955-1894
Fax: (949) 955-3041

VTI Instruments
Cleveland Instrument Division

5425 Warner Road
Suite 13
Valley View, OH 44125

Phone: (216) 447-8950
Fax: (216) 447-8951

VTI Instruments
Lake Stevens Instrument Division

3216 Wetmore Avenue, Suite 1
Everett, WA 98201

Phone: (949) 955-1894
Fax: (949) 955-3041

VTI Instruments, Pvt. Ltd.
Bangalore Instrument Division

642, 80 Feet Road
Koramangala IV Block
Bangalore – 560 034
India

Phone: +91 80 4040 7900
Phone: +91 80 4162 0200
Fax: +91 80 4170 0200

Technical Support

Phone: (949) 955-1894
Fax: (949) 955-3041
E-mail: support@vtiinstruments.com

Visit http://www.vtiinstruments.com for worldwide support sites and service plan information.

SECTION 1

INTRODUCTION

OVERVIEW

The VM2164 is a high-performance system level universal counter, designed to outperform traditional rack-and-stack and other C-size VXIbus counters, but with a considerably smaller footprint. A part of the VMIP™ (*VXI Modular Instrumentation Platform*) family of products, the VM2164 can be combined with up to two other high-performance instruments on a single C-Size card to form a customized and highly integrated instrument (see Figure 1-1).

This allows the user to reduce system size and cost by combining the VM2164 with two other instrument functions in a single-wide C-size VXIbus module. Up to three VM2164s can also be combined together on a single VXIbus card, making it an ideal choice for applications that require multi-signal measurement functions, such as in automotive or medical electronic test.

A powerful combination for any automated test set is our single VXIbus module, VT2000 combining a 6.5 digit system DMM (VM2710A), a 200 MHz 1 ns universal counter (VM2164) and a 50 MSample/s arbitrary waveform/function generator (VM3640A). Our single-slot timer counter (VM2164) plus a Rubidium standard (VM3000) is another powerful combination.

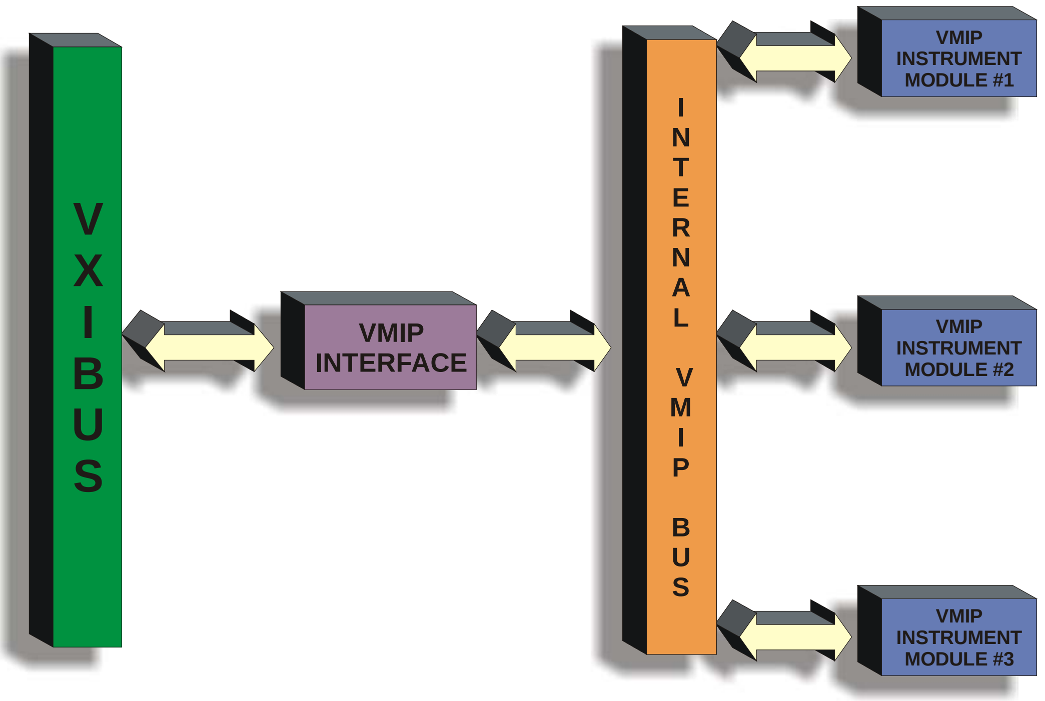

VXIBUS
VMIP INTERFACE
INTERNAL VMIP BUS
VMIP INSTRUMENT MODULE #1
VMIP INSTRUMENT MODULE #2
VMIP INSTRUMENT MODULE #3

FIGURE 1-1 THE VMIP™ PLATFORM

Each VM2164 Counter/Timer is treated as an independent instrument in the VXIbus chassis. Each has its own unique Logical Address and its own front panel FAIL and ACC indicators. The ACC (ACCESS) LED flashes when read/write commands are being sent to the module. The FAIL LED glows green to indicate that the board is receiving power. This LED glows red when a fail condition has occurred.

PROGRAMMING

The VM2164 is programmed using message-based word serial protocol. The commands are SCPI and IEEE-STD-488-2 compatible. VXI*plug&play* drivers are also provided to further ease programming.

CALIBRATION

The calibration constants used to correct the data values are stored in non-volatile memory and are password protected for security. These constants are determined when the instrument is calibrated and can be changed as necessary. These constants may also be queried at any time via a word-serial query and altered via a word-serial command (with the password). All calibration is done using calibration DACs to adjust the gain and offset of each channel. This eliminates the need for removing covers from the unit and allows for automated calibration.

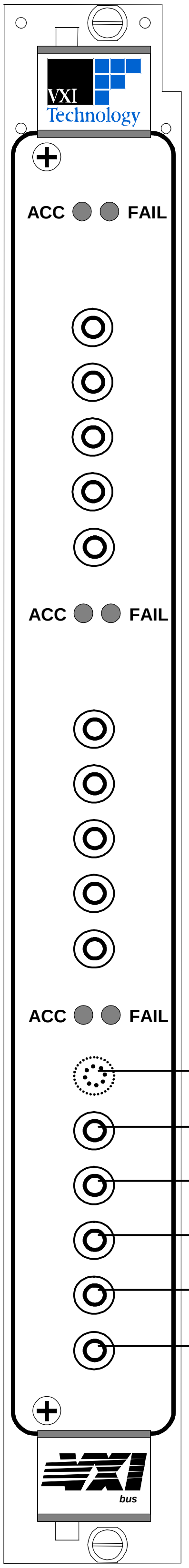


FIGURE 1-2 FRONT PANEL LAYOUT

BUILT-IN SOFTWARE FUNCTIONS

BUILT IN SOFTWARE FUNCTIONS

- **Auto-Level**
- **Period**
- **Positive Pulse Width**
- **Positive Duty Cycle**
- **Rise Time**
- **Burst Characterization**
- **Clock On/Off – In/Out**
- **Pulse Characterization**
- **Frequency**
- **Negative Pulse Width**
- **Burst Frequency**
- **Fall Time**
- **BIT (Built-In Test)**

FEATURES

FEATURES	
FREQUENCY	
	Frequency Frequency Ratio Frequency in Bursts Channel 3
PERIOD AND TIME	
	Period (Single) Period (Average) Positive Pulse Width Negative Pulse Width Rise Time Fall Time Time Interval Time Interval Average
PHASE	
VOLTAGE	
	VDC V_{P-P} V_{MAX} V_{MIN}
ARMING	
Arm Source	Ch 1, Ch 2, Ext, VXI TTLT
Arm Slope	Positive, Negative
Trigger Level	Fixed (approximately TTL)
Arming Start Delay	Events/Timed
Hold Off	Timed
Burst Sync Delay	Timed
MEASUREMENT STORAGE	
Standard	1000 measurements
POSITIVE / NEGATIVE DUTY CYCLE	
TOTALIZE	

General Specifications

Input Specifications	
Channel 1 & 2	
Impedance	1 MΩ‖20 pF 50 Ω‖20 pF
Frequency Range	
DC Coupled	DC – 200 MHz
AC Coupled	20 Hz – 200 MHz
Low Pass Filter	
-5% Point	50 kHz
-3 dB	155 kHz
Sensitivity	
1x	20 mVrms – up to 50 MHz 40 mVrms – 50 MHz to 200 MHz 100 mV$_{P-P}$ – 5 to 10 ns pulse 50 mV$_{P-P}$ – Greater than 10 ns pulse
10x	200 mVrms – up to 50 MHz 400 mVrms – 50 MHz to 200 MHz 1.0 V$_{P-P}$ – 5 to 10 ns pulse 500 mV$_{P-P}$ – Greater than 10 ns pulse
Crosstalk	< -36 dB at 100 MHz into 50 Ω
Input Damage Level	
1x / 10x	240 Vrms (DC + ACrms) to 2 kHz linearly derated to 5 Vrms at 100 kHz. 5 Vrms above 100 kHz
50 Ω Input	5 Vrms – DC to 200 MHz
Trigger Level Range	
1x	±5.0 V
10x	±50 V
Trigger Level Resolution	
1x	2.5 mV
10x	25 mV
Trigger Sensitivity	
1x	20 mVrms Sine Wave (< 50 MHz) 40 mVrms Sine Wave (50 MHz to 200 MHz)
10x	200 mVrms Sine Wave (< 50 MHz) 400 mVrms Sine Wave (50 MHz to 200 MHz)
Auto-Trigger	Automatically set to the 50% point between the signal's peak-to-peak levels. The signal's 10% and 90% points are sued for rise and fall time measurements.
Trigger Error (seconds)	$\frac{\sqrt{E^2_{\text{Input}} + E^2_{\text{Signal}}}}{\text{Input Slew rate @ Trigger point}}$, ($E_{\text{Signal}}$ is the input signal noise)
E_{Input} (RMS Noise of the Input)	
1x	≤ 2 mVrms, (500 μVrms typical)
10x	≤ 20 mVrms, (5 mVrms typical)
Trigger Level Timing Error	
1x	$\pm\frac{12.5\,\text{mV}}{\text{Input Slew Rate at Start}} \pm \frac{12.5\,\text{mV}}{\text{Input Slew Rate at Stop}}$
10x	$\pm\frac{125\,\text{mV}}{\text{Input Slew Rate at Start}} \pm \frac{125\,\text{mV}}{\text{Input Slew Rate at Stop}}$
Base Resolution and Accuracy	
t_{res}	50 ps
t_{acc}	0.4 ns typical, 0.8 ns worst case
Differential Channel Error	100 ps

Channel 3 Input (Option 17)

Frequency Range	150 MHz to 3.0 GHz
Sensitivity	
150 MHz – 2.4 GHz	-25 dBm to +19 dBm
2.4 GHz – 3.0 GHz	-19 dBm to +19 dBm
Impedance	50 Ω
Input Coupling	AC
Input Damage Level	5 Vrms

External Reference Output

Frequency	10 MHz
Coupling	DC
Output Impedance	50 Ω
Output Level Low	≤ 0.8 V into > 10 kΩ
Output Level High	≥ 4.2 V into > 10 kΩ
Gate Time	Programmable from 200 µs to 99.9999 s

External Reference Input

Frequency	10 MHz
Coupling	AC
Input Impedance	1 kΩ
Voltage Range	500 mVrms to 12 Vrms
Input Damage Level	15 Vrms

External Arm Input

Coupling	DC
Impedance	1 kΩ
Input Threshold	1.3 V fixed
Input Signal Level	≥ 500 mV$_{P-P}$ about the input threshold
Pulse Width	≥ 50 ns
Transition Time	≤ 250 ns

TTL Trigger Bus Arming

Input	Any VXIbus TTL Trigger line may be selected for arming (Rising or Falling edge sensitive)
Output	Any VXIbus TTL Trigger line may be selected to follow the measurement gate signal (polarity is programmable)

Measurements

Frequency Measurements

Input 1 & 2 Range	500 µHz to 200 MHz (DC coupled) 20 Hz to 200 MHz (AC coupled)
Input 1 & 2 Resolution	$\text{Frequency} \times \frac{\sqrt{t_{res}^2 + [(\text{Start Trigger Error})^2 + (\text{Stop Trigger Error})^2]}}{\text{Gate Time}}$
Input 1 & 2 Systematic Error	$\text{Frequency} \times \left(\pm \text{Time Base Error} \pm \frac{t_{acc}}{\text{GateTime}} \right)$
Input 3 Frequency Range	150 MHz to 2.5 GHz
Input 3 Resolution	$32 \times \left(\text{Frequency} \times \frac{\sqrt{t_{res}^2 + [(\text{Start Trigger Error})^2 + (\text{Stop Trigger Error})^2]}}{\text{Gate Time}} \right)$
Input 3 Systematic Error	$32 \times \left(\text{Frequency} \times \left(\pm \text{Time Base Error} \pm \frac{t_{acc}}{\text{GateTime}} \right) \right)$
Accuracy	$\text{Resolution} + (\text{Time Base Error} \times f_{\text{INPUT}}) + \left(\frac{\left(\frac{1}{\text{Systematic Error}} \right)}{\text{Gate Time}} \times f_{\text{INPUT}} \right)$

FREQUENCY RATIO	
Input 1 & 2 Range	500 µHz to 200 MHz (DC coupled) 20 Hz to 200 MHz (AC coupled)
Results Range $\frac{\mathbf{CH1}}{\mathbf{CH2}}, \frac{\mathbf{CH2}}{\mathbf{CH1}}$	2.5 x 10^{-12} to 4.0 x 10^{11}
Resolution $\frac{\mathbf{CH1}}{\mathbf{CH2}}$	$\frac{\text{Count}_{\text{CH1}}}{\text{Count}_{\text{CH2}}} - \frac{\text{Count}_{\text{CH1}}}{\text{Count}_{\text{CH2}} + 1}$
Resolution $\frac{\mathbf{CH2}}{\mathbf{CH1}}$	$\frac{\text{Count}_{\text{CH2}}}{\text{Count}_{\text{CH1}}} - \frac{\text{Count}_{\text{CH2}} + 1}{\text{Count}_{\text{CH1}}}$
Input 3 Range	150 MHz to 2.5 GHz
Results Range $\frac{\mathbf{CH3}}{\mathbf{CH1}}, \frac{\mathbf{CH3}}{\mathbf{CH2}}, \frac{\mathbf{CH1}}{\mathbf{CH3}}, \frac{\mathbf{CH2}}{\mathbf{CH3}}$	2.0 x 10^{-13} to 5.0 x 10^{12}
Resolution $\frac{\mathbf{CH1}}{\mathbf{CH3}}, \frac{\mathbf{CH2}}{\mathbf{CH3}}$	$\frac{\text{Count}_{\text{CH1 or CH2}}}{\text{Count}_{\text{CH3}}} - \frac{\text{Count}_{\text{CH1 or CH2}}}{\text{Count}_{\text{CH3}} + 32}$
Resolution $\frac{\mathbf{CH3}}{\mathbf{CH1}}, \frac{\mathbf{CH3}}{\mathbf{CH2}}$	$\frac{\text{Count}_{\text{CH3}}}{\text{Count}_{\text{CH1 or CH2}}} - \frac{\text{Count}_{\text{CH3}}}{\text{Count}_{\text{CH1 or CH2}} + 1}$
PERIOD MEASUREMENT	
Input 1 & 2 Range	5 ns to 2000 s
Resolution	$\sqrt{t_{\text{res}}^2 + \left[(\text{Start Trigger Error})^2 + (\text{Stop Trigger Error})^2\right]}$
Systematic Error	$\text{Period} \times \left(\pm \text{Time Base Error} \pm \frac{t_{\text{acc}}}{\text{Gate Time}} \right)$
PHASE MEASUREMENT	
Range	0° to 360° or -180° to +180°
Resolution	$\text{Frequency} \times 360° \times \sqrt{\left[t_{\text{res}}^2 + \left(4 \times \text{Trigger Error}^2\right)\right] \times \left[1 + \left(\frac{\text{Phase}}{360°}\right)^2\right]}$
Systematic Error	$\text{Frequency} \times 360° \times \left(\pm \text{Trigger Error} \pm \frac{t_{\text{acc}}}{\text{Period}} \pm \frac{t_{\text{acc}}}{\text{Phase Time}} \pm \text{Differential Channel Error} \right)$
TIME INTERVAL MEASUREMENTS	
Range	2 ns to 1 x 10^{6} s
Resolution – Single Shot	$\sqrt{t_{\text{res}}^2 + \left[(\text{Start Trigger Error})^2 + (\text{Stop Trigger Error})^2\right]}$
Systematic Error	$\text{Time Interval} \times \left(\pm \text{Time Base Error} \pm \frac{t_{\text{acc}}}{\text{Time Interval}} \pm \text{Differential Channel Error} \right)$
PULSE WIDTH MEASUREMENT	
Range	5 ns to 20 ms
Resolution – Single Shot	$\sqrt{t_{\text{res}}^2 + \left[(\text{Start Trigger Error})^2 + (\text{Stop Trigger Error})^2\right] + (\text{Trigger Level Timing Error})^2}$
Systematic Error	$\text{Width} \times \left(\pm \text{Time Base Error} \pm \frac{t_{\text{acc}}}{\text{Width}} \right)$
Accuracy	$\text{Resolution} + (\text{Time Base Error} \times \text{Pulse Width}) + \left(\left(\frac{1}{\text{Systematic Error}} \right) \times \text{Pulse Width} \right)$
RISE AND FALL TIME MEASUREMENT	
Range	10 ns to 1000 s
Resolution – Single Shot	$\sqrt{t_{\text{res}}^2 + \left[(\text{Start Trigger Error})^2 + (\text{Stop Trigger Error})^2\right] + (\text{Trigger Level Timing Error})^2}$
Systematic Error	$\text{Time Interval} \times \left(\pm \text{Time Base Error} \pm \frac{t_{\text{acc}}}{\text{Time Interval}} \right)$

DC VOLTAGE MEASUREMENT	
Range	
1x	±4 V
10x	±40 V
Resolution	
1x	2.5 mV
10x	25 mV
Accuracy	
1x	±12.5 mV
10x	±125 mV

PEAK VOLTAGE MEASUREMENT	
Range	
1x	±5 V
10x	±50 V
Resolution	
1x	2.5 mV
10x	25 mV
Accuracy	
1x	±12.5 mV
10x	±125 mV

OSCILLATOR SPECIFICATIONS

NO OSCILLATOR – USE VXI 10 MHZ	
Performance	±100 ppm
EX2500A	
Performance	±50 ppm
TCXO – STANDARD	
Performance	High Performance
Aging	±1 x 10^{-6}/year
Temperature	±3 x 10^{-6} (0°C to 50°C)
Adjustment Range	±3 x 10^{-6} minutes
Warm Up Time	N/A
OCXO – OPTION 16	
Performance	Ultra High Performance
Aging	±1 x 10^{-7}/year ±1 x 10^{-9}/day
Temperature	±1 x 10^{-7} (0°C to 50°C)
Adjustment Range	±4 x 10^{-7} minutes
Warm Up Time	< 3 minutes

SECTION 2

PREPARATION FOR USE

INTRODUCTION

When the VMIP is unpacked from its shipping carton, the contents should include the following items:

(1) VMIP VXIbus module
(1) VM2164 Counter / Timer User's Manual (this manual)

All components should be immediately inspected for damage upon receipt of the unit.

The chassis should be checked to ensure that it is capable of providing adequate power and cooling for the VMIP. Once the chassis is found adequate, the VMIP's logical address and the chassis' backplane jumpers should be configured prior to the VMIP's installation. Once these steps are complete, it may then be installed into an appropriate chassis in any slot other than slot zero.

CALCULATING SYSTEM POWER AND COOLING REQUIREMENTS

It is imperative that the chassis provide adequate power and cooling for this module. Referring to the chassis operation manual, confirm that the power budget for the system (the chassis and all modules installed therein) is not exceeded and that the cooling system can provide adequate airflow at the specified backpressure.

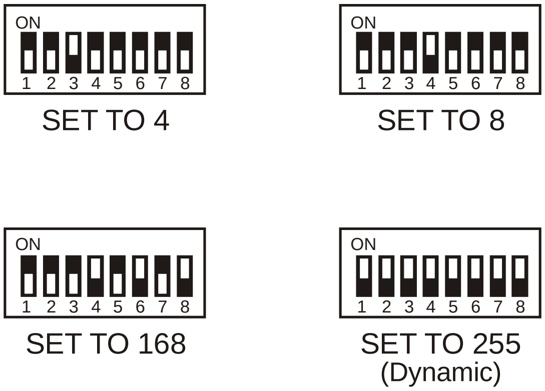
It should be noted that if the chassis cannot provide adequate power to the module, the instrument might not perform to specification or possibly not operate at all. In addition, if adequate cooling is not provided, the reliability of the instrument will be jeopardized and permanent damage may occur. Damage found to have occurred due to inadequate cooling will also void the module's warranty.

SETTING THE CHASSIS BACKPLANE JUMPERS

Please refer to the chassis operation manual for further details on setting the backplane jumpers.

SETTING THE LOGICAL ADDRESS

The logical address of the VM2164 is set by a single 8-position DIP switch located near the VMIP module’s backplane connectors (this is the only switch on the module). The switch is labeled with positions 1 through 8 and with an ON position. A switch pushed toward the ON legend will signify a logic 1; switches pushed away from the ON legend will signify a logic 0. The switch located at position 1 is the least significant bit while the switch located at position 8 is the most significant bit. See Figure 2-1 for examples of setting the logical address switch.



Switch Position	Switch Value
1	1
2	2
3	4
4	8
5	16
6	32
7	64
8	128

FIGURE 2-1 LOGICAL ADDRESS SWITCH SETTING EXAMPLES

The VMIP may contain three separate instruments and will allocate logical addresses as required by the VXIbus specification (revisions 1.3 and 1.4). The logical address of the instrument is set on the VMIP carrier. The VMIP logical addresses must be set to an even multiple of 4 *unless dynamic addressing is used*. Switch positions 1 and 2 must always be set to the OFF position. Therefore, only addresses of 4, 8, 12, 16, ...252 are allowed. The address switch should be set for one of these legal addresses and the address for the second instrument (the instrument in the center position) will automatically be set to the switch set address plus one; while the third instrument (the instrument in the lowest position) will automatically be set to the switch set address plus two. If dynamic address configuration is desired, the address switch should be set for a value of 255 (All switches set to ON). Upon power-up, the slot 0 resource manager will assign the first available logical addresses to each instrument in the VMIP module.

If dynamic address configuration is desired, the address switch should be set for a value of 255. Upon power-up, the slot 0 resource manager will assign logical addresses to each instrument in the VMIP module.

SECTION 3

COMMAND DICTIONARY

INTRODUCTION

This section presents the instrument command set. It begins with an introduction to the Standard Commands for Programmable Instruments (*SCPI*) programming language, detailing proper syntax and explaining SCPI nomenclature. The introduction is then followed by an alphabetical listing of all the commands supported by the VM2164 Counter/Timer. The remainder of this section is devoted to describing each command, one per page, in detail. The description is presented in a way to assist the user in the use of each command. Every command entry describes the exact command and/or query syntax, the use and range of parameters, and a description of the command's purpose.

THE SCPI PROGRAMMING LANGUAGE

The VM2164 is a VXIbus message-based device whose command set is compliant with the SCPI programming language. All module commands are sent over the VXIbus backplane to the module. Commands may be in upper, lower or mixed case. All numbers are sent in ASCII decimal unless otherwise noted.

The SCPI programming language is a tree-structured language based on IEEE-STD-488.2 Specifications. It utilizes the IEEE-STD-488.2 Standard command and the device dependent commands are structured to allow multiple branches off the same trunk to be used without repeating the trunk. To use this facility, terminate each branch with a semicolon. For example, **CALibration:SECure:CODE** and **CALibration:SECure:STATe** are both branches off the **CALibration:** trunk and can be combined as follows:

```
CALibration:SECure:CODE <string>;STATe <boolean>,<string>
```

The above command is the same as the these two commands:

```
CALibration:SECure:CODE <string>
CALibration:SECure:STATe <boolean>,<string>
```

See the *Standard Commands for Programmable Instruments (SCPI)* Manual, Volume 1: Syntax & Style, Section 6, for more information.

The SCPI commands in this section are listed in upper and lower case. Character case is used to indicate different forms of the same command. Keywords can have both a short form and a long form (some commands only have one form). The short form uses just the keyword characters in uppercase. The long form uses the keyword characters in uppercase plus the keyword characters in lowercase. Either form is acceptable. Note that there are no intermediate forms. All characters of the short form or all characters of the long form must be used. Short forms and long forms may be freely intermixed. The actual commands sent can be in upper case, lower case or mixed case (case is only used to distinguish short and long form for the user). As an example, these commands are all correct and all have the same effect:

```
CALibration:SECure:CODE <string>
calibration:secure:code <string>
CALIBRATION:SECURE:CODE <string>
CAL:SECure:CODE <string>
CAL:SEC:CODE <string>
cal:sec:code <string>
```

The following command is **not** correct because it uses part of the long form of **CALibration**, but not all the characters of the long form:

cal~~ib~~:sec:code <value> ***(incorrect syntax - extra "ib"- only cal or calibration is correct)***

All of the SCPI commands also have a query form unless otherwise noted. Query forms contain a question mark (?). The query form allows the system to ask what the current setting of a parameter is. The query form of the command generally replaces the parameter with a question mark (?). Query responses do not include the command header. This means only the parameter is returned: no part of the command or "question" is returned.

NOTATION

Keywords or parameters enclosed in square brackets ([ ]) are optional. If the optional part is a keyword, the keyword can be included or left out. Omitting an optional parameter will cause its default to be used.

Parameters are enclosed by angle brackets (< >). Braces ({ }), or curly brackets, are used to enclose one or more parameters that may be included zero or more times. A vertical bar (|), read as "or", is used to separate parameter alternatives.

ALPHABETICAL COMMAND LISTING

The tables on the pages that follow provide an alphabetical listing of each command supported by the VM2164 Counter/Timer along with a brief definition. If an X is found in the column titled “*RST” (Reset), then the value or setting controlled by this command is possibly changed by the execution of the *RST command. If an X is not found, then the *RST has no effect. The *RST value is provided with each command. This value is set when the unit is powered up or when an *RST or a RESet command is executed. Note that calibration values revert to the values stored in non-volatile memory upon reset. Using the CALibration:DEFault command will return calibration values back to known, factory preset values. In order for CALibration commands/queries to be executed, calibration security must be turned off. If security is not turned off, a “-203, Command Protected” error will be returned. See CALibration:SECure:CODE for information on calibration security.

ALPHABETICAL COMMAND LISTING

Command	Description	*RST	*RST Value
*CLS	Clears all status and event registers.		
*ESE	Sets the bits of the Event Status Enable Register.		
*ESR?	Queries and clears the Standard Event Status Register.		
*IDN?	Queries the module for its identification string.		
*OPC	Sets the OPC bit in the Event Status Register.		
*RST	Resets the module’s hardware and software to a known state.		
*SRE	Sets the service request enable register.		
*STB?	Queries the Status Byte Register.		
*TRG	Causes a trigger event to occur.		
*TST?	Causes a self-test procedure to occur and queries the results.		
*WAI	Halts execution of additional commands and queries until the No Operation Pending message is true.		
ABORt	This command aborts any actions in process.		
ARM([:SEQuence1]‖[:STARt])[:LAYer]:DELay	Specifies a time delay to occur after the receipt of an arm signal before actually arming the counter.	X	0.000000000000000e+00
ARM([:SEQuence1]‖[:STARt])[:LAYer]:ECOunt	Specifies the number of arm signals to count prior to arming the counter.	X	0.000000000000000e+00
ARM([:SEQuence1]‖[:STARt])[:LAYer]:IMMediate	To create a one time entry by the counter into the armed state.		
ARM([:SEQuence1]‖[:STARt])[:LAYer]:MODE	If the counter has been configured for an array measurement, this command specifies whether the counter will perform one or all operations when an ARM command is received.	X	ALL
ARM([:SEQuence1]‖[:STARt])[:LAYer]:SLOPe	Specifies the slope of the counter external arm signal.	X	POS
ARM([:SEQuence1]‖[:STARt])[:LAYer]:SOURce	Selects or queries the start arming source.	X	IMM
ARM([:SEQuence1]‖[:STARt])[:LAYer]:SOURce:CATalog[:ALL]?	Lists all trigger sources available for use with the ARM:SOUR command.		
ARM([:SEQuence1]‖[:STARt])[:LAYer]:SOURce:CATalog:DELayable?	Lists all delayable trigger sources available for use with the ARM:SOUR command.		
ARM([:SEQuence1]‖[:STARt])[:LAYer]:SOURce:CATalog:FIXed?	Lists all fixed trigger sources available for use with the ARM:SOUR command.		
ARM(:SEQuence2|:STOP)[:LAYer]:DELay	Specifies a time delay to occur after receipt of a stop arm signal prior to actually disarming the counter.	X	0.000000000000000e+00
ARM(:SEQuence2|:STOP)[:LAYer]:ECOunt	Specifies the number of stop arm signals the instrument will count prior to disarming the counter.	X	0.000000000000000e+00
ARM(:SEQuence2|:STOP)[:LAYer]:IMMediate	Causes a one-time exit by the counter from the armed state.		
ARM(:SEQuence2|:STOP)[:LAYer]:SOURce	Selects or queries the stop arming source to be used when the counter is initiated.	X	IMM
ARM(:SEQuence2|:STOP)[:LAYer]:SOURce:CATalog[:ALL]?	Lists all trigger sources available for use with the ARM:STOP:SOUR command.	X	See command for possible query responses
ARM(:SEQuence2|:STOP)[:LAYer]:SOURce:CATalog:DELayable?	Lists all fixed trigger sources available for use with the ARM:STOP:SOUR command.		
ARM(:SEQuence2|:STOP)[:LAYer]:SOURce:CATalog:FIXed?	Lists all delayable trigger sources available for use with ARM:STOP:SOUR command.		

ALPHABETICAL COMMAND LISTING (CONT.)

Command	Description	*RST	*RST Value
CALCulate:AVERage?	This query calculates the average of a specified number of measurements in the memory buffer.		
CALCulate:LIMit:ENVelope[:DATA]?	This command searches for all the input data values within an envelope of values defined as being above, below, or in between as set boundary of values.	X	-9.989999999999990e+99, 9.989999999999990e+99
CALCulate:LIMit:FCOunt?	This query performs a limit test on the current available data.		
CALCulate:LIMit:LOWer[:DATA]?	Searches for all the input data values below a certain <threshold>.	X	-9.989999999999990e+99
CALCulate:LIMit:REPort[:DATA]?	This query returns the <memory_index> and <failed_value> values collected.		
CALCulate:LIMit:UPPer[:DATA]?	Searches for all the input data values above a certain <threshold>.	X	9.989999999999990e+99
CALCulate:MAXimum?	This query calculates and returns the maximum value of a set of data.		
CALCulate:MEDian?	This query calculates and returns the median value of a set of data.		
CALCulate:MINimum?	This query calculates and returns the minimum value of a set of data.		
CALCulate:SDEViation?	This query calculates and returns the standard deviation for a set of data.		
CALCulate:TRANsform:HISTogram:ABOVe?	This query returns the number of points above the maximum value in a histogram calculation.		
CALCulate:TRANsform:HISTogram:BELow?	This query returns the number of points below the minimum value in a histogram calculation.		
CALCulate:TRANsform:HISTogram:COUnt?	Determines the number of data points to include in a histogram calculation.	X	1
CALCulate:TRANsform:HISTogram:POINts?	Sets the number of intervals in a histogram calculation.	X	1
CALCulate:TRANsform:HISTogram:RANGe?	Sets the minimum and maximum values to use in a histogram calculation.	X	-9.989999999999990e+99, 9.989999999999990e+99
CALCulate:TRANsform:HISTogram:RANGe:AUTO?	This command sets the minimum and maximum values to use in a histogram calculation.	X	1
CALCulate:TRANsform:HISTogram?	This query calculates and returns the histogram for a set of data.		
CALCulate:VARiance?	This query calculates and returns the variance for a set of data.		
CALibration:COSCillator	Calibrates the reference oscillator. (Must have Option 15 or Option 16 installed)		Assumes the last value stored in non-volatile memory
CALibration:DAC:OFFSet	Calibrates one of the two factors used by the DAC.		
CALibration:DAC:SLOPE	Calibrates one of two factors used by the DAC.		
CALibration:DEFault	Initializes calibration values to known values.		
CALibration:SECure:CODE	Sets the code required to disable calibration security.		
CALibration:SECure[:STATe]	Enable or disable calibration security.		
CALibration:STORe	Stores calibration data into non-volatile memory.		
CALibration:TEC:OFFSet	Calibrates one of three factors used by the TEC circuitry.		
CALibration:TEC:STARtslope	Calibrates one of three factors used by the TEC circuitry.		
CALibration:TEC:STOPslope	Calibrates one of three factors used by the TEC circuitry.		
CALibration:TINTerval:OFFSet	This command compensates for the differences between Channel 1 and Channel 2.	X	

ALPHABETICAL COMMAND LISTING (CONT.)

Command	Description	*RST	*RST Value
CONFigure[1|2](:SCALar]|:ARRay):NDUTy cycle|PDUTCycle|DCYCle	This command configures a positive or negative duty cycle measurement.	X	Array size = 1 Dcycle Reference = 50
CONFigure[1|2](:SCALar]|:ARRay):NWIDth|PWIDth	This command configures the counter to measure the positive or negative pulse width time of the signal on the CONFigure suffix input channel.	X	Array size = 1 Dcycle Ref = 50
CONFigure[1|2](:SCALar]|:ARRay):PHASe	This command configures a phase measurement.	X	1
CONFigure[1|2](:SCALar]|:ARRay):RTIMe|FTIMe|RISE:TIME|FALL:TIME	This command configures the counter to measure the rise or fall time of the signal on the CONFigure suffix input channel.	X	Array size = 1 Low Reference = 10 High Reference = 90
CONFigure[1|2](:SCALar]|:ARRay):TINTerval	This command sets the counter to make a time interval measurement.	X	1
CONFigure[1|2](:SCALar]|:ARRay)[:VOLTage]:[:…]	These commands configure the counter to measure the voltage on the CONFigure suffix input channel.	X	1
CONFigure[1|2|3](:SCALar]|:ARRay):FREQuency	This command configures the counter to measure the frequency of the signal on the CONFigure suffix input channel.	X	1
CONFigure[1|2|3](:SCALar]|:ARRay):FREQuency:RATio	This command configures the counter to measure the ratio of the frequencies of the signals on the CONFigure suffix input channel and <second channel>.	X	1
CONFigure[1|2|3](:SCALar]|:ARRay):PERiod	This command configures the counter to measure the period of the signal on the CONFigure suffix input channel.	X	1
CONFigure[1|2|10|20](:SCALar]|:ARRay):TOTalize	This command configures a totalized measurement.		
FETCh[:…]?	This query returns the values of measurements.		
FETCh:COUNt?	This query returns the number of measurements completed.	X	0
FETCh:TOTalize?	This query returns the total counts from Channel 1 and 2		
FETCh:[:VOLTage][:…]?	This query sets up to return the results of the pervious voltage measurement.		
INITiate:CONTinuous	Verifies whether the counter is taking continuous measurements.	X	0 if not continuous, 1 if continuous
INITiate[:IMMediate]	This command initiates the current trigger sequence.		
INPut[1|2]:ATTenuation	This command sets the input block signal attenuator for the specified channel.	X	1
INPut[1|2]:COMParator[1|2]:LEVel:RELative	This command sets the comparator threshold level voltage of the channel and comparator selected.	X	0
INPut[1|2]:COMParator[1|2]:SLOPe	This command sets the slope for the selected input channel and comparator.	X	POS
INPut[1|2]:COUPling	This command sets the input block signal coupling for the specified channel AC or DC.	X	AC
INPut[1|2]:FILTer[:FREQuency]	This command sets the frequency of the low pass filter.	X	20e6 below 30 MHz 100e6 at or above 30 MHz
INPut[1|2]:FILTer[:STATe]	This command sets the input block signal low-pass filter state for the selected channel to ON or OFF.	X	ON
INPut[1|2]:IMPedance	This command sets the input terminating impedance for the specified channel.	X	1000000.000000 (1e6)
INPut[1|2]:SETup	This command sets up Input Channel 1 or 2 by specifying an expected peak-to-peak input voltage and optionally an expected input offset voltage.		
INPut[1|2]:SETup:AUTO	This command controls the auto setup of Input Channels 1 and 2.	X	ONCE

ALPHABETICAL COMMAND LISTING (CONT.)

Command	Description	*RST	*RST Value
INPut[1|2]:SETup:AUTO:TIMe	This command sets the duration of time that will be allowed for a signal to occur before a measurement is aborted when autotriggered.	X	0.02
INPut[1|2]:SETup:TIMe	This command sets the duration of time after an INITiate command that will be allowed for a signal to occur before a measurement is aborted.	X	0.04
MEASure[1|2]([:SCALar]|:ARRay]:DCYCle|NDUTycycle|PDUTycycle?	This query performs a positive or negative duty cycle measurement.	X	1
MEASure[1|2]([:SCALar]|:ARRay):NWIDth|PWIDth?	This query configures the counter to measure the positive or negative pulse width time of the signal on the MEASure suffix input channel.	X	1
MEASure[1|2]([:SCALar]|:ARRay):PHASe?	This query performs a phase measurement.	X	1
MEASure[1|2]([:SCALar]|:ARRay):RTIMe|FTIMe|RISE:TIME|FALL:TIME?	This query configures the counter to measure the rise and or fall time of the signal on the MEASure suffix input channel.	X	Array size = 1 Low reference = 10 High reference = 90
MEASure[1|2]([:SCALar]|:ARRay):TINTerval?	Sets the counter to make a time interval measurement and fetch the result.		
MEASure[1|2]([:SCALar]|:ARRay)[:VOLTage][:…]?	These queries configure the counter to measure the voltage on the MEASure suffix input channel.	X	1
MEASure[1|2|3]([:SCALar]|:ARRay):FREQuency?	Configures the counter to measure the frequency of the signal on the MEASure suffix input channel.	X	1
MEASure[1|2|3]([:SCALar]|:ARRay):FREQuency:RATio?	This query configures the counter to measure the ratio of the frequencies of the signals on the MEASure suffix input channel and <second channel>.	X	1
MEASure[1|2|3]([:SCALar]|:ARRay):PERiod?	Configures the counter to measure a period of the signal on the MEASure suffix input channel.	X	1
MEASure[1|2|10|20][:SCALar]]:TOTalize?	This query performs a totalize measurement.		
OUTPut:CLOCk	This command toggles the External Reference as a useable reference clock.	X	1
OUTPut:TTLTrg	This command selects the TTL trigger line that will receive the output.	X	0
OUTPut:TTLTrg:STATe	This command toggles the use of TTL trigger lines as usable outputs.	X	ON
READ?	This query causes an INITiate:IMMediate action and a FETCh? query.		
RESet	Resets the module’s hardware and software to a known state.		
SENSe:APERture	This command sets the counter measurement aperture <time>.	X	0.100000
SENSe:COUNt	This command sets the counter to do <array size> number of measurements.	X	1
SENSe:EVENts	This command sets the counter <# of events>.	X	1000
SENSe:MODe	This command sets the counter to make a measurement for a length of time (APERture) or for a number of cycles of the input signal (EVENTs).	X	APER
SENSe[1,2]:FUNCtion	This command selects a function and input channel without changing most of the setup of the counter.	X	FREQ
SENSe[1|2|3]:FUNCtion	The SENSe:FUNCtion command selects a function and input channel without changing most of the counter setup.	X	FREQ
SENSe[1|2|10|20]:FUNCtion	The SENSe:FUNCtion command selects a function and input channel without changing most of the counter setup.		

ALPHABETICAL COMMAND LISTING (CONT.)

Command	Description	*RST	*RST Value
SOURce:COSCillator[:SOURce]	The SOURce subsystem commands are used to command the TCXO1 option (if available).	X	ROSC, if Option 15 is used, then TCXO1 is returned
SOURce:COSCillator:VALue?	This query returns the current oscillator frequency.	X	9.9999999999e+06
TEST?	Performs an internal communication test.		
TEST:ALL?	The Test subsystem handles the self test operations of the instrument.		

UNIT:ANGLe	The UNIT subsystem command specifies the units for the phase measurements as either degrees or radians and determines whether the units will be positive or centered around zero.	X	Unit = RAD
			Zero = MIN

STATus:OPERation:CONDition?	The STATus:OPERation:CONDition query returns the current operational status of the counter.	X	0
STATus:OPERation:ENABle	Sets the Questionable Status Enable Register.		
STATus:OPERation:NTR	Sets the negative transition filter.		
STATus:OPERation:PTR	Sets the positive transition filter.		
STATus:OPERation[:EVENt]?	Queries the Operation Status Register's event register.		
STATus:PRESet	Presets the Status Registers.		
STATus:QUEStionable:CONDition?	Queries the Questionable Status Condition Register.		
STATus:QUEStionable:ENABle	Sets the Questionable Status Enable Register.		
STATus:QUEStionable[:EVENt]?	Queries the Questionable Status Event Register.		

Command Dictionary

The remainder of this section is devoted to the actual command dictionary. Each command is fully described on its own page. In defining how each command is used, the following characteristics are used:

Purpose	Describes the purpose of the command.
Type	Describes the type of event, such as type or setting.
Command Syntax	Details the exact command format
Command Parameters	Describes the parameters sent with the command and their legal parameters
***RST Value**	Describes the value assumed when the *RST (reset) command is sent.
Query Syntax	Details the exact query form of the command.
Query Parameters	Describes the parameters sent with the command and their legal range. The default parameter values are assumed the same as in the command form unless described otherwise.
Query Response	Describes the format of the query response and the valid range of output.
Description	Describes in detail what the command does and refers to additional sources.
Examples	Presents the proper use of each command and its query (when available).
Related Commands	Lists commands that affect the use of this command or commands that are affected by this command.

IEEE 488.2 COMMON COMMANDS

*CLS

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Clears all status and event registers</td></tr>
<tr><td><b>Type</b></td><td colspan="2">IEEE 488.2 Common Command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">*CLS</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command clears the Status Event Register, Operation Status Register and the Questionable Data/Signal Register. It also clears the OPC flag and clears all queues (except the output queue).</td></tr>
<tr><td rowspan="2"><b>Examples</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>*CLS</code></td><td><i>(Clears all status and event registers)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">N/A</td></tr>
</table>

*ESE

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Sets the bits of the Event Status Enable Register</td></tr>
<tr><td><b>Type</b></td><td colspan="2">IEEE 488.2 Common Command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">*ESE <mask></td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><mask> = numeric ASCII value</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A – required parameter</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">*ESE?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Numeric ASCII value from 0 to 255</td></tr>
<tr><td><b>Description</b></td><td colspan="2">The Event Status Enable (ESE) command is used to set the bits of the Event Status Enable Register. See ANSI/IEEE 488.2-1987 section 11.5.1 for a complete description of the ESE register. A value of 1 in a bit position of the ESE register enables generation of the Event Status Bit (ESB) in the Status Byte by the corresponding bit in the Event Status Register (ESR). If the ESB is set in the Service Request Enable (SRE) register, then an interrupt will be generated. See the *ESR? command for details regarding the individual bits. The ESE register layout is:

Bit 0 - Operation Complete
Bit 1 - Request Control
Bit 2 - Query Error
Bit 3 - Device Dependent Error
Bit 4 - Execution Error
Bit 5 - Command Error
Bit 6 - User Request
Bit 7 - Power On

The Event Status Enable query reports the current contents of the Event Status Enable Register.</td></tr>
<tr><td rowspan="2"><b>Examples</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>*ESE 36</code>
<code>*ESE?</code></td><td>36 <i>(Returns the value of the event status enable register)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">*ESR?</td></tr>
</table>

*ESR?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Queries and clears the Standard Event Status Register</td></tr>
<tr><td><b>Type</b></td><td colspan="2">IEEE 488.2 Common Command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">*ESR?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Numeric ASCII value from 0 to 255</td></tr>
<tr><td><b>Description</b></td><td colspan="2">The Event Status Register (ESR) query - queries and clears the contents of the Standard Event Status Register. This register is used in conjunction with the ESE register to generate the Event Status Bit (ESB) in the Status Byte. The layout of the ESR is:

Bit 0 - Operation Complete
Bit 1 - Request Control
Bit 2 - Query Error
Bit 3 - Device Dependent Error
Bit 4 - Execution Error
Bit 5 - Command Error
Bit 6 - User Request
Bit 7 - Power On

The Operation Complete bit is set when it receives an *OPC command.

The Query Error bit is set when data is over-written in the output queue. This could occur if one query is followed by another without reading the data from the first query.

The Execution Error bit is set when an execution error is detected. Errors that range from -200 to -299 are execution errors.

The Command Error bit is set when a command error is detected. Errors that range from -100 to -199 are command errors.

The Power On bit is set when the module is first powered on or after it receives a reset via the VXI Control Register. Once the bit is cleared (by executing the *ESR? command) it will remain cleared.</td></tr>
<tr><td><b>Examples</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td>*ESR?</td><td>4</td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">*ESE</td></tr>
</table>

*IDN?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Queries the module for its identification string</td></tr>
<tr><td><b>Type</b></td><td colspan="2">IEEE 488.2 Common Command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">*IDN?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">ASCII character string</td></tr>
<tr><td><b>Description</b></td><td colspan="2">The Identification (IDN) query returns the identification string of the module. The response is divided into four fields separated by commas. The first field is the manufacturer’s name, the second field is the model number, the third field is an optional serial number and the fourth field is the firmware revision number. If a serial number is not supplied, the third field is set to 0 (zero).</td></tr>
<tr><td rowspan="2"><b>Examples</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>*IDN?</code></td><td>VXI Technology, Inc.,VM2164,0,1.0
<i>(The revision listed here is for reference only; the response will always be the current revision of the instrument.)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">N/A</td></tr>
</table>

*OPC

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Sets the OPC bit in the Event Status Register</td></tr>
<tr><td><b>Type</b></td><td colspan="2">IEEE 488.2 Common Command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">*OPC</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">*OPC?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">1</td></tr>
<tr><td><b>Description</b></td><td colspan="2">The Operation Complete (OPC) command sets the OPC bit in the Event Status Register when all pending operations have completed. The OPC query will return a 1 to the output queue when all pending operations have completed.</td></tr>
<tr><td rowspan="3"><b>Examples</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>*OPC</code></td><td><i>(Sets the OPC bit in the Event Status Register)</i></td></tr>
<tr><td><code>*OPC?</code></td><td>1 <i>(Returns the value of the Event Status Register)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">*WAI</td></tr>
</table>

*RST

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Resets the module’s hardware and software to a known state</td></tr>
<tr><td><b>Type</b></td><td colspan="2">IEEE 488.2 Common Command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">*RST</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Description</b></td><td colspan="2">The Reset (RST) command resets the module’s hardware and software to a known state. See the command index at the beginning of this chapter for the default parameter values used with this command.</td></tr>
<tr><td rowspan="2"><b>Examples</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>*RST</code></td><td><i>(Resets the module)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">N/A</td></tr>
</table>

*SRE

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Sets the service request enable register</td></tr>
<tr><td><b>Type</b></td><td colspan="2">IEEE 488.2 Common Command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">*SRE &lt;mask&gt;</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">&lt;mask> = Numeric ASCII value from 0 to 255</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">None – required parameter</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">*SRE?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Numeric ASCII value from 0 to 255</td></tr>
<tr><td><b>Description</b></td><td colspan="2">The Service Request Enable (SRE) mask is used to control which bits in the status byte generate back plane interrupts. If a bit is set in the mask that newly enables a bit set in the status byte and interrupts are enabled, the module will generate a REQUEST TRUE event via an interrupt. See the *STB? Command for the layout of bits.

<b>Note:</b>
Bit 6 is always internally cleared to zero as required by IEEE 488.2 section 11.3.2.3.

The layout of the Service Request Enable Register is:

Bit 0 – Unused
Bit 1 – Unused
Bit 2 – Error Queue Has Data
Bit 3 – Questionable Status Summary (Not Used)
Bit 4 – Message Available
Bit 5 – Event Status Summary
Bit 6 – 0 (per IEEE 488.2 section 11.3.2.3)
Bit 7 – Operation Status Summary</td></tr>
<tr><td rowspan="2"><b>Examples</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>*SRE 4</code>
<code>*SRE?</code></td><td><i>(Sets the service request enable register)</i>
4 <i>(Returns the value of the SRE register)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">N/A</td></tr>
</table>

*STB?

Purpose	Queries the Status Byte Register	
Type	IEEE 488.2 Common Command	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	*STB?	
Query Parameters	N/A	
Query Response	Numeric ASCII value from 0 to 255	
Description	The Read Status Byte (STB) query fetches the current contents of the Status Byte Register. See the IEEE 488.2 specification for additional information regarding the Status byte Register and its use. The layout of the Status Register is: Bit 0 – Unused Bit 1 – Unused Bit 2 – Error Queue Has Data Bit 4 – Questionable Status Summary (not used) Bit 5 – Message Available Bit 6 – Master Summary Status Bit 7 – Operation Status Summary	
Examples	**Command / Query**	**Response *(Description)***
	`*STB?`	16 (*Queries the Status Byte Register)*
Related Commands	N/A	

*TRG

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Causes a trigger event to occur</td></tr>
<tr><td><b>Type</b></td><td colspan="2">IEEE 488.2 Common Command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">*TRG</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Description</b></td><td colspan="2">The Trigger command causes a trigger event to occur.</td></tr>
<tr><td rowspan="2"><b>Examples</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>*TRG</code></td><td><i>(Triggers an event)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">N/A</td></tr>
</table>

*TST?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Causes a self-test procedure to occur and queries the results</td></tr>
<tr><td><b>Type</b></td><td colspan="2">IEEE 488.2 Common Command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">*TST?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Numeric ASCII value from 0 to 143</td></tr>
<tr><td><b>Description</b></td><td colspan="2">Initiates the counter self-test operation. If the test fails, an error message is placed in the error queue and then the error LED blinks. The self test tests the following:
• Two 4 kb counter measurement buffers
• Logic registers
• Analog front end per-amp offset, pre-amp inverter and pre-amp gain digital to analog converters (DACs)
• A 2.5 MHz signal is routed through a test source and checked for accuracy</td></tr>
<tr><td rowspan="2"><b>Examples</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td>*TST?</td><td>0 (<i>Begins the self-test procedure returns the result)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">N/A</td></tr>
</table>

*WAI

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Halts execution of additional commands and queries until the No Operation Pending message is true</td></tr>
<tr><td><b>Type</b></td><td colspan="2">IEEE 488.2 Common Command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">*WAI</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Description</b></td><td colspan="2">The Wait to Continue command halts the execution of commands and queries until the No Operation Pending message is true. This command makes sure that all previous commands have been executed before proceeding. It provides a way of synchronizing the module with its commander.</td></tr>
<tr><td rowspan="2"><b>Examples</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>*WAI</code></td><td><i>(Pauses the execution of additional commands until the No Operation Pending message is true.)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">*OPC</td></tr>
</table>

INSTRUMENT SPECIFIC COMMANDS

ABORt

Purpose	This command aborts any actions in process	
Type	Instrument specific command	
Command Syntax	ABORt	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	N/A	
Query Parameters	N/A	
Query Response	N/A	
Description	This command aborts any actions in process.	
Examples	**Command / Query**	**Response *(Description)***
	`ARM:SOUR:CAT?`	BUS, COUNTER, CTR_EXTARM, TTLTRG0, TTLTRG1, TTLTRG2, TTLTRG3, TTLTRG4, TTLTRG5, TTLTRG6, TTLTRG7, HOLD, IMMEIDATE, CTR_CHAN2
	`CONF:FREQ`	*(Configures the counter to read frequency)*
	`ARM:SOUR BUS`	*(Arms the BUS source)*
	`INIT`	*(Begins the measurement)*
	`ABOR`	*(Aborts the measurement)*
Related Commands	INITiate	

ARM([:SEQuence1]|[:STARt])[:LAYer]:DELay

<table>
<tr><td><b>Purpose</b></td><td>Specifies a time delay to occur after the receipt of an arm signal before actually arming the counter</td></tr>
<tr><td><b>Type</b></td><td>Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td>ARM([:SEQuence1]|[:STARt])[:LAYer]:DELay <time_delay></td></tr>
<tr><td><b>Command Parameters</b></td><td><time_delay> = 0 to 65,535 seconds (in 1 µs steps)</td></tr>
<tr><td><b>*RST Value</b></td><td>0 seconds (pass-through)</td></tr>
<tr><td><b>Query Syntax</b></td><td>ARM([:SEQuence1]|[:STARt])[:LAYer]:DELay?</td></tr>
<tr><td><b>Query Parameters</b></td><td>N/A</td></tr>
<tr><td><b>Query Response</b></td><td>Returns the set <time_delay> parameter value</td></tr>
<tr><td><b>Description</b></td><td>Specifies a time delay to occur after receipt of an arm signal prior to actually arming the counter. If the arming source selected is fixed (i.e. HOLD, IMMEDIATE, CTR_CHAN2), this command will have no effect on the counter arming. This command always zeros the event count delay, so specifying a delay of zero places the arm subsystem in pass-though mode. In this mode, the instrument arms immediately upon the receipt of a trigger.</td></tr>
<tr><td><b>Examples</b></td><td><table>
<tr><th>Command / Query</th><th>Response <i>(Description)</i></th></tr>
<tr><td><code>CONF:VOLT:DC</code></td><td><i>(Sets the counter for DC voltage measurement)</i></td></tr>
<tr><td><code>ARM:SOUR TTLT0</code></td><td><i>(Arms the TTLT0 source)</i></td></tr>
<tr><td><code>ARM:DEL 1e-3</code></td><td><i>(Sets time delay for 0.001 seconds)</i></td></tr>
<tr><td><code>INIT</code></td><td><i>(Begins the measurement)</i></td></tr>
<tr><td><code>ARM:DEL?</code></td><td>1.000000000000000e-03</td></tr>
</table></td></tr>
<tr><td><b>Related Commands</b></td><td></td></tr>
</table>

ARM([:SEQuence1]|[:STARt])[:LAYer]:ECOunt

Purpose	Specifies the number of arm signals to count prior to arming the counter	
Type	Instrument specific command	
Command Syntax	ARM([:SEQuence1]|[:STARt])[:LAYer]:ECOunt <event_delay>	
Command Parameters	<event delay> = 0 to 65,535 triggers	
***RST Value**	0 (pass though)	
Query Syntax	ARM([:SEQuence1]|[:STARt])[:LAYer]:ECOunt?	
Query Parameters	N/A	
Query Response	Returns the current <event_delay> parameter value	
Description	Specifies the number of arm signals to count prior to arming the counter. Upon receipt of *n* arming signals (where *n* is the number specified in the command), the counter will be armed to take measurements. If a fixed arm source (i.e. HOLD, IMMEDIATE, CTR_CHAN2) is being used, this command will have no effect on the counter arming. This command always zeros the delay by time parameter, so specifying an event count of zero places the arm subsystem into the pass-through mode. In this mode, the instrument arms immediately upon the receipt of a trigger.	
Example	**Command / Query**	**Response *(Description)***
	`CONF:VOLT:DC`	*(Sets the counter for DC voltage measurement)*
	`ARM:SOUR TTLT0`	*(Arms the TTLT0 source)*
	`ARM:ECO 100`	*(Sets the event counter for 100 events)*
	`INIT`	*(Begins the measurement)*
	`ARM:ECO?`	1.000000000000000e+02
Related Commands		

ARM([:SEQuence1]|[:STARt])[:LAYer]:IMMediate

Purpose	To create a one time entry by the counter into the armed state	
Type	Instrument specific command	
Command Syntax	ARM([:SEQuence1]|[:STARt])[:LAYer]:IMMediate	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	N/A	
Query Parameters	N/A	
Query Response	N/A	
Description	This function creates a one-time entry by the counter into the armed state without receiving the specified start arm signal.	
Example	**Command / Query**	**Response *(Description)***
Related Commands		

ARM([:SEQuence1]|[:STARt])[:LAYer]:MODE

Purpose	If the counter has been configured for an array measurement, this command specifies whether the counter will perform one or all operations when an ARM command is received	
Type	Instrument specific command	
Command Syntax	ARM([:SEQuence1]|[:STARt])[:LAYer]:MODE <mode>	
Command Parameters	<mode> = ONCE or ALL	
***RST Value**	ALL	
Query Syntax	ARM([:SEQuence1]|[:STARt])[:LAYer]:MODE?	
Query Parameters	N/A	
Query Response	ONCE | ALL	
Description	When the counter has been configured for an array measurement, this command specifies whether the counter will perform one or all operations when an ARM command is received. If the mode is ALL, then all operations will be completed upon receipt of one arm signal. If the mode is ONCE, then the instrument will perform one operation and reenter the initiated state. This will continue until the specified number of arm signals have been received. At that point, the specified number of operations have been completed.	
Example	**Command / Query**	**Response *(Description)***
	`CONF:ARR:FREQ 3`	*(Configures the counter to take three array measurements)*
	`ARM:MODE ONCE`	*(Sets up counter to take one measurement and then re-enter the initiated state)*
	`ARM:SOUR HOLD`	*(Selects ARM:IMM as the starting point)*
	`INIT`	*(Begins the measurement)*
	`FETC:COUN?`	0
	`ARM:IMM`	
	`FETC:COUN?`	1
	`ARM:IMM`	
	`ARM:IMM`	
	`FETCH:COUN?`	3
	`FETC?`	#368 1.234567891000000e+06, 1.234567890000000e+06, 1.234567892000000e+06
	`ARM:MODE?`	ONCE
Related Commands		

ARM([:SEQuence1]|[:STARt])[:LAYer]:SLOPe

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Specifies the slope of the counter external arm signal</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">ARM([:SEQuence1]|[:STARt])[:LAYer]:SLOPe <slope></td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><slope> = POSitive or NEGative</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">POSitive</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">ARM([:SEQuence1]|[:STARt])[:LAYer]:SLOPe?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">POS | NEG</td></tr>
<tr><td><b>Description</b></td><td colspan="2">Specifies the slope of the counter external arm signal. When the slope is POSitive, the CTR_EXTARM trigger source will be activated by a rising edge passing through the specified level. When the slope is NEGative, the CTR_EXTARM trigger source will be activated by a falling edge passing through the specified level.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce</td></tr>
</table>

ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce

Purpose	Selects or queries the start arming source	
Type	Instrument specific command	
Command Syntax	ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce <source>	
Command Parameters	<source> = BUS, TTLTRG0, TTLTRG1, TTLTRG2, TTLTRG3, TTLTRG4, TTLTRG5, TTLTRG6, TTLTRG7, COUNTER, CTR_EXTARM, CTR_CHAN2, IMMEDIATE, HOLD	
***RST Value**	IMMEDIATE	
Query Syntax	ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce?	
Query Parameters	N/A	
Query Response	Returns the current <source> parameter value	
Description	This command selects or queries the start arming source to be used when the counter is initiated.	
Example	**Command / Query**	**Response *(Description)***
Related Commands	ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce:CATalog[:ALL]? ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce:CATalog:DELayable? ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce:CATalog:FIXed?	

ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce:CATalog[:ALL]?

Purpose	Lists all trigger sources available for use with the ARM:SOUR command	
Type	Instrument specific query	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce:CATalog[:ALL]?	
Query Parameters	N/A	
Query Response	BUS, COUNTER, CTR_EXTARM, TTLTRG0, TTLTRG1, TTLTRG2, TTLTRG3, TTLTRG4, TTLTRG5, TTLTRG6, TTLTRG7, HOLD, IMMEDIATE, CTR_CHAN2	
Description	Lists all trigger sources available for use with the ARM:SOUR command. Specifies the start arming source for the counter.	
Example	**Command / Query**	**Response *(Description)***
	`ARM:SOUR:CAT?`	BUS, COUNTER, CTR_EXTARM, TTLTRG0, TTLTRG1, TTLTRG2, TTLTRG3, TTLTRG4, TTLTRG5, TTLTRG6, TTLTRG7, HOLD, IMMEDIATE, CTR_CHAN2
	`CONF:FREQ`	*(Configures the counter to read frequency)*
	`ARM:SOUR BUS`	*(Arms the BUS source)*
	`INIT`	*(Begins the measurement)*
	`FETC:COUN?`	0
	`*TRIG`	
	`FETC:COUN?`	1
	`FETC?`	1.234567890000000e+06
Related Commands	ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce? ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce:CATalog:DELayable? ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce:CATalog:FIXed?	

ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce:CATalog:DELayable?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Lists all delayable trigger sources available for use with the ARM:SOUR command</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce:CATalog:DELayable?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">BUS, COUNTER, CTR_EXTARM, TTLTRG0, TTLTRG1, TTLTRG2, TTLTRG3, TTLTRG4, TTLTRG5, TTLTRG6, TTLTRG7</td></tr>
<tr><td><b>Description</b></td><td colspan="2">Lists all trigger sources available for use with the ARM:SOUR command which are delayable. Specifies the delayable start arming source for the counter.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td>`ARM:SOUR:CAT:DEL?`</td><td>BUS, COUNTER, CTR_EXTARM, TTLTRG0, TTLTRG1, TTLTRG2, TTLTRG3, TTLTRG4, TTLTRG5, TTLTRG6, TTLTRG7</td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">ARM([:SEQuence1]|:STARt)[:LAYer]:SOURce?
ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce:CATalog[:ALL]?
ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce:CATalog:FIXed?</td></tr>
</table>

ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce:CATalog:FIXed?

Purpose	Lists all fixed trigger sources available for use with the ARM:SOUR command	
Type	Instrument specific query	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce:CATalog:FIXed?	
Query Parameters	N/A	
Query Response	HOLD, IMMEDIATE, CTR_CHAN2	
Description	Lists all trigger sources available for use with the ARM:SOUR command that are fixed. Specifies the fixed start arming source for the counter.	
Example	**Command / Query**	**Response *(Description)***
	`ARM:SOUR:CAT:FIX?`	HOLD, IMMEDIATE, CTR_CHAN2
Related Commands	ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce? ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce:CATalog[:ALL]? ARM([:SEQuence1]|[:STARt])[:LAYer]:SOURce:CATalog:DELayable?	

ARM(:SEQuence2|:STOP)[:LAYer]:DELay

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Specifies a time delay to occur after receipt of a stop arm signal prior to actually disarming the counter</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">ARM(:SEQuence2|:STOP)[:LAYer]:DELay <time_delay></td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><time_delay> = 0 to 65,535 seconds (in 1 μs steps)</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">0 seconds (pass-through)</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">ARM(:SEQuence2|:STOP)[:LAYer]:DELay?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the set <time_delay> parameter value</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command specifies a time delay to occur after receipt of a stop arm signal prior to actually disarming the counter. If the stop arming source selected is fixed (i.e. HOLD, IMMEDIATE, TIMER, CTR_CHAN2), this command will have no effect on the counter arming. This command always zeros the event count delay, so specifying a delay of zero places the arm subsystem in pass-through mode. In this mode, the instrument disarms immediately upon receipt of an arming signal.</td></tr>
<tr><td rowspan="6"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>CONF:VOLT:DC</code></td><td><i>(Sets the counter for DC voltage measurement)</i></td></tr>
<tr><td><code>ARM:STOP:SOUR TTLT0</code></td><td><i>(Sets source as TLT0)</i></td></tr>
<tr><td><code>ARM:STOP:DEL 1e3</code></td><td><i>(Sets time delay to be 1000 seconds)</i></td></tr>
<tr><td><code>INIT</code></td><td><i>(Begins the measurement)</i></td></tr>
<tr><td><code>ARM:STOP:DEL?</code></td><td>1.000000000000000e+03</td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

ARM(:SEQuence2|:STOP)[:LAYer]:ECOut

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Specifies the number of stop arm signals the instrument will count prior to disarming the counter</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">ARM(:SEQuence2|:STOP)[:LAYer]:ECOunt <event_delay></td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><event_delay> = 0 to 65,535 triggers</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">0 triggers (pass through)</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">ARM(:SEQuence2|:STOP)[:LAYer]:ECOunt?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the current <event_delay> parameter value</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command specifies the number of stop arm signals the instrument will count prior to disarming the counter. Upon receipt of an arming signal, the counter will exit the armed state. If the arm source selected is fixed (i.e. HOLD, IMMEDIATE, TIMER, CTR_CHAN2), this command will have no effect on disarming the counter. This command always zeros the delay by time parameter, so specifying an event count of zero places the arm subsystem in pass-through mode. In this mode, the instrument arms immediately upon receipt of a trigger.</td></tr>
<tr><td rowspan="6"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td>CONF:VOLT:DC</td><td><i>(Sets the counter for DC voltage measurement)</i></td></tr>
<tr><td>ARM:STOP:SOUR TTLT0</td><td><i>(Sets the disarm source to TTLT0)</i></td></tr>
<tr><td>ARM:STOP:ECO 100</td><td><i>(Sets the number of stop arm signals that will lead to disarming the counter)</i></td></tr>
<tr><td>INIT</td><td><i>(Begins the measurement)</i></td></tr>
<tr><td>ARM:STOP:ECO?</td><td>1.000000000000000e+02</td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

ARM(:SEQuence2|:STOP)[:LAYer]:IMMediate

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Causes a one-time exit by the counter from the armed state</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">ARM(:SEQuence2|:STOP)[:LAYer]:IMMediate</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command causes a one-time exit by the counter from the armed state without receiving the specified stop arm signal.</td></tr>
<tr><td rowspan="7"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>CONF:FREQ</code></td><td><i>(Configures the counter to read frequency)</i></td></tr>
<tr><td><code>ARM:STOP:SOUR TTLT0</code></td><td><i>(Sets the disarm source to TTLT0)</i></td></tr>
<tr><td><code>INIT</code></td><td></td></tr>
<tr><td><code>FETC:COUN?</code></td><td>0</td></tr>
<tr><td><code>ARM:STOP:IMM</code></td><td></td></tr>
<tr><td><code>FETC:COUN?</code></td><td>0</td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

ARM(:SEQuence2|:STOP)[:LAYer]:SOURce

<table>
<tr><td rowspan="1"><b>Purpose</b></td><td colspan="2">Selects or queries the stop arming source to be used when the counter is initiated</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">ARM(:SEQuence2|:STOP)[:LAYer]:SOURce <source></td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><source> = BUS, TTLTRG0, TTLTRG1, TTLTRG2, TTLTRG3, TTLTRG4, TTLTRG5, TTLTRG6, TTLTRG7, HOLD, IMMEDIATE, CTR_EXTARM, INTERNAL, LEVEL</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">IMMEDIATE</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">ARM(:SEQuence2|:STOP)[:LAYer]:SOURce?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">BUS, TTLTRG0, TTLTRG1, TTLTRG2, TTLTRG3, TTLTRG4, TTLTRG5, TTLTRG6, TTLTRG7, HOLD, IMMEDIATE, CTR_EXTARM, INTERNAL, LEVEL</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command selects or queries the stop arming source to be used when the counter is initiated.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">ARM(:SEQuence2|:STOP)[:LAYer]:SOURce:CATalog[:ALL]?
ARM(:SEQuence2|:STOP)[:LAYer]:SOURce:CATalog:DELayable?
ARM(:SEQuence2|:STOP)[:LAYer]:SOURce:CATalog:FIXed?</td></tr>
</table>

ARM(:SEQuence2|:STOP)[:LAYer]:SOURce:CATalog[:ALL]?

<table>
<tr><td><b>Purpose</b></td><td>Lists all trigger sources available for use with the ARM:STOP:SOUR command</td></tr>
<tr><td><b>Type</b></td><td>Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td>N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td>N/A</td></tr>
<tr><td><b>*RST Value</b></td><td>Same as Query Response</td></tr>
<tr><td><b>Query Syntax</b></td><td>ARM(:SEQuence2|:STOP)[:LAYer]:SOURce:CATalog[:ALL]?</td></tr>
<tr><td><b>Query Parameters</b></td><td>N/A</td></tr>
<tr><td><b>Query Response</b></td><td>BUS, COUNTER, CTR_EXTARM, TTLTRG0, TTLTRG1, TTLTRG2, TTLTRG3, TTLTRG4, TTLTRG5, TTLTRG6, TTLTRG7, HOLD, IMMEDIATE, INTERNAL, LEVEL</td></tr>
<tr><td><b>Description</b></td><td>Lists all trigger sources available for use with the ARM:STOP:SOUR command. This command specifies the stop arming source for the counter.</td></tr>
<tr><td><b>Example</b></td><td>
<table>
<tr><th>Command / Query</th><th>Response <i>(Description)</i></th></tr>
<tr><td><code>ARM:STOP:SOUR:CAT?</code></td><td>BUS, COUNTER, CTR_EXTARM, TTLTRG0, TTLTRG1, TTLTRG2, TTLTRG3, TTLTRG4, TTLTRG5, TTLTRG6, TTLTRG7, HOLD, IMMEDIATE, INTERNAL, LEVEL</td></tr>
<tr><td><code>CONF:ARR:FREQ 512</code></td><td></td></tr>
<tr><td><code>ARM:SOUR BUS</code></td><td><i>(Sets the ARM source to BUS)</i></td></tr>
<tr><td><code>ARM:STOP:SOUR:BUS</code></td><td><i>(Sets the disarm source to BUS)</i></td></tr>
<tr><td><code>INIT</code></td><td></td></tr>
<tr><td><code>FETC:COUN?</code></td><td>0</td></tr>
<tr><td><code>*TRG</code></td><td></td></tr>
<tr><td><code>FET:COUN?</code></td><td>23</td></tr>
<tr><td><code>FETC:COUN?</code></td><td>47</td></tr>
<tr><td><code>*TRG</code></td><td></td></tr>
<tr><td><code>FETC:COUN?</code></td><td>53</td></tr>
</table>
</td></tr>
<tr><td><b>Related Commands</b></td><td>ARM(:SEQuence2|:STOP)[:LAYer]:SOURce?
ARM(:SEQuence2|:STOP)[:LAYer]:SOURce:CATalog:DELayable?
ARM(:SEQuence2|:STOP)[:LAYer]:SOURce:CATalog:FIXed?</td></tr>
</table>

ARM(:SEQuence2|:STOP)[:LAYer]:SOURce:CATalog:DELayable?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Lists all delayable trigger sources available for use with ARM:STOP:SOUR command</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">ARM(:SEQuence2|:STOP)[:LAYer]:SOURce:CATalog:DELayable?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">BUS, CTR_EXTARM, TTLTRG0, TTLTRG1, TTLTRG2, TTLTRG3, TTLTRG4, TTLTRG5, TTLTRG6, TTLTRG7</td></tr>
<tr><td><b>Description</b></td><td colspan="2">Lists all delayable trigger sources available for use with ARM:STOP:SOUR command. This command specifies the stop arming source for the counter.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>ARM:STOP:SOUR:CAT:DEL?</code></td><td>BUS, COUNTER, CTR_EXTARM, TTLTRG0, TTLTRG0, TTLTRG0, TTLTRG0, TTLTRG0, TTLTRG0, TTLTRG0, TTLTRG7</td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">ARM(:SEQuence2|:STOP)[:LAYer]:SOURce?
ARM(:SEQuence2|:STOP)[:LAYer]:SOURce:CATalog[:ALL]?
ARM(:SEQuence2|:STOP)[:LAYer]:SOURce:CATalog:FIXed?</td></tr>
</table>

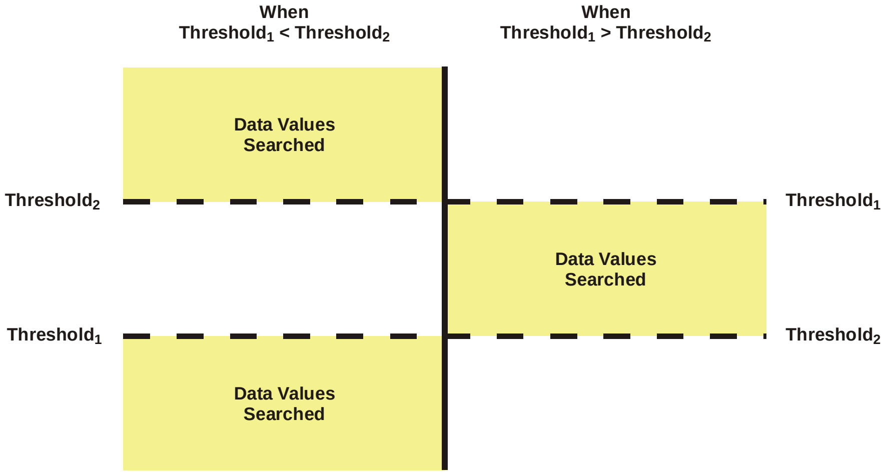
ARM(:SEQuence2|:STOP)[:LAYer]:SOURce:CATalog:FIXed?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Lists all fixed trigger sources available for use with the ARM:STOP:SOUR command</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">ARM(:SEQuence2|:STOP)[:LAYer]:SOURce:CATalog:FIXed?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">HOLD, IMMEDIATE, INTERNAL, LEVEL</td></tr>
<tr><td><b>Description</b></td><td colspan="2">Lists all fixed trigger sources available for use with the ARM:STOP:SOUR command. This command specifies the stop arming source for the counter.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>ARM:STOP:SOUR:CAT:FIX?</code></td><td>HOLD, IMMEDIATE, INTERNAL, LEVEL</td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">ARM([:SEQuence2|:STOP)[:LAYer]:SOURce?
ARM([:SEQuence2|:STOP)[:LAYer]:SOURce:CATalog[:ALL]?
ARM([:SEQuence2|:STOP)[:LAYer]:SOURce:CATalog:DELayable?</td></tr>
</table>

CALCulate:AVERage?

<table>
<tr><td><b>Purpose</b></td><td>This query calculates the average of a specified number of measurements in the memory buffer</td></tr>
<tr><td><b>Type</b></td><td>Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td>N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td>N/A</td></tr>
<tr><td><b>*RST Value</b></td><td><count> = size of last array measurement
<offset> = 1
<step_size> = 1</td></tr>
<tr><td><b>Query Syntax</b></td><td>CALCulate:AVERage?[<count>[,<offset>[,<step_size>]]]</td></tr>
<tr><td><b>Query Parameters</b></td><td><count> = 1 to 1000
<offset> = 1 to 1000
<step_size> = 1 to 1000</td></tr>
<tr><td><b>Query Response</b></td><td>Averages a specified number of measurements in the memory buffer. The optional parameters are for averaging selected values in the memory buffer.</td></tr>
<tr><td><b>Description</b></td><td>This query averages a specified number of measurements in the memory buffer. The optional parameters are for averaging selected values in the memory buffer.
<count> specifies the number of data points to calculate.
<offset> determines at which point the instrument will begin averaging stored values.
<step_size> determines the number of measurements the instrument will skip before taking a value to be averaged.
<b>Note</b>: In order to specify <step_size>, the <count> and <offset> values must be entered first. If a <count> value is not specified, then the instrument will use the most recent <count> as the default.</td></tr>
<tr><td><b>Example</b></td><td><table>
<tr><th>Command / Query</th><th>Response <i>(Description)</i></th></tr>
<tr><td><code>CALC:LIM:UPP 5.0</code></td><td><i>(Sets upper data value limit)</i></td></tr>
<tr><td><code>CALC:AVER?</code></td><td><i>(Averages all the data that has been collected)</i></td></tr>
<tr><td><code>CALC:AVER? 20,3,2</code></td><td><i>(Averages 20 measurement readings. Starts with the 3rd measurement. Averages every other data point after that.)</i></td></tr>
</table></td></tr>
<tr><td><b>Related Commands</b></td><td></td></tr>
</table>

CALCulate:LIMit:ENVelope[:DATA]

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command searches for all the input data values within an envelope of values defined as being above, below or in-between as set boundary of values</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">CALCulate:LIMit:ENVelope[:DATA] <threshold1>,<threshold2></td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><threshold1> = -9.989999999999990e+99 to +9.989999999999990e+99
<threshold2> = -9.989999999999990e+99 to +9.989999999999990e+99</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">-9.989999999999990e+99, +9.989999999999990e+99</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">CALCulate:LIMit:ENVelope[:DATA]?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the <threshold1> and <threshold2> values.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command searches for all the input data values within an envelope of values defined as being above, below or in-between a set of values. The range of the envelope is determined by the <threshold1> and <threshold2> values. For example:
• If the <threshold2> is greater than the <threshold1>, the range of data values searched for is above the <threshold1> value or below the <threshold1> value.
• If the <threshold2> is less than <threshold1> the range of data values searched for is between the <threshold1> and <threshold2>.


When
Threshold$_1$ < Threshold$_2$
When
Threshold$_1$ > Threshold$_2$
Data Values Searched
Threshold$_2$
Threshold$_1$
Data Values Searched
Threshold$_1$
Threshold$_2$
Data Values Searched

</td></tr>
<tr><td><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td><code>CALC:LIM:ENV 1000,5000</code></td><td><i>(Sets an envelope value. All data points above 5.0 kHz and below 1.0 kHz are targeted)</i></td></tr>
<tr><td></td><td><code>CALC:LIM:ENV?</code></td><td>1000, 5000 <i>(Returns the envelope threshold value)</i></td></tr>
<tr><td></td><td><code>CALC:LIM:ENV 5000,1000</code></td><td><i>(Sets an envelope value. All data points between 5.0 kHz and 1.0 kHz are targeted)</i></td></tr>
<tr><td></td><td><code>CALC:LIM:ENV?</code></td><td>5000, 1000 <i>(Returns the envelope threshold value)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">CALCulate:LIMit:FCOcunt[:DATA]?
CALCulate:LIMit:REPort[:DATA]?</td></tr>
</table>

CALCulate:LIMit:FCOunt?

<table>
<tr><td><b>Purpose</b></td><td>This query returns the number of data points that failed a limit test</td></tr>
<tr><td><b>Type</b></td><td>Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td>N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td>N/A</td></tr>
<tr><td><b>*RST Value</b></td><td>N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td>CALCulate:LIMit:FCOunt?</td></tr>
<tr><td><b>Query Parameters</b></td><td>N/A</td></tr>
<tr><td><b>Query Response</b></td><td>This query returns the number of data points outside of a defined threshold</td></tr>
<tr><td><b>Description</b></td><td>This query performs a limit test on the current available data and returns the number of data points that failed a limit test.
<b>Note</b>: A CALCulate:LIMit:UPPer or LOWer or ENVelope command must be sent before this query.</td></tr>
<tr><td><b>Example</b></td><td><table>
<tr><th>Command / Query</th><th>Response <i>(Description)</i></th></tr>
<tr><td><code>CALC:LIM:UPP 5000</code></td><td><i>(Sets the upper threshold value)</i></td></tr>
<tr><td><code>CALC:LIM:FCO?</code></td><td><i>(Returns the number of data points outside of a defined threshold.)</i></td></tr>
</table></td></tr>
<tr><td><b>Related Commands</b></td><td></td></tr>
</table>

CALCulate:LIMit:LOWer[:DATA]

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Searches for all the input data values below a certain <threshold&gt;</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">CALCulate:LIMit:LOWer[:DATA] <threshold&gt;</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">&lt;threshold> = -9.9899999999999990e+99 to +9.9899999999999990e+99</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">-9.9899999999999990e+99</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">CALCulate:LIMit:LOWer[:DATA]?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the <threshold&gt; value</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command searches for all the input data values below a certain <threshold&gt;.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>CALC:LIM:LOW 5.0</code>
<code>CALC:LIM:LOW?</code></td><td><i>(Sets the lower threshold value)</i>
5.0000000000000000e+00 <i>(Returns the lower threshold value)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

CALCulate:LIMit:REPort[:DATA]?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This query returns the <memory_index> and <failed_value> values collected</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">CALCulate:LIMit:REPort[:DATA]?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the lower threshold value.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This query returns the <memory_index> and <failed_value> values collected in the most recent CALCulate:LIMit….[:DATA] command.
<b>Note</b>
• The CALCulate:LIMit….[:DATA] command must be executed before running the CALC:REP command. If no data values were found, the instrument will return a value of zero. (The first point of memory is “1”).
• The CALCulate:LIMit:UPPer, LOWer or ENVelope command must be sent before sending this query.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>CAL:LIM:UPP 5000</code>
<code>CALC:LIM:REP?</code></td><td><i>(Sets <threshold2> value)</i>
2,6002.0,5,5001.0 <i>(Returns the number of data points and data values outside of the defined threshold.)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

CALCulate:LIMit:UPPer[:DATA]

Purpose	Searches for all the input data values above a certain <threshold>	
Type	Instrument specific command	
Command Syntax	CALCulate:LIMit:UPPer[:DATA] <threshold>	
Command Parameters	<threshold> = -9.989999999999990e+99 to +9.989999999999990e+99	
***RST Value**	9.989999999999990e+99	
Query Syntax	CALCulate:LIMit:UPPer[:DATA]?	
Query Parameters	N/A	
Query Response	Returns the <threshold> value	
Description	This command searches for all the input data values above a certain <threshold>.	
Example	**Command / Query**	**Response *(Description)***
	`CALC:LIM:UPP 5.0`	*(Sets the <threshold1> value)*
	`CALC:LIM:UPP?`	5.000000000000000e+00 *(Returns the <threshold1> value)*
Related Commands		

CALCulate:MAXimum?

<table>
<tr><td><b>Purpose</b></td><td>This query calculates and returns the maximum value of a set of data</td></tr>
<tr><td><b>Type</b></td><td>Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td>N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td>N/A</td></tr>
<tr><td><b>*RST Value</b></td><td>N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td>CALCulate:MAXimum?[<count>[,<offset>[,<step_size>]]]</td></tr>
<tr><td><b>Query Parameters</b></td><td><count> = 1 to 1000
<offset> = 1 to 1000
<step size> = 1 to 1000</td></tr>
<tr><td><b>Query Response</b></td><td>Returns the maximum value for a set of data.</td></tr>
<tr><td><b>Description</b></td><td>This query calculates and returns the maximum value of a set of data.
The <data_index> returned indicates the data point in memory where the maximum value is.
The <max_value> returns the value of the maximum data point. If no valid data values were found then “No Data” will be returned. The optional parameters are for comparing selected values in the memory buffer.
The optional <count> parameter specifies the number of data points to compare. If <count> is not specified, the number measured last will be used as the default.
The optional <offset> parameter determines at which point in memory values will start to be searched.
The optional <step_size> parameter determines the number of measurements to skip before taking a value to be compared.
<b>Note</b>: In order to specify a <step_size>, the user must enter the <count> and the <offset> information.</td></tr>
<tr><td><b>Example</b></td><td><table><tr><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr><tr><td><code>CALC:MAX?</code></td><td><i>(Returns the maximum value for a set of data)</i></td></tr></table></td></tr>
<tr><td><b>Related Commands</b></td><td></td></tr>
</table>

CALCulate:MEDian?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This query calculates and returns the median value of a set of data</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">1</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">CALCulate:MEDian?[<count>[,<offset>[,<step_size>]]]</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2"><count> = 1 to 1000
<offset> = 1 to 1000
<step size> = 1 to 1000</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the median value for a set of data.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This query calculates and returns the median value for a set of data. The <data_index> returned indicates the data point in memory where the median value is. The <median_value> returns the value of the median data point. If no valid data values were found, then “No Data” will be returned. The optional parameters allow for searching for selected values in the memory buffer. The optional <count> parameter specifies the number of data points to search. If no <count> is specified, the number measured last is used as the default. The optional <offset> parameter determines the point in memory where the search for values begins. The optional <step_size> parameter determines the number of measurements to skip before taking a value to be compared.
<b>Note</b>: In order to specify <step_size>, the user must enter the <count> and the <offset> information.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>CALC:MED?</code></td><td><i>(Returns the median value for the data set)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

CALCulate:MINimum?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This query calculates and returns the minimum value of a set of data</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">CALCulate:MINimum?[<count>[,<offset>[,<step_size>]]]</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2"><count> = 1 to 1000
<offset> = 1 to 1000
<step size> = 1 to 1000</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the minimum data point for the set of data.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This query calculates and returns the minimum value of a set of data.
The <data_index> returned indicates the data point in memory where the minimum value is.
The <min_value> returns the value of the minimum data point. If no valid data values are found, then “No Data” will be returned. The optional parameters are for comparing selected values in the memory buffer.
The optional <count> parameter specifies the number of data points to compare. If <count> is not specified, the number measured last will be used as the default.
The optional <offset> parameter determines at which point in memory values will start to be searched.
The optional <step_size> parameter determines the number of measurements to skip before taking a value to be compared.
<b>Note</b>: In order to specify a <step_size>, the user must enter the <count> and the <offset> information.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>CALC:MIN?</code></td><td><i>(Returns the minimum value for a set of data)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

CALCulate:SDEViation?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This query calculates and returns the standard deviation for a set of data</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">CALCulate:SDEViation?[<count>[,<offset>[,<step_size>]]]</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2"><count> = 1 to 1000
<offset> = 1 to 1000
<step size> = 1 to 1000</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the standard deviation for a set of data.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This query calculates and returns the standard deviation for a set of data. The formula used for standard deviation is:
$$\sigma = \sqrt{\frac{(n)(\Sigma x^2) - (\Sigma x)^2}{(n)(n-1)}}$$
where n = the number of data summed
x = the value of the data in the set
If no valid data values were found “No Data” will be returned. The optional parameters are for calculating selected values in the memory buffer.
The optional <count> parameter specifies the number of data points to calculate. If no <count> is specified, the number measured last is used as the default.
The optional <offset> parameter determines at which point in memory values will start to be calculated.
The optional <step_size> parameter determines the number of measurements to skip before taking a value to be used.
<b>Note</b>: In order to specify a <step_size>, the <count> and <offset> information must be entered first.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td>CALC:SDEV?</td><td><i>(Calculates and returns the standard deviation on a set of data)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

CALCulate:TRANsform:HISTogram:ABOVe?

Purpose	This query returns the number of points above the maximum value in a histogram calculation	
Type	Instrument specific query	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	CALCulate:TRANsform:HISTogram:ABOVe?	
Query Parameters	N/A	
Query Response	Returns the number of points above the maximum value in a histogram calculation.	
Description	Returns the number of points above the maximum value in a histogram calculation.	
Example	**Command / Query**	**Response *(Description)***
	`CALC:TRAN:HIST:RANGE:AUTO OFF`	*(Turns off auto ranging)*
	`CALC:TRAN:HIST:RANGE 10,50`	*(Sets the range of the histogram calculation for 10 - 50)*
	`CALC:TRAN:HIST:ABOV?`	*(Returns the number of data points above 50)*
Related Commands		

CALCulate:TRANsform:HISTogram:BELow?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This query returns the number of points below the minimum value in a histogram calculation</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">CALCulate:TRANsform:HISTogram:HISTogram:BELow?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Description</b></td><td colspan="2">Returns the number of points below the minimum value in a histogram calculation.</td></tr>
<tr><td rowspan="4"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>CALC:TRAN:HIST:RANG:AUTO OFF</code></td><td><i>(Turns off auto ranging)</i></td></tr>
<tr><td><code>CALC:TRAN:HIST:RANG:AUTO 10,50</code></td><td><i>(Sets the range of the histogram calculation for 10 - 50)</i></td></tr>
<tr><td><code>CALC:TRAN:HIST:BEL?</code></td><td><i>(Returns the number of data points below 10)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

CALCulate:TRANsform:HISTogram:COUnt

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Determines the number of data points to include in a histogram calculation</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">CALCulate:TRANsform:HISTogram:COUnt <numeric_value></td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><numeric_value></td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">1</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">CALCulate:TRANsform:HISTogram:COUNt?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the number of points in a histogram calculation.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command determines the number of data points to include in a histogram calculation.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>CALC:TRAN:HIST:COUN 5</code>
<code>CALC:TRAN:HIST:COUN?</code></td><td><i>(Sets the number of data to use in a histogram calculation to 5)</i>
5.000000000000000e+00 <i>(Returns the number of data points to use in a histogram calculation)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

CALCulate:TRANsform:HISTogram:POINts

<table>
<tr><td><b>Purpose</b></td><td>Sets the number of intervals in a histogram calculation</td></tr>
<tr><td><b>Type</b></td><td>Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td>CALCulate:TRANsform:HISTogram:POINts <numeric_value></td></tr>
<tr><td><b>Command Parameters</b></td><td><numeric_value> = 1 - 6</td></tr>
<tr><td><b>*RST Value</b></td><td>1</td></tr>
<tr><td><b>Query Syntax</b></td><td>CALCulate:TRANsform:HISTogram:POINts?</td></tr>
<tr><td><b>Query Parameters</b></td><td>N/A</td></tr>
<tr><td><b>Query Response</b></td><td>Returns the number of intervals in a histogram calculation.</td></tr>
<tr><td><b>Description</b></td><td>This command sets the number of intervals in a histogram calculation. If a data value is exactly the same value as a limit dividing two bins, the data value will be counted in the next bin (i.e. 25 is placed in Bin #5), unless the value matches the last interval limit (i.e. 35 is placed in Bin #6). The reference table below delineates the limits for each bin.
<table>
<tr><th>BIN #</th><th>LIMITS</th></tr>
<tr><td>1</td><td>5-10</td></tr>
<tr><td>2</td><td>10-15</td></tr>
<tr><td>3</td><td>15-20</td></tr>
<tr><td>4</td><td>20-25</td></tr>
<tr><td>5</td><td>25-30</td></tr>
<tr><td>6</td><td>30-35</td></tr>
</table></td></tr>
<tr><td><b>Example</b></td><td>
<table>
<tr><th>Command / Query</th><th>Response <i>(Description)</i></th></tr>
<tr><td>CALC:TRAN:HIST:POIN 3</td><td><i>(Sets the number of intervals in a histogram calculation to 3)</i></td></tr>
<tr><td>CALC:TRAN:HIST:POIN?</td><td>3.000000000000000e+00 <i>(Returns the number of intervals in a histogram calculation)</i></td></tr>
</table></td></tr>
<tr><td><b>Related Commands</b></td><td></td></tr>
</table>

CALCulate:TRANsform:HISTogram:RANGe

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Sets the minimum and maximum values to use in a histogram calculation</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">CALCulate:TRANsform:HISTogram:RANGe <min_value>,<max_value></td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><min_value> = -9.989999999999990e+99 to +9.989999999999990e+99
<max_value> = -9.989999999999990e+99 to +9.989999999999990e+99</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">1</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">CALCulate:TRANsform:HISTogram:RANGe?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the <min_value> and <max_value> in a histogram calculation.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command sets the minimum and maximum values to be used in a histogram calculation.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>CALC:TRAN:HIST:RANG 1,100</code>
<code>CALC:TRAN:HIST:RANG?</code></td><td><i>(Sets the range of a histogram calculation)</i>
1,100 <i>(Returns the range of a histogram calculation)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

CALCulate:TRANsform:HISTogram:RANGe:AUTO

Purpose	This command sets the minimum and maximum values to use in a histogram calculation	
Type	Instrument specific command	
Command Syntax	CALCulate:TRANsfrom:HISTogram:RANGe:AUTO <ON|OFF>	
Command Parameters	<ON|OFF>	
***RST Value**	N/A	
Query Syntax	CALCulate:TRANsform:HISTogram:RANGe:AUTO?	
Query Parameters	N/A	
Query Response	<ON|OFF>	
Description	This command automatically determines the minimum and maximum values to be used in a histogram calculation. The minimum and maximum data points will be used.	
Example	**Command / Query**	**Response *(Description)***
	`CALC:TRAN:HIST:RANG:AUTO ON`	*(Sets the range of a histogram calculation)*
	`CALC:TRAN:HIST:RANG:AUTO?`	ON
Related Commands		

CALCulate:TRANsform:HISTogram?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This query calculates and returns the histogram for a set of data</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">CALCulate:TRANsform:HISTogram?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2"><bin_data{bin_data>}</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This query calculates and returns the histogram for a set of data.
The format is as follows:
<bin_data{bin_data>}</td></tr>
<tr><td rowspan="5"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>CALC:TRAN:HIST:COUN 5</code></td><td><i>(Sets the number of data to use in a histogram calculation to 5)</i></td></tr>
<tr><td><code>CALC:TRAN:HIST:POIN 3</code></td><td><i>(Sets the number of intervals in a histogram calculation to 3)</i></td></tr>
<tr><td><code>CALC:TRAN:HIST:RANG 10,00</code></td><td><i>(Sets the range of a histogram calculation)</i></td></tr>
<tr><td><code>CALC:TRAN:HIST?</code></td><td><i>(Returns the histogram distribution)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

CALCulate:VARiance?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This query calculates and returns the variance for a set of data</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">CALCulate:VARiance? [<count>[,<offset>[,<step_size>]]]</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2"><count> = 1 to 1000
<offset> = 1 to 1000
<step size> = 1 to 1000</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the variance for a set of data as defined by the equation below.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This query calculates and returns the variance for a set of data. The formula for variance used is:
$$\sigma^2 = \frac{(n)(\Sigma x^2) - (\Sigma x)^2}{(n)(n-1)}$$
where n = the number of data summed
x = the value of the data in the set
If no valid data values were found “No Data” will be returned. The optional parameters are for calculating selected values in the memory buffer.
The optional <count> parameter specifies the number of data points to calculate. If no <count> is specified then the number measurements last taken will be the default.
The optional <offset> parameter determines at which point in memory values will start to be calculated.
The optional <step_size> parameter determines the number of measurements to skip before taking a value to be used.
<b>Note</b><i>:</i> In order to specify a <step_size> the <count> and <offset> information must be entered first.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>CALC:VAR?</code></td><td><i>(Calculates and returns the variance on a set of data)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

CALibration:COSCillator

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Calibrates the reference oscillator. (Must have Option 15 or Option 16 installed)</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">CALibration:COSCillator</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><daclevel> = 0 – 4095
Values outside of this range are changed to the closest parameter limit (i.e. 6000 is set to 4095)</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">CALibration:COSCillator?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the set <dac_level> parameter value</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command calibrates the TCXO (Option 15) or the OCXO oscillator (Option 16) by adjusting the DAC level when a known user clock is used to calibrate the oscillator.
⚠ <b>Calibration commands should only be executed by qualified personnel. Changing these values incorrectly can cause the instrument to perform improperly</b></td></tr>
<tr><td rowspan="2"><b>Examples</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>CAL:COSC 2048</code>
<code>CAL:COSC?</code></td><td><i>(Calibrates the oscillator)</i>
2048 <i>(Returns the calibration value)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">CALibration:SECure:CODE
CALibration:SECure:STATe</td></tr>
</table>

CALibration:DAC:OFFSet

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command calibrates one of two factors used by the DAC</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">CALibration:DAC <dacnum>:OFFSet <dacoffset&gt;</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">&lt;dacnum> = 1 | 2
<dacoffset> = Numbers greater than 1948 and less than 2148</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">CALibration:DAC:OFFSet?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the set <dacoffset> parameter value</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command calibrates one of two factors used by the DAC.
⚠ <b>Calibration commands should only be executed by qualified personnel. Changing these values incorrectly can cause the instrument to perform improperly</b></td></tr>
<tr><td rowspan="2"><b>Examples</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>CAL:DAC 1:OFFSET 2048</code>
<code>CAL:DAC 1:OFFSET?</code></td><td><i>(Sets the DAC slope offset for Channel 1)</i>
2048 <i>(Returns the DAC offset value)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">CALibration:SECure:CODE
CALibration:SECure:STATe</td></tr>
</table>

CALibration:DAC:SLOPE

<table>
<tr><td><b>Purpose</b></td><td>Calibrates one of two factors used by the DAC</td></tr>
<tr><td><b>Type</b></td><td>Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td>CALibration:DAC <dacnum>:SLOPe <dacslope></td></tr>
<tr><td><b>Command Parameters</b></td><td><dacnum> = 1 | 2
<dacslope> = At 1x, numbers greater than -500 and less than -300
At 10x, numbers greater than -50 and less than -30</td></tr>
<tr><td><b>*RST Value</b></td><td>N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td>CALibration:DAC:SLOPe?</td></tr>
<tr><td><b>Query Parameters</b></td><td>N/A</td></tr>
<tr><td><b>Query Response</b></td><td>Returns the set <dacslope> parameter value</td></tr>
<tr><td><b>Description</b></td><td>This command calibrates one of two factors used by the DAC.
<b>Calibration commands should only be executed by qualified personnel. Changing these values incorrectly can cause the instrument to perform improperly</b></td></tr>
<tr><td><b>Examples</b></td><td><table>
<tr><th>Command / Query</th><th>Response <i>(Description)</i></th></tr>
<tr><td><code>CAL:DAC 1:SLOP -409.6</code></td><td><i>(Sets the DAC slope value for Channel 1)</i></td></tr>
<tr><td><code>CAL:DAC 1:SLOP?</code></td><td>-409.6 <i>(Returns the DAC slope value)</i></td></tr>
</table></td></tr>
<tr><td><b>Related Commands</b></td><td>CALibration:SECure:CODE
CALibration:SECure:STATe</td></tr>
</table>

CALibration:DEFault

Purpose	Initializes calibration values to known values	
Type	Instrument specific command	
Command Syntax	CALibration:DEFault	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	N/A	
Query Parameters	N/A	
Query Response	N/A	
Description	Initializes calibration values to known values. The following values are set: Security Code = VM2164 Serial Number = 0 Product = 2164 TEC Slope = 5.92e-11 TEC Offset = -3.9e-9 Time Interval = 1.44e-9 DAC Scale = 409.6 @ 1x = 40.96 @ 10x DAC Offset = 2048.0 Oscillator Trim Value = 2048 Executing this command changes all previously set calibration values. ⚠ **Calibration commands should only be executed by qualified personnel. Changing these values incorrectly can cause the instrument to perform improperly**	
Examples	**Command / Query**	**Response *(Description)***
	`CAL:DEF`	*(Initializes calibration values to known values)*
Related Commands		

CALibration:SECure:CODE

<table>
<tr><td><b>Purpose</b></td><td>Sets the code required to disable calibration security</td></tr>
<tr><td><b>Type</b></td><td>Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td>CALibration:SECure:CODE <string></td></tr>
<tr><td><b>Command Parameters</b></td><td><string> = the code string can be from 1 to 12 ASCII characters in length entered in IEEE 488.2 definite or indefinite length arbitrary block format</td></tr>
<tr><td><b>*RST Value</b></td><td>N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td>CALibration:SECure:CODE? <string></td></tr>
<tr><td><b>Query Parameters</b></td><td>N/A</td></tr>
<tr><td><b>Query Response</b></td><td>Returns the security code</td></tr>
<tr><td><b>Description</b></td><td>The Calibration Security Code command sets the code required to disable calibration security. Calibration security must first be disabled before the code can be changed. Before shipping the instrument, the factory code setting is VM2164.
⚠ <b>Calibration commands should only be executed by qualified personnel. Changing these values incorrectly can cause the instrument to perform improperly</b></td></tr>
<tr><td><b>Examples</b></td><td><table><tr><th>Command / Query</th><th>Response <i>(Description)</i></th></tr><tr><td><code>CAL:SEC:CODE #16VM2164</code></td><td><i>(Sets the factory code setting of VM2164)</i></td></tr></table></td></tr>
<tr><td><b>Related Commands</b></td><td>CALibration:SECure:STATe
CALibration:STORe</td></tr>
</table>

CALibration:SECure[:STATe]

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Enable or disable calibration security</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">CALibration:SECure:STATe <boolean>,<string></td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><boolean> = 0 | 1 | OFF | ON
<string> = the code string can be from 1 to 12 ASCII characters in length entered in IEEE 488.2 definite or indefinite length arbitrary block format</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2"><boolean> = ON</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">CALibration:SECure:STATe?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the set <boolean> value</td></tr>
<tr><td><b>Description</b></td><td colspan="2">The Calibration Security State enables or disables the calibration security. While security is on, no stores to the non-volatile memory are allowed. In order to disable the security state, the security code must be supplied. To enable the security, the code does not need to be supplied. The security state is enabled by default.
Security can also be enabled without entering the <string> parameter by sending the CALibration:SECure:STATe 1 | ON command. Security cannot, however, be disabled using a CALibration:SECure:STATe 0 | OFF command. If this command is sent, a “Missing Parameter” error will be returned.
<b>Calibration commands should only be executed by qualified personnel. Changing these values incorrectly can cause the instrument to perform improperly</b></td></tr>
<tr><td rowspan="4"><b>Examples</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>CAL:SEC:STAT OFF,#16VM2164</code></td><td><i>(Disables calibration security)</i></td></tr>
<tr><td><code>CAL:SEC:STAT 1</code></td><td><i>(Turns the calibration security back on)</i></td></tr>
<tr><td><code>CAL:SEC:STAT?</code></td><td>1 <i>(Indicates that calibration security is enabled)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">CALibration:SECure:CODE
CALibration:STORe</td></tr>
</table>

CALibration:STORe

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Stores calibration data into non-volatile memory</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">CALibration:STORe</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Description</b></td><td colspan="2">The Calibration:STORe command stores correction data into non-volatile memory. The correction data is calibration data that has been downloaded via the program messages in the Calibration Data subsystem. The CALibration:STORe command should only be performed after all the correction data has been finalized.
<b>Note</b>: Security must be turned off in order to use this command.
⚠ <b>Calibration commands should only be executed by qualified personnel. Changing these values incorrectly can cause the instrument to perform improperly</b></td></tr>
<tr><td><b>Examples</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td><code>CAL:SEC OFF,#16VM2164</code>
<code>CAL:STOR</code></td><td><i>(Disables security)</i>
<i>(Stores correction data into non-volatile memory)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">CALibration:SECure:CODE
CALibration:SECure:STATe</td></tr>
</table>

CALibration:TEC:OFFSet

Purpose	Calibrates one of three factors used by the TEC circuitry
Type	Instrument specific command
Command Syntax	CALibration:TEC:OFFSet <tec_offset>
Command Parameters	<tech_offset> = All real numbers
***RST Value**	N/A
Query Syntax	CALibration:TEC:OFFSet?
Query Parameters	N/A
Query Response	Returns the set value of the <tec_offset> parameter.
Description	Calibrates one of three factors used by the TEC circuitry. These factors are the start slope, the stop slope and the offset. ⚠ **Calibration commands should only be executed by qualified personnel. Changing these values incorrectly can cause the instrument to perform improperly**
Examples	**Command / Query** — **Response *(Description)*** `CAL:TEC:OFFSET -3.9e-9` — *(Sets the TEC offset)* `CAL:TEC:OFFSET?` — -3.9e-9 *(Returns the TEC offset)*
Related Commands	CALibration:SECure:CODE CALibration:SECure:STATe

CALibration:TEC:STARtslope

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Calibrates one of three factors used by the TEC circuitry</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">CALibration:TEC:STARtslope <startslope></td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><startslope> = all real number</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">CALibration:TEC:STARtslope?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the set <slope> parameter value</td></tr>
<tr><td><b>Description</b></td><td colspan="2">Calibrates one of three factors used by the TEC circuitry. These factors are the start slope, the stop slope and the offset.
⚠ <b>Calibration commands should only be executed by qualified personnel. Changing these values incorrectly can cause the instrument to perform improperly</b></td></tr>
<tr><td><b>Examples</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td>CAL:TEC:STAR 5.92e-11</td><td><i>(Sets the start slope adjustment)</i></td></tr>
<tr><td></td><td>CAL:TEC:STAR?</td><td>5.92e-11 <i>(Returns the start slope adjustment value)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">CALibration:SECure:CODE
CALibration:SECure:STATe</td></tr>
</table>

CALibration:TEC:STOPslope

<table>
<tr><td><b>Purpose</b></td><td>Calibrates one of three factors used by the TEC circuitry</td></tr>
<tr><td><b>Type</b></td><td>Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td>CALibration:TEC:STOPslope <stopslope></td></tr>
<tr><td><b>Command Parameters</b></td><td><stopslope> = all real numbers</td></tr>
<tr><td><b>*RST Value</b></td><td>N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td>CALibration:TEC:STOPslope?</td></tr>
<tr><td><b>Query Parameters</b></td><td>N/A</td></tr>
<tr><td><b>Query Response</b></td><td>Returns the set <stopslope> parameter value</td></tr>
<tr><td><b>Description</b></td><td>Calibrates one of three factors used by the TEC circuitry. These factors are the start slope, the stop slope and the offset.
⚠ <b>Calibration commands should only be executed by qualified personnel. Changing these values incorrectly can cause the instrument to perform improperly</b></td></tr>
<tr><td><b>Examples</b></td><td>
<table>
<tr><th>Command / Query</th><th>Response <i>(Description)</i></th></tr>
<tr><td><code>CAL:TEC:STOP 5.92e-11</code></td><td><i>(Sets the start slope adjustment)</i></td></tr>
<tr><td><code>CAL:TEC:STOP?</code></td><td>5.92e-11 <i>(Returns the start slope adjustment value)</i></td></tr>
</table>
</td></tr>
<tr><td><b>Related Commands</b></td><td>CALibration:SECure:CODE
CALibration:SECure:STATe</td></tr>
</table>

CALibration:TINTerval:OFFSet

Purpose	This command compensates for the differences between Channel 1 and Channel 2	
Type	Instrument specific command	
Command Syntax	CALibration:TINTerval:OFFSet <offset_val>	
Command Parameters	<offset_val> = all real numbers	
***RST Value**	N/A	
Query Syntax	CALibration:TINTerval:OFFSet?	
Query Parameters	N/A	
Query Response	Returns the set <offset_val> parameter	
Description	This command compensates for the differences between Channel 1 and Channel 2 created by differences in circuitry and their components. **Calibration commands should only be executed by qualified personnel. Changing these values incorrectly can cause the instrument to perform improperly**	
Examples	**Command / Query**	**Response *(Description)***
	`CAL:TINT:OFFS 1.44e-9`	*(Sets the time interval offset)*
	`CAL:TINT:OFFS?`	1.44e-9 *(Returns the set time interval offset value)*
Related Commands	CALibration:SECure:CODE CALibration:SECure:STATe	

CONFigure[1|2](:SCALar]|:ARRay):NDUTy cycle|PDUTCycle|DCYCle

Purpose	This command configures a positive or negative duty cycle measurement
Type	Instrument specific command
Command Syntax	CONFigure[1|2](SCALar]|:ARRay):NDUTycycle|DCYCLE[,<dcycle reference>[,<expected>[<array size>[,<expected value>[,<resolution>]]]]]
Command Parameters	<array size> = 1 to 1000 If SCALar is specified, this parameter is no longer valid If ARRay is specified, <array size> is a required parameter <dcycle reference> = 10 to 50
***RST Value**	<array size> = 1 <dcycle reference> = 50
Query Syntax	CONFigure?
Query Parameters	N/A
Query Response	Returns the current measurement configuration. This includes any channels, SCALar or ARRay settings and measurements selected.
Description	This command configures a positive or negative duty cycle measurement. The reference is the percent of the signals peak value (i.e. the percent of the peak-to-peak value as measured from the signals minimum.) This command will modify the following: • function – set to PDUT or NDUT • aperture – described below • aperture/events mode – set to APERture The input channel attenuation, offset, gain, level and slope can be modified. If neither of the optional arguments are used: • aperture is set to the default value If only the <expected value> argument is used: • aperture is set to the default value If both <expected value> and <resolution> are used the aperture is calculated as follows: $\text{apperature} = 10^{\left(-9+\log\langle\text{expected}\rangle-\log\langle\text{resolution}\rangle\right)}$ with a minimum of 1e-8 and a maximum of 5 seconds. A longer aperture may be set with the SENSe: APERture command.
Example	See CONFigure[1|2|10|20](:SCALar]|:ARRay):TOTalize for example.
Related Commands	MEASure commands SENSe commands

CONFigure[1|2](:SCALar]|:ARRay):NWIDth|PWIDth

Purpose	This command configures the counter to measure the positive or negative pulse width time of the signal on the CONFigure suffix input channel
Type	Instrument specific command
Command Syntax	CONFigure[1|2](SCALar]|:ARRay):NWIDth|PWIDth[<array size>[,<pwidth reference>[,<expected value>[,<resolution>]]]]
Command Parameters	<array size> = 1 to 1000 <pdwidth reference> = 10 to 90
***RST Value**	<array size> = 1 If SCALar is specified, this parameter is no longer valid If ARRay is specified, <array size> is a required parameter <pdwidth reference> = 50
Query Syntax	CONFigure?
Query Parameters	N/A
Query Response	Returns the current measurement configuration. This includes any channels, SCALar or ARRay settings and measurements selected.
Description	This command configures the counter to measure the positive or negative pulse width time of the signal on the CONFigure suffix input channel. The units of the <reference> are percentage. The units of <expected value> and <resolution> are seconds. If the <expected value> argument is used, the expected period of the input signal should be used, not the expected pulse width. This measurement uses both comparators of the input channel. The reference value is used to set the comparator threshold level to a percentage of the peak-to-peak signal. If a reference value is specified and INPut:SETup:AUTO is set to OFF, then INPut:SETup:AUTO is set to ONCE. If a reference value is not specified, the input channel comparators 1 and 2 levels will be set to 0 V. This command will modify the following: • function – set to PWID or NWID • aperture – described below • aperture/events mode – set to APERture The input channel attenuation, offset, gain, level and slope can be modified. If neither of the optional arguments are used: • aperture is set to the default value If only the <expected value> argument is used: • aperture is set to the default value If both <expected value> and <resolution> are used the aperture is calculated as follows: $\text{apperature} = 10^{\left(-9+\log\langle \text{expected}\rangle-\log\langle \text{resolution}\rangle\right)}$ with a minimum of 1e-8 and a maximum of 5 seconds. A longer aperture may be set with the SENSe: APERture command.
Example	See CONFigure[1|2|10|20](:SCALar]|:ARRay):TOTalize for example.
Related Commands	MEASure commands SENSe commands

CONFigure[1|2](:SCALar]|:ARRay):PHASe

Purpose	This command configures a phase measurement
Type	Instrument specific command
Command Syntax	CONFigure[1|2](SCALar]|:ARRay):PHASe[<array size>[,<expected value>[,<resolution>]]]
Command Parameters	<array size> = 1 to 1000 If SCALar is specified, this parameter is no longer valid If ARRay is specified, <array size> is a required parameter
***RST Value**	1
Query Syntax	CONFigure?
Query Parameters	N/A
Query Response	Returns the current measurement configuration. This includes any channels, SCALar or ARRay settings and measurements selected.
Description	This command configures a phase measurement. The suffix selects the channel for the beginning of the measurement. For example, CONF1:PHASe will set up the instrument to perform a phase measurement from Channel 1 to Channel 2, whereas CONF2:PHASe will set up the instrument to perform a phase measurement from Channel 2 to Channel 1. This command will modify the following: • Function set to PHASe • Aperture/events mode set to aperture If auto setup is ON or ONCE the input attenuation, offset, gain, level and slope can be modified. **Note**: Phase measurements use all available hardware timers. When the counter is in this mode the aperture is controlled by software and has a minimum period of approximately 10 ms.
Example	See CONFigure[1|2|10|20](:SCALar]|:ARRay):TOTalize for example.
Related Commands	MEASure commands SENSe commands

CONFigure[1|2](:SCALar]|:ARRay):RTIMe|FTIMe|RISE:TIME|FALL:TIME

Purpose	This command configures the counter to measure the rise or fall time of the signal on the CONFigure suffix input channel
Type	Instrument specific command
Command Syntax	CONFigure[1|2](SCALar]|:ARRay):RTIMe|FTIMe|RISE:TIME|FALL:TIME[<array size>[,<low reference>[,<high reference>[,<expected value>[,<resolution>]]]]]
Command Parameters	<array size> = 1 to 1000 If SCALar is specified, this parameter is no longer valid If ARRay is specified, <array size> is a required parameter <low reference> = 10 to 90 <high reference> = 10 to 90
***RST Value**	<array size> = 1 <low reference> = 10 <high reference> = 90
Query Syntax	CONFigure?
Query Parameters	N/A
Query Response	Returns the current measurement configuration. This includes any channels, SCALar or ARRay settings and measurements selected.
Description	This command configures the counter to measure the rise or fall time of the signal on the CONFigure suffix input channel. The unit of the <low reference> and <high reference> are a percentage. The units of <expected value> and <resolution> are seconds. If the <expected value> argument is used the expected period of the input signal should be used not the expected rise/fall time. This measurement uses both comparators of the input channel. If a reference value is specified and INPut:SETup:AUTO is set to OFF, INPut:SETup:AUTO will be set to ONCE. If a reference value is not specified, the input channel comparator 1 level will be set to -0.25 V and input channel comparator 2 level will be set to +0.25 V for a rise time measurement. For fall time the reverse is set. This command will modify the following: • function – set to RTIMe or FTIMe • aperture – described below • aperture/events mode – set to APERture The input channel attenuation, offset, gain, level and slope can be modified. If neither of the optional arguments are used: • aperture is set to the default value If only the <expected value> argument is used: • aperture is set to the default value If both <expected value> and <resolution> are used the aperture is calculated as follows: $\text{apperature} = 10^{\left(-9+\log\langle\text{expected}\rangle-\log\langle\text{resolution}\rangle\right)}$ with a minimum of 1e-8 and a maximum of 5 seconds. A longer aperture may be set with the SENSe: APERture command.
Example	See CONFigure[1|2|10|20](:SCALar]|:ARRay):TOTalize for example.
Related Commands	MEASure commands SENSe commands

CONFigure[1|2](:SCALar]|:ARRay):TINTerval

Purpose	This command sets the counter to make a time interval measurement
Type	Instrument specific command
Command Syntax	CONFigure[1|2](SCALar]|:ARRay):TINTerval[<array size>[,<expected value>[,<resolution>]]]
Command Parameters	<array size> = 1 to 1000 If SCALar is specified, this parameter is no longer valid If ARRay is specified, <array size> is a required parameter
***RST Value**	1
Query Syntax	CONFigure?
Query Parameters	N/A
Query Response	Returns the current measurement configuration. This includes any channels, SCALar or ARRay settings and measurements selected.
Description	This command sets the counter to make a time interval measurement. This measurement is made between input Channels 1 and 2. The CONFigure suffix selects the input channel for the beginning of the interval. The end of the interval will be from the remaining channel. The measurement is made from the first detected rising edge on the first channel to the first following rising edge on the second channel. If the <expected value> argument is used the expected period of the input signal should be used not the expected timer interval. This command will modify the following: • function – set to TINTerval • aperture – described below • aperture/events mode – set to APERture If autosetup mode is ON or ONCE, the input channel attenuation, offset, gain, level and slope can be modified. If neither of the optional arguments are used: • aperture is set to the default value If only the <expected value> argument is used: • aperture is set to the default value If both <expected value> and <resolution> are used the aperture is calculated as follows: $\text{apperature} = 10^{\left(-9+\log\left\langle \text{expected} \right\rangle - \log\left\langle \text{resolution} \right\rangle\right)}$ with a minimum of 1e-8 and a maximum of 5 seconds. A longer aperture may be set with the SENSe:TINTerval:APERture command.
Example	See CONFigure[1|2|10|20](:SCALar]|:ARRay):TOTalize for example.
Related Commands	MEASure commands SENSe commands

CONFigure[1|2](:SCALar]|:ARRay)[:VOLTage][<volt_func>]

Purpose	These commands configure the counter to measure the voltage on the CONFigure suffix input channel
Type	Instrument specific command
Command Syntax	CONFigure[1|2](SCALar]|:ARRay)[:VOLTage]:[<volt_func>][<array size>[,<expected value>[,<resolution>]]]] <volt_func> = :AC?, :DC?, :MINimum?, :MAXimum?, :PTPeak?
Command Parameters	<array size> = 1 to 1000 If SCALar is specified, this parameter is no longer valid If ARRay is specified, <array size> is a required parameter
***RST Value**	1
Query Syntax	CONFigure?
Query Parameters	N/A
Query Response	Returns the current measurement configuration. This includes any channels, SCALar or ARRay settings and measurements selected.
Description	These commands configure the counter to measure the voltage on the CONFigure suffix input channel. The <expected value> and <resolution> parameters are accepted but ignored. The maximum and minimum voltage of the input signal is determined assuming either a DC signal or a repetitive signal with a frequency of at least 1000 Hz. The user must select the proper INPut:COUPling and INPut:IMPedance separately. The voltage measurements are calculated as follows: • AC = (maximum – minimum) /2.828 • DC = (maximum – minimum) /2 • MAXimum = maximum • MINimum = minimum • PTPeak = maximum – minimum These commands will modify the following: • input setup – no effect • function – set to AC, DC, MIN, MAX or PTP • autosetup mode – no effect • aperture/events mode – no effect The actions of these commands are modified by the following: • <expected value> - no effect • <resolution> - no effect • autosetup mode – no effect • aperture/events mode – no effect
Example	See CONFigure[1|2|10|20](:SCALar]|:ARRay):TOTalize for example.
Related Commands	MEASure commands SENSe commands

CONFigure[1|2|3](:SCALar]|:ARRay):FREQuency

Purpose	This command configures the counter to measure the frequency of the signal on the CONFigure suffix input channel
Type	Instrument specific command
Command Syntax	CONFigure[1|2|3](SCALar]|:ARRay):FREQuency[<array size>[,<expected value>[,<resolution>]]]
Command Parameters	<array size> = 1 to 1000 If SCALar is specified, this parameter is no longer valid If ARRay is specified, <array size> is a required parameter
***RST Value**	1
Query Syntax	CONFigure?
Query Parameters	Returns the current measurement configuration. This includes any channels, SCALar or ARRay settings and measurements selected.
Query Response	Returns the current measurement configuration. This includes any channels, SCALar or ARRay settings and measurements selected.
Description	This command configures the counter to measure the frequency of the signal on the CONFigure suffix input channel. The units of <expected value> and <resolution> are both Hz. This command will modify the following: • function – set to FREQuency • aperture – described below • aperture/events mode – set to APERture If autosetup mode is ON or ONCE the input channel attenuation offset gain level and slope can be modified If neither of the optional arguments are used: • aperture is set to the default value If only the <expected value> argument is used: • aperture is set to the default value If both <expected value> and <resolution> are used, the aperture is calculated as follows: $\text{apperature} = 10^{\left(-9+\log\langle \text{expected}\rangle - \log\langle \text{resolution}\rangle\right)}$ with a minimum of 1e-8 and a maximum for 5 seconds. A longer aperture may be set with the SENSe:FREQuency:APERture command.
Example	See CONFigure[1|2|10|20](:SCALar]|:ARRay):TOTalize for example.
Related Commands	MEASure commands SENSe commands

CONFigure[1|2|3](:SCALar]|:ARRay):FREQuency:RATio

Purpose	This command configures the counter to measure the ratio of the frequencies of the signals on the CONFigure suffix input channel and <second channel>
Type	Instrument specific command
Command Syntax	CONFigure[1|2|3](SCALar]|:ARRay):FREQuency:RATio[<array size>],<second_channel>[,<expected value>[,<resolution>]]
Command Parameters	<array size> = 1 to 1000 If SCALar is specified, this parameter is no longer valid If ARRay is specified, <array size> is a required parameter
***RST Value**	1
Query Syntax	CONFigure?
Query Parameters	N/A
Query Response	Returns the current measurement configuration. This includes any channels, SCALar or ARRay settings and measurements selected.
Description	This command configures the counter to measure the ratio of the frequencies of the signals on the CONFigure suffix input channel and <second channel>. The <expected value> and <resolution> arguments have no units. The parameters <expected value> and <resolution> are accepted but are not used. This command will modify the following: • function – set to FREQuecy:RATio • aperture – set to default • aperture/events mode – set to APERture If autosetup mode is ON or ONCE the input channel attenuation offset gain level slope can be modified. The SENSe suffix selects the input channel for the numerator, the <second channel> selects the input channel for the denominator ratios of a channel to itself are always one and the counter will generate an error if programmed to do so. <second channel> can be 1, 2 or 3. When Channel 3 is not being used and the counter Mode is EVENts, the <second channel> will be used as the input to the EVENts and the other specified input channel will be used as the input to the EVENts counter.
Example	See CONFigure[1|2|10|20](:SCALar]|:ARRay):TOTalize for example.
Related Commands	MEASure commands SENSe commands

CONFigure[1|2|3](:SCALar]|:ARRay):PERiod

Purpose	This command configures the counter to measure the period of the signal on the CONFigure suffix input channel
Type	Instrument specific command
Command Syntax	CONFigure[1|2|3](SCALar]|:ARRay):PERiod[<array size>[,<expected value>[,<resolution>]]]
Command Parameters	<array size> = 1 to 1000 If SCALar is specified, this parameter is no longer valid If ARRay is specified, <array size> is a required parameter
***RST Value**	1
Query Syntax	CONFigure?
Query Parameters	N/A
Query Response	Returns the current measurement configuration. This includes any channels, SCALar or ARRay settings and measurements selected.
Description	This command configures the counter to measure the period of the signal on the CONFigure suffix input channel. The units of <expected value> and <resolution> are seconds. This command will modify the following: • function – set to PERiod • aperture – described below • aperture/events mode – set to APERture If autosetup mode is ON or ONCE the input channel attenuation, offset, gain, level and slope can be modified. If neither of the optional arguments are used: • aperture is set to the default value If only the <expected value> argument is used: • aperture is set to the default value If both <expected value> and <resolution> are used the aperture is calculated as follows: $\text{apperature} = 10^{\left(-9+\log\langle\text{expected}\rangle-\log\langle\text{resolution}\rangle\right)}$ with a minimum of 1e-8 and a maximum of 5 seconds. A longer aperture may be set with the SENSe:FREQuency:APERture command.
Example	See CONFigure[1|2|10|20](:SCALar]|:ARRay):TOTalize for example.
Related Commands	MEASure commands SENSe commands

CONFigure[1|2|10|20](:SCALar]|:ARRay):TOTalize

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command configures a totalized measurement</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">CONFigure[1|2|10|20|](SCALar]|:ARRay):TOTalize</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">CONFigure?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the current measurement configuration.
This includes any channels, SCALar or ARRay settings and measurements selected.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command configures a totalized measurement. The counter totalizes two selected channels simultaneously. Channels 1 and 2 are selected by either 1or 2. Channel 1 and the 1 GHz VCO are selected by 10. Channel 2 and the 1 GHz VCO are selected by 20. If either Channel 1 or 2 and the VCO measurement is selected, an elapsed time in nanoseconds is provided after the totalized results for the channel.</td></tr>
<tr><td rowspan="7"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>CONF2:ARR:NDUT 1000,25</code></td><td><i>(Configures the instrument to take 1000 negative duty cycle measurements with a trigger point of 25% of the signal’s peak on Channel 2)</i></td></tr>
<tr><td><code>CONF1:ARR:DCYC 100,50</code></td><td><i>(Configures the instrument to take 100 positive duty cycle measurements with at trigger point of 50% of the signal’s peak on Channel 1.)</i></td></tr>
<tr><td><code>CONF1:PHAS</code></td><td><i>(Configures the instrument to take a phase measurement from Channel 1 to Channel 2)</i></td></tr>
<tr><td><code>CONF1:TINT:DEL:EVEN 100</code></td><td><i>(Configures a time interval with delay measurement form Channel 1 to the 100th edge on Channel 2)</i></td></tr>
<tr><td><code>CONF10:TOT</code></td><td><i>(Sets up the instrument to totalize Channel 1 and the 1 GHz VCO)</i></td></tr>
<tr><td><code>CONF?</code></td><td>10:SCAL:TOT <i>(Returns the set configuration values)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">MEASure commands
SENSe commands</td></tr>
</table>

FETCh[<function>]?

<table>
<tr><td><b>Purpose</b></td><td>This query returns the values of measurements</td></tr>
<tr><td><b>Type</b></td><td>Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td>N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td>N/A</td></tr>
<tr><td><b>*RST Value</b></td><td><count> = the greatest measurement requested for the array
<start> = 1
<step> = 1</td></tr>
<tr><td><b>Query Syntax</b></td><td>FETCh[<function>]?
<function> = :DCYCle?, :FALL:TIME?, FREQuency?, FREQuency:RATio?, FTIMe?, NDUTycycle?, PDUTycycle?, NWIDth?, PWIDth?, PHASe?, PERiod?, :RISE:TIME?, RTIMe?, TINTerval?, TINTerval:DELay?, :AC?, :DC?, :MINimum?, :MAXimum?, :PTPeak?</td></tr>
<tr><td><b>Query Parameters</b></td><td><count> = 1 to 1000
<start> = 1 to 1000
<step> = 1 to 1000</td></tr>
<tr><td><b>Query Response</b></td><td>See Description</td></tr>
<tr><td><b>Description</b></td><td>If a single measurement is made, the format of the returned value is:
• n.nnnnnnnnnnnnnnnesxx<1f>
If an array measurement is made the format of the returned values is:
• #abbrn.nnnnnnnnnnnnnnnesxx.rn.nnnnnnnnnnnnnnesxx, …, rn.nnnnnnnnnnnnnnnesxx<1f>
where
• a = number of b digits
• b = number of characters in the returned data not including #abb
• r = space or-
• n = value
• s = + or –
• xx = exponent
The default value of the <count> parameter is the number of measurements requested for the array. The default value of <start> is 1. The default value of <step> is 1. The number of values returned is <count>. The first of the values returned is value <start>. Then every <step> values after start are returned.

If a CONFigure command is made measure frequency, period can also be fetched after the command is initiated.</td></tr>
<tr><td><b>Example</b></td><td><table>
<tr><th>Command / Query</th><th>Response <i>(Description)</i></th></tr>
<tr><td><code>ARM:SOUR:CAT?</code></td><td>BUS, COUNTER, HOLD, IMMEDIATE, TTLTRG0, TTLTRG1, TTLTRG2, TTLTRG3, TTLTRG4, TTLTRG5, TTLTRG6, TTLTRG7, TIMER, CTR_EXTARM, CTR_CHAN2</td></tr>
<tr><td><code>CONF:FREQ</code></td><td><i>(Configures the counter to read frequency)</i></td></tr>
<tr><td><code>TRIG:IMM</code></td><td><i>(Arms counter to take an immediate measurement)</i></td></tr>
<tr><td><code>FETC?</code></td><td>1.234567890000000e+06</td></tr>
</table></td></tr>
<tr><td><b>Related Commands</b></td><td>CONFigure commands
SENSe commands</td></tr>
</table>

FETCh:COUNt?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This query returns the number of measurements completed</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">FETCh:COUNt?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">The number of measurements requested for the array.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command returns the number of measurements completed. This command may be used to monitor the progress of a measurement or an array of measurements.
<b>CAUTION</b>: Do not continuously issue FETCh:COUNt? or STAT:OPER:COND? queries to check if the measurement is complete. Provide a minimum 100 ms delay between each query to permit the multitasking system to process the measurement efficiently or use *SRQ to avoid processing delays caused by polling.</td></tr>
<tr><td><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td><code>CONF:FREQ</code></td><td><i>(Configures the counter to measure frequency)</i></td></tr>
<tr><td></td><td><code>ARM:STOP:SOUR TTLT0</code></td><td></td></tr>
<tr><td></td><td><code>INIT</code></td><td><i>(Initiates the measurement)</i></td></tr>
<tr><td></td><td><code>FETC:COUN?</code></td><td>0 <i>(Returns the number of measurements)</i></td></tr>
<tr><td></td><td><code>ARM:IMM</code></td><td><i>(Arms counter to take an immediate measurement)</i></td></tr>
<tr><td></td><td><code>FETC:COUN?</code></td><td>1</td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">CONFigure commands
SENSe commands</td></tr>
</table>

FETCh:TOTalize?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This query returns the total counts from Channel 1 and 2</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">FETCh:TOTalize?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Description</b></td><td colspan="2">The totalize measurement returns two integers of up to 15 digits each. The first integer is the total counts from input Channel 1 and the second integer is the total counts from input Channel 2.</td></tr>
<tr><td><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td><code>MEAS:TOT?</code></td><td>“9.179000000000000e+03, 0.000000000000000e+00”</td></tr>
<tr><td></td><td><code>FETC?</code></td><td>“6.271005500000000e+08, 0.000000000000000e+00”</td></tr>
<tr><td></td><td><code>FETC?</code></td><td>“7.216138500000000e+08, 0.000000000000000e+00”</td></tr>
<tr><td></td><td><code>FETC?</code></td><td>“8.170426200000000e+08, 0.000000000000000e+00”</td></tr>
<tr><td></td><td><code>FETC?</code></td><td>“1.005015850000000e+09, 0.000000000000000e+00”</td></tr>
<tr><td></td><td><code>FETC?</code></td><td>“1.121600670000000e+09, 0.000000000000000e+00”</td></tr>
<tr><td></td><td><code>ABORT</code></td><td></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">CONFigure commands
SENSe commands</td></tr>
</table>

FETCh[:VOLTage?]

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This query sets up to return the results of the pervious voltage measurement</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">FETCh[:VOLTage]<volt_func>?[<count>[,<start>[,<step>]]]</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2"><volt_func> = :AC?, :DC?, :MINimum?, :MAXimum?, :PTPeak?
<count> = 1 to 1000
<start> = 1 to 1000
<step> = 1 to 1000</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">See Description</td></tr>
<tr><td><b>Description</b></td><td colspan="2">Sets up to return the results of the previous voltage measurement. If a single voltage measurement has been made, any other voltage function results may be fetched. If an array of voltage measurements have been made, only the results of the requested voltage measurement function may be fetched.
The default value <count> is the number of measurements requested for the array. The default value of <start> is 1. The default value of <step> is 1. The number of values returned is <count>. The first of the values returned is value <start>. Then every <step> values after start are returned.
If a single measurement is made, the format of the returned voltage is:
• n.nnnn<1f>
If an array measurement is made, the format of the returned values is:
• #abbrn.nnnnesxx.rn.nnnnesxx., …, rn.nnnnesxx<1f>
where:
• a = number of b digits
• b = number of characters in the returned data not including #abb
• r = or space
• n = value
• s = + or –
• xx = exponent</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td>FETC:ARR:DC? 10</td><td>#3119 2.5712e+01, 1.5392e+02,-1.0252e+02, 2.5642e+02,-9.7442e+01, 3.0777e+01,-2.2567e+02, 2.5647e+02,-9.7447e+01, 3.0777e+01</td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">CONFigure commands
SENSe commands</td></tr>
</table>

INITiate:CONTinuous

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Verifies whether the counter is taking continuous measurements</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">INITiate:CONTinuous</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">INITiate:CONTinuous?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns 0 if the counter is not taking continuous measurements
Returns 1 if the counter is taking continuous measurements.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">Measurements are continuously made until a *RST or ABORt command is used while the counter is continuously making measurements the FETCh? command may be used to return the results of the most recently completed measurement.
Initiates its current trigger sequence. After the instrument has completed the current trigger sequence, it re-enters the initiated state. It will continue this cycle until an abort, reset or INIT:CONT OFF is received.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>INIT:CONT</code>
<code>INIT:CONT?</code></td><td>
1</td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">READ?
MEASure
ARM</td></tr>
</table>

INITiate[:IMMediate]

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command initiates the current trigger sequence</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Description</b></td><td colspan="2">Initiates its current trigger sequence. After the instrument has completed the current trigger sequence, it enters the idle state.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>INIT:IMM</code></td><td>Initiates the current trigger sequence</td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">READ?
MEASure?
ARM</td></tr>
</table>

INPut[1|2]:ATTenuation [DEFault | MINimum | MAXimum]

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command sets the input block signal attenuator for the specified channel</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">INPut[1|2]:ATTenuation <attentuation> [DEFault | MINimum | MAXimum]</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><attenuation> = 1 or 10 (Default value = 1)</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">1</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">INPut[1|2]:ATTenuation? [DEFault | MINimum | MAXimum]</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Without one of the optional parameters, this query returns the current setting of the input block signal attenuator for the specified channel. If one of the optional parameters is used, the default, minimum or maximum value for attenuation is returned instead.

The possible values returned are 1 or 10.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command sets the input block signal attenuator for the specified channel.
If <attenuation> is less than 2, the attenuator is set to 1.
If <attenuation> is greater than 2, the attenuator is set to 10.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

INPut[1|2]:COMParator[1|2]:LEVel:RELative

Purpose	This command sets the comparator threshold level voltage of the channel and comparator selected	
Type	Instrument specific command	
Command Syntax	INPut[1|2]:COMParator[1|2]:LEVel:RELative <relative level>	
Command Parameters	<relative level> = -4.5 to 4.5 for 1x range or -45 to 45 for 10x range	
***RST Value**	0	
Query Syntax	INPut[1|2]:COMParator[1|2]:LEVel:RELative?	
Query Parameters	N/A	
Query Response	Returns the current threshold level.	
Description	This command sets the comparator threshold level voltage of the channel and comparator selected. If the input number and comparator number are different, the comparator number is the only number that is valid when this command is called.	
Example	**Command / Query**	**Response *(Description)***
Related Commands		

INPut[1|2]:COMParator[1|2]:SLOPe [DEFault]

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command sets the slope for the selected input channel and comparator</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">INPut[1|2]:COMParator[1|2]:SLOPe<slope> [DEFault]</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">&lt;slope> = POSitive or NEGative (Default: POSitive)</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">POSitive</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">INPut[1|2]:COMParator[1|2]:SLOPe? [DEFault]</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Without one of the optional parameters, this query returns the current setting of the slope for the selected input channel and comparator. If the optional argument is used, the default value for the slope is returned.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command sets the slope for the selected input channel and comparator. The slope may be either positive or negative.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

INPut[1|2]:COUPling

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command sets the input block signal coupling for the specified channel AC or DC</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">INPut[1|2]:COUPling <coupling> [DEFault]</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><coupling> = AC or DC (Default = AC)</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">AC</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">INPut[1|2]:COUPling? [DEFault]</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Without the optional parameter, this command returns the current setting of the input block signal coupling for the specified channel. If the optional argument DEFault is included, the default coupling is returned.
The possible values returned are “AC” and “DC”.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command sets the input block signal coupling for the specified channel to AC or DC.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

INPut[1|2]:FILTer:FREQuency

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command has no effect on the unit.</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">INPut[1|2]:FILTer:FREQuency [MINimum | MAXimum | DEFault] or
INPut[1|2]:FILTer:LPASs:REQuency [MINimum | MAXimum | DEFault]</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><filtfreq> = 20000000</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">20000000</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">INPut[1|2]:FILTer[:FREQuency]? or
INPut[1|2]:FILTer:LPASs:FREQuency?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns 20000000.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command has no effect on the unit. Querying the <filtfreq> parameter will always return 20000000. The filter frequency is always 155 kHz at 3 db and 50 kHz at the 5% point.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

INPut[1|2]:FILTer[:STATe] [DEFault]

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command sets the input block signal low-pass filter state for the selected channel to ON or OFF.</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">INPut[1|2]:FILTer[:STATe] <filter_state> [DEFault]</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><filter_state> = OFF/ON (Default = ON)</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">ON</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">INPut[1|2]:FILTer[:STATe]?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the current <filter_state> parameter value.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command sets the input block signal low-pass filter state for the selected channel to ON or OFF. Without the optional parameter, this command moves to the output buffer the current setting of the input low-pass filter state for the specified channel. If the optional argument DEFault is included, the default filter state is moved to the output buffer.

The possible values returned are:
1 for ON with the 155 kHz filter being used
0 for OFF</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td>INPut1:FILT:STAT ON</td><td>ON</td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

INPut[1|2]:IMPedance [DEFault]

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command sets the input terminating impedance for the specified channel</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">INPut[1|2]:IMPedance <impedance> [DEFault]</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><impedance> = 50 to 1e6 (Default = 1e6)</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">1e6</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">INPut[1|2]:IMPedance? [DEFault]</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Without the optional parameter, this query returns the current setting of the input terminating impedance for the specified channel. If the optional argument DEFault is included, the default impedance is returned.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command sets input terminating impedance for the specified channel. If <impedance> is less than 60, the impedance is set to 50 Ω. If <impedance> is greater than 60, the impedance is set to 1e6 Ω (1 MΩ).</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

INPut[1|2]:SETup

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command sets up Input Channel 1 or 2 by specifying an expected peak-to-peak input voltage and, optionally, an expected input offset voltage</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">INPut[1|2]:SETup <expected PTP>[,<expected offset>]</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command sets up Input Channel 1 or 2 by specifying an expected peak-to-peak input voltage and, optionally, an expected input offset voltage. The counter will set the input channel attenuation, offset and gain to settings that would center the expected signal in 80% of the comparator range. Both comparators slope is set to POSitive level to 0 V and hysteresis to MAXimum.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

INPut[1|2]:SETup:AUTO

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command controls the auto setup of Input Channels 1 and 2</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">INPut[1|2]:SETup:AUTO <auto></td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><auto> = ON | OFF | ONCE</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">ONCE</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">INPut[1|2]:SETup:AUTO?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">This command moves the current setting of autosetup to the output buffer.
The return values will be:
• 0 for OFF
• 1 for ON
• ONCE for ONCE</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command controls the auto setup of Input Channels 1 and 2. When ON, each measurement will be preceded by an automatic setup of the input channel(s) involved in the measurement. When OFF, the current settings are used for the measurement. For ARRay measurements, the ONCE setting will cause an auto setup to occur only for the first measurements. For SCALar measurements, ONCE will cause an auto setup with each measurement.
Auto setup adjusts the input channel’s attenuation offset and gain so that he input signals peak-to-peak voltage into the comparator is centered on about 80% of the range of the comparator.
INPut commands which manually set the input channel hardware other than COUPling, IMPedance and FILTering will remain in effect when a measurement is initiated only if auto setup is set to OFF.</td></tr>
<tr><td><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

INPut[1|2]:SETup:AUTO:TIMe

<table>
<tr><td><b>Purpose</b></td><td>This command sets the duration of time that will be allowed for a signal to occur before a measurement is aborted</td></tr>
<tr><td><b>Type</b></td><td>Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td>INPut[1|2]:SETup:AUTO:TIMe</td></tr>
<tr><td><b>Command Parameters</b></td><td>N/A</td></tr>
<tr><td><b>*RST Value</b></td><td>0.02</td></tr>
<tr><td><b>Query Syntax</b></td><td>INPut[1|2]:SETup:AUTO:TIMe?</td></tr>
<tr><td><b>Query Parameters</b></td><td>N/A</td></tr>
<tr><td><b>Query Response</b></td><td>Returns the set value</td></tr>
<tr><td><b>Description</b></td><td>This command sets the duration of time the counter will wait before aborting a measurement. If a signal has not been received within this time interval, the measurement is aborted. If the frequency of a signal is less than 50 Hz, this setting should be adjusted accordingly (frequency = 1/time). This command establishes the lowest frequency that can be measured by the counter.

This time duration is taken into consideration when the INPut:SETup:AUTO command is used. The time used will be the longer of the two values set for the aperture and INPut:SETup:AUTO:TIMe settings.</td></tr>
<tr><td><b>Example</b></td><td><table>
<tr><th>Command / Query</th><th>Response <i>(Description)</i></th></tr>
<tr><td><code>INP1:SET:AUTO:TIM 0.4</code></td><td><i>(Sets the lowest measurable frequency to 25 Hz)</i></td></tr>
<tr><td><code>INP1:SET:AUTO:TIM?</code></td><td>0.4 <i>(Returns the set value for the wait time)</i></td></tr>
</table></td></tr>
<tr><td><b>Related Commands</b></td><td>INPut[1|2]:SETup:AUTO
INPut[1|2]:SETup:TIMe</td></tr>
</table>

INPut[1|2]:SETup:TIMe

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command sets the duration of time that will be allowed for a signal to occur before a measurement is aborted</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">INPut[1|2]:SETup:TIMe</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><time_out></td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">0.04</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">INPut[1|2]:SETup:TIMe?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the current value of the <time_out> parameter</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command sets the amount of time after an INITiate before a measurement is aborted. If a signal is not received within this allotted period of time the measurement is aborted. If a signal source of less than 25 Hz is used, then this measurement should be adjusted accordingly (frequency = 1/time).

<b>Note</b>: The time used will be the longer of the two values set for the aperture and INPut:SETup:TIMe settings.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>INP1:SET:TIM 0.1</code>

<code>INP1:SET:TIM?</code></td><td><i>(Sets the allowable time needed to measure a 10 Hz signal)</i>
0.1 <i>(Returns the set time out value)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

MEASure[1|2]([:SCALar]|:ARRay]:DCYCle|NDUTycycle|PDUTycycle?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This query performs a positive or negative duty cycle measurement</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">1</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">MEASure[1|2]([:SCALar]|:ARRay]:DCYCle|NDUTycycle|PDUTycycle? [<array size>[,<reference>[,<expected value>[,<resolution>]]]</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2"><array size> = 1 to 1000
If SCALar is specified, <array size> is not a valid parameter.
If ARRay is specified, <array size> is a required parameter</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">This command will modify the following:
• function – set to PDUT or NDUT
• aperture – described below
• aperture/events mode – set to aperture
The input channel attenuation, offset, gain, level and slope can be modified.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This query performs a positive or negative duty cycle measurement. The reference is the percent of the signal’s peak value (i.e. the percent of the peak-to-peak value as measured from the signal’s minimum.) Note that when DCYCle is the same as PDUTycycle, the <expected value> and <resolution> are accepted but not used.</td></tr>
<tr><td rowspan="6"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>MEAS2:ARR:NDUT? 1000,25</code></td><td><i>(Takes 1000 negative duty cycle measurements with a trigger point of 25% of the signal’s peak)</i></td></tr>
<tr><td><code>MEAS2:ARR:PDUT? 100, 50</code></td><td><i>(Takes 100 positive duty cycle measurements with a trigger point of 50% of the signal’s peak value)</i></td></tr>
<tr><td><code>MEAS1:PHAS?</code></td><td><i>(Take a phase measurement from Channel 1 to Channel 2)</i></td></tr>
<tr><td><code>MEAS:TINT:DEL:EVEN? 100</code></td><td><i>(Take a time interval with delay measurement from Channel 1 to the 100th edge on Channel 2)</i></td></tr>
<tr><td><code>MEAS10:TOT?</code></td><td><i>(Totalize Channel 1 and the 1 GHz VCO)</i></td></tr>
<tr><td><b>Related Command</b></td><td colspan="2">CONFigure:SENSe</td></tr>
</table>

MEASure[1|2]([:SCALar]|:ARRay):NWIDth|PWIDth?

Purpose	This query configures the counter to measure the positive or negative pulse width time of the signal on the MEASure suffix input channel
Type	Instrument specific query
Command Syntax	N/A
Command Parameters	N/A
***RST Value**	1
Query Syntax	MEASure[1|2]([:SCALar]|:ARRay):NWIDth|PWIDth? [<array size>[,<reference> [,<expected value>[,<resolution>]]]
Query Parameters	<array size> = 1 to 1000 If SCALar is specified, <array size> is not a valid parameter. If ARRay is specified, <array size> is a required parameter
Query Response	This command will modify the following: • function – set to PWID or NWID • aperture – described below • aperture/events mode – set to APERture
Description	This query configures the counter to measure the positive or negative pulse width time of the signal on the MEASure suffix input channel. The measurement is initiated and the result placed in the output buffer. The units of the <reference> are percentage. The units of <expected value> and <resolution> are seconds. If the <expected value> argument is used, the expected period of the input signal should be used not the expected pulse width. This measurement uses both comparators of the input channel. The <reference value> is used to set the comparator threshold levels to a percentage of the peak-to-peak signal. If a reference value is specified and INPut:SETup:AUTO is set to OFF INPut:SETup:AUTO will be set to ONCE. If a reference value is not specified the input channel comparators 1 and 2 levels will be set to 0 V. The input channel attenuation, offset, gain, level and slope can be modified if the optional arguments <expected value> and <resolution> are not used: • aperture is set to the default value If only the <expected value> argument is used: • aperture is set to the default If both <expected value> and <resolution> are used the aperture is calculated as follows: $\text{apperature} = 10^{\left(-9+\log\langle\text{expected}\rangle-\log\langle\text{resolution}\rangle\right)}$ with a minimum of 1e-8 and a maximum of five seconds. A longer aperture my be set with the SENSe:PWIDth:APERture command.
Example	**Command / Query** **Response *(Description)***
Related Command	CONFigure:SENSe

MEASure[1|2]([:SCALar]|:ARRay):PHASe?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This query performs a phase measurement</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">1</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">MEASure[1|2]([:SCALar]|:ARRay):PHASe? [<array size> [,<expected value> [,<resolution&gt;]]]</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">&lt;array size> = 1 to 1000
If SCALar is specified, <array size> is not a valid parameter.
If ARRay is specified, <array size> is a required parameter</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">This command will modify the following:
• Function set PHASe
• Aperture/events mode set to APERture
The input channel attenuation, offset, gain, level and sloped can be modified.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This query performs a phase measurement. The suffix selects the channel for the beginning of the measurement. For example MEAS1:PHASe will perform a phase measurement from Channel 1 to Channel 2, where MEAS2:PHASe performs a phase measurement from Channel 2 to Channel 1.
<b>Note</b>: Time Interval With Delay Phase and Duty Cycle use all available hardware timers. When the counter is in one of these modes the aperture is controlled by software and has a minimum period of approximately 10 ms.</td></tr>
<tr><td><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td><code>MEAS2:ARR:NDUT? 1000,25</code></td><td><i>(Takes 1000 negative duty cycle measurements with a trigger point of 25% of the signal's peak)</i></td></tr>
<tr><td></td><td><code>MEAS2:ARR:PDUT? 100, 50</code></td><td><i>(Takes 100 positive duty cycle measurements with a trigger point of 50% of the signal's peak value)</i></td></tr>
<tr><td></td><td><code>MEAS1:PHAS?</code></td><td><i>(Take a phase measurement from Channel 1 to Channel 2)</i></td></tr>
<tr><td></td><td><code>MEAS:TINT:DEL:EVEN? 100</code></td><td><i>(Take a time interval with delay measurement from Channel 1 to the 100th edge on Channel 2)</i></td></tr>
<tr><td></td><td><code>MEAS10:TOT?</code></td><td><i>(Totalize Channel 1 and the 1 GHz VCO)</i></td></tr>
<tr><td><b>Related Command</b></td><td colspan="2">CONFigure:SENSe</td></tr>
</table>

MEASure[1|2]([:SCALar]|:ARRay):RTIMe|FTIMe|RISE:TIME|FALL:TIME?

Purpose	This query configures the counter to measure the rise and or fall time of the signal on the MEASure suffix input channel	
Type	Instrument specific query	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	<array size> = 1 <low reference> = 10 <high reference> = 90	
Query Syntax	MEASure[1|2]([:SCALar]|:ARRay):RTIMe|FTIMe? [<array size>[,<low reference>[,<high reference>[,<expected value>[,<resolution>]]]]	
Query Parameters	<array size> = 1 to 1000 If SCALar is specified, <array size> is not a valid parameter. If ARRay is specified, <array size> is a required parameter <low reference> = 10 to 90 <high reference> = 10 to 90	
Query Response	This command will modify the following: • function – set to TRIMe or FTIMe • aperture – described below • aperture/events mode – set to APERture If auto setup mode is ON or ONCE the input channel attenuation, offset, gain, level and slope can be modified.	
Description	This query configures the counter to measure the rise and or fall time of the signal on the MEASure suffix input channel. The measurement is initiated and the result is placed in the output buffer. The units of the <low reference> and <high reference>are percentage. The units of <expected value> and <resolution> are seconds. If the <expected value> argument is used the expected period of the input signal should be used instead of the expected rise/fall time. This measurement uses both comparators of the input channel. If a reference value is specified and INPut:SETup:AUTO is set to OFF INPut:SETup:AUTO will be set to ONCE. If a reference value is not specified, the input channel comparator 1 level will be set to ±0.25 V for a rise time measurement. For fall time, the reverse is set.	
Example	**Command / Query**	**Response *(Description)***
Related Command	CONFigure:SENSe	

MEASure[1|2]([:SCALar]|:ARRay):TINTerval?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Sets the counter to make a time interval measurement and fetch the result</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">MEASure[1|2]([:SCALar]|:ARRay):TINTerval?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">This command will modify the following:
• function – set to TINT
• aperture – described below
• aperture/events mode – set to APERture</td></tr>
<tr><td><b>Description</b></td><td colspan="2">Sets the counter to make a time interval measurement and fetch the result. This measurement is made between input Channels 1 and 2. The MEASure suffix selects the input channel for the beginning of the interval and, by default, the end of the interval will be from the remaining channel. The measurement is made from the first detected rising edge on the first channel to the first following rising edge on the second channel. If the <expected value> argument is used, then the expected period of the input signal should be used, not the expected time interval.
If auto setup mode is ON or ONCE the input channel attenuation, offset, gain, level and slope can be modified.
If neither of the optional arguments are used:
• aperture is set to the default value
If only the <expected value> argument is used:
• aperture is set to the default value
If both <expected value> and <resolution> are used, the aperture is calculated as follows:
$\text{apperature} = 10^{\left(-9+\log\langle\text{expected}\rangle-\log\langle\text{resolution}\rangle\right)}$
with a minimum of 1e-8 and a maximum of 5 seconds. A longer aperture may be set with the SENSe:TINTerval:APERture command.</td></tr>
<tr><td rowspan="6"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>MEAS2:ARR:NDUT? 1000,25</code></td><td><i>(Takes 1000 negative duty cycle measurements with a trigger point of 25% of the signal's peak)</i></td></tr>
<tr><td><code>MEAS2:ARR:PDUT? 100,50</code></td><td><i>(Takes 100 positive duty cycle measurements with a trigger point of 50% of the signal's peak value)</i></td></tr>
<tr><td><code>MEAS1:PHAS?</code></td><td><i>(Take a phase measurement from Channel 1 to Channel 2)</i></td></tr>
<tr><td><code>MEAS:TINT:DEL:EVEN? 100</code></td><td><i>(Take a time interval with delay measurement from Channel 1 to the 100th edge on Channel 2)</i></td></tr>
<tr><td><code>MEAS10:TOT?</code></td><td><i>(Totalize Channel 1 and the 1 GHz VCO)</i></td></tr>
<tr><td><b>Related Command</b></td><td colspan="2">CONFigure:SENSe</td></tr>
</table>

MEASure[1|2]([:SCALar]|:ARRay)[:VOLTage][<volt_func>]?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">These queries configure the counter to measure the voltage on the MEASure suffix input channel</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">1</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">MEASure[1|2]([:SCALar]|:ARRay)[:VOLTage][<volt_func>]?
[<volt_func>] = :AC?, :DC?, :MAX?, :MIN?, :PTP?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2"><array size> = 1 to 1000
If SCALar is specified, <array size> is not a valid parameter.
If ARRay is specified, <array size> is a required parameter</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">These commands can or will modify the following:
• function – set to AC, DC, MIN, MAX or PTP
• auto setup mode – no effect
• aperture/events mode – no effect</td></tr>
<tr><td><b>Description</b></td><td colspan="2">These queries configure the counter to measure the voltage on the MEASure suffix input channel. The measurement is initiated and the result placed in the output buffer. The <expected value> and <resolution> parameters are accepted but ignored.
The maximum and minimum voltage of the input signal is determined assuming either a DC signal or a repetitive signal with a frequency of at least 1000 Hz. The user must select the proper INPut:COUPling and INPut:IMPedance separately. The voltage measurements are calculated as follows:
• AC = (maximum – minimum) / 2.828
• DC = (maximum + minimum) / 2
• MAXimum = maximum
• MINimum = minimum
• PTPeak = maximum – minimum</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td></td></tr>
<tr><td><b>Related Command</b></td><td colspan="2">CONFigure:SENSe</td></tr>
</table>

MEASure[1|2|3]([:SCALar]|:ARRay):FREQuency?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Configures the counter to measure the frequency of the signal on the MEASure suffix input channel</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">0</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">MEASure[1|2|3]([:SCALar]|:ARRay):FREQuency? [<array size>[,<expected value> [,<resolution>]]]</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2"><array size> = 1 to 1000
If SCALar is specified, this parameter is no longer valid
If ARRay is specified, <array size> is a required parameter</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">This command will modify the following:
• function – set to FREQuency
• aperture – described below
• events/events mode – set to APERture</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This query configures the counter to measure frequency of the signal on the MEASure suffix input channel. The measurement is initiated and the result placed in the output buffer. The units of <expected value> and <resolution> are both Hertz.
If autosetup mode is ON or ONCE, the input channel attenuation, offset, gain, level and slope can be modified.
If neither of the optional arguments are used:
• aperture is set to the default
If only the <expected value> argument is used:
• aperture is set to the default value
If both <expected value> and <resolution> are used, the aperture is calculated as follows:
$\text{apperature} = 10^{\left(-9+\log\langle\text{expected}\rangle-\log\langle\text{resolution}\rangle\right)}$
with a minimum of 1e-8 and a maximum of five seconds a longer aperture may be set with the SENSe:FREQuency:APERture command.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td></td></tr>
<tr><td><b>Related Command</b></td><td colspan="2">CONFigure:SENSe</td></tr>
</table>

MEASure[1|2|3]([:SCALar]|:ARRay):FREQuency:RATio?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This query configures the counter to measure the ratio of the frequencies of the signals on the MEASure suffix input channel and <second channel></td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">1</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">MEASure[1|2|3]([:SCALar]|:ARRay):FREQuency:RATio? [<array size>[,<second channel>[,<expected value>[,<resolution>]]]]</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2"><array size> = 1 to 1000
If SCALar is specified, this parameter is no longer valid
If ARRay is specified, <array size> is a required parameter</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">This command will modify the following:
• function – set to FREQquency:RATio
• aperture – set to default
• aperture/events mode – set to APERture</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This query configures the counter to measure the ratio of the frequencies of the signals on the MEASure suffix input channel and <second channel>. The measurement is initiated and the results are placed in the output buffer. Ratio <expected> and <resolution> are accepted but are not used.
If autosetup mode is ON or ONCE the input channel attenuation, offset, gain, level and slope can be modified.
The SENSe suffix selects the input channel for the numerator. The <second> selects the input channel for the denominator. Ratios of a channel to itself are always one and the counter will generate an error if programmed to do it. The <second channel> can be 1, 2 or 3. When Channel 3 is not being used and the counter mode is EVENts, the other specified input channel will be used as the input to the EVENts counter.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td></td></tr>
<tr><td><b>Related Command</b></td><td colspan="2">CONFigure:SENSe</td></tr>
</table>

MEASure[1|2|3]([:SCALar]|:ARRay):PERiod?

Purpose	Configures the counter to measure a period of the signal on the MEASure suffix input channel
Type	Instrument specific query
Command Syntax	N/A
Command Parameters	N/A
***RST Value**	1
Query Syntax	MEASure[1|2|3]([:SCALar]|:ARRay):PERiod? [<array size>[,<expected value>[,<resolution>]]]
Query Parameters	<array size> = 1 to 1000 If SCALar is specified, <array size> is not a valid parameter. If ARRay is specified, <array size> is a required parameter
Query Response	This command will modify the following: • function – set to PERiod • aperture – described below • aperture/events mode – set to APERture
Description	Configures the counter to measure the period of the signal on the MEASure suffix input channel. The measurement is initiated and the result placed in the output buffer. The units of <expected value> and <resolution> are seconds. If autosetup mode is ON or ONCE, the input channel attenuation, offset, gain, level and slope can be modified. If the optional arguments <expected value> and <resolution> are not used: • aperture is set to the default value If only the <expected value> argument is used: • aperture is set to the default value If both <expected value> and <resolution> are used the aperture is calculated as follows: $\text{apperature} = 10^{\left(-9+\log\langle\text{expected}\rangle-\log\langle\text{resolution}\rangle\right)}$ with a minimum of 1e-8 and a maximum of 5 seconds. A longer aperture may be set with the SENSe:FREQuency:APERture command.
Example	**Command / Query** **Response *(Description)***
Related Command	CONFigure:SENSe

MEASure[1|2|10|20][:SCALar]]:TOTalize?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This query performs a totalize measurement</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">MEASure[1|2|10|20][:SCALar]]:TOTalize?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the value of the totalize measurement between the indicated channels.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This query performs a totalize measurement. The counter totalizes two selected channels simultaneously.
Channels 1 and 2 are selected by either 1 or 2
Channel 1 and the 1 GHz VCO are selected by 10.
Channel 2 and the 1 GHz VCO are selected by 20.
Selecting either Channel 1 or 2 and the VCO provides an elapsed time in nanoseconds after the totalized results for the selected channel.
The measurement is unique. It allows totals to be fetched while the counter is still in the process of counting. Each fetch will return updated count values. This command has a default aperture of 99 days. Use the ABORt command to end this measurement. Since this measurement allows reading the counter hardware while it is counting there is some risk that the value returned will be in error.
If the optional <expected value> and <resolution> arguments are not used:
• aperture is set to the default value
If only the <expected value> argument is used:
• aperture is set to the default value
If both <expected value> and <resolution> are used the aperture is calculated as follows:
$\text{apperature} = 10^{\left(-9+\log\langle \text{expected}\rangle - \log\langle \text{resolution}\rangle\right)}$
with a minimum of 1e-8 and a maximum of 5 seconds. A longer aperture may be set with the SENSe:RTIMe:APERture command.</td></tr>
<tr><td><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td>MEAS2:ARR:NDUT? 1000,25</td><td><i>(Takes 1000 negative duty cycle measurements with a trigger point of 25% of the signal’s peak)</i></td></tr>
<tr><td></td><td>MEAS2:ARR:PDUT? 100, 50</td><td><i>(Takes 100 positive duty cycle measurements with a trigger point of 50% of the signal’s peak value)</i></td></tr>
<tr><td></td><td>MEAS1:PHAS?</td><td><i>(Take a phase measurement from Channel 1 to Channel 2)</i></td></tr>
<tr><td></td><td>MEAS:TINT:DEL:EVEN? 100</td><td><i>(Take a time interval with delay measurement from Channel 1 to the 100th edge on Channel 2)</i></td></tr>
<tr><td></td><td>MEAS10:TOT?</td><td><i>(Totalize Channel 1 and the 1 GHz VCO)</i></td></tr>
<tr><td><b>Related Command</b></td><td colspan="2">CONFigure:SENSe</td></tr>
</table>

OUTPut:CLOCk

Purpose	This command toggles the External Reference as a useable reference clock	
Type	Instrument specific command	
Command Syntax	OUTPut:CLOCk <boolean>	
Command Parameters	<boolean> = 0 | 1 | OFF | ON	
***RST Value**	1	
Query Syntax	OUTPut:CLOCk?	
Query Parameters	N/A	
Query Response	Returns the set <boolean> parameter value	
Description	This command toggles the External Reference as a useable reference clock. Setting the value to 0 or OFF disables the clock function of the External Reference while setting the value to 1 or ON enables it.	
Example	**Command / Query**	**Response *(Description)***
	`OUTP:CLOC ON`	*(Enables the clock for the External Reference)*
	`OUTP:CLOC?`	ON *(Indicates that the External Reference clock in enabled)*
Related Commands		

OUTPut:TTLTrg

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command selects the TTL trigger line that will receive the output</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">OUTPut:TTLTrg <line></td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><line> = 0 – 7</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">0</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">OUTPut:TTLTrg?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the set <line> parameter value</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command selects the TTL trigger line that will receive the output.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>OUTP:TTLT 3</code>
<code>OUTP:TTLT?</code></td><td><i>(Selects TTLT3 trigger line for output)</i>
3 <i>(Indicates that the TTLT3 trigger line is selected)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

OUTPut:TTLTrg:STATe

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command toggles the use of TTL trigger lines as usable outputs</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">OUTPut:TTLTrg:STATe <boolean></td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><boolean> = 0 | 1 | OFF | ON</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">1</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">OUTPut:TTLTrg:STATe?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the set <boolean> parameter value</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command toggles the use of TTL trigger lines as a useable output. Setting the value to 0 or OFF disables the use of TTLT lines as outputs, while setting the value to 1 or ON enables it.</td></tr>
<tr><td rowspan="3"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>OUTP:TTLT:STAT 1</code></td><td><i>(Enables the use of the TTL trigger lines as outputs)</i></td></tr>
<tr><td><code>OUTP:TTLT:STAT?</code></td><td>1 <i>(Indicates that the TTL trigger lines are enabled as outputs)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

READ?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This query causes an INITiate:IMMediate action and a FETCh? query</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">READ?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">See Description</td></tr>
<tr><td><b>Description</b></td><td colspan="2">The query causes an INITiate:IMMediate action and a FETCh? query.
See the INITiate and FETCh command descriptions.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td></td><td></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">INITiate
FETCh?</td></tr>
</table>

RESet

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Resets the module’s hardware and software to a known state</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">RESet</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Description</b></td><td colspan="2">The Reset command resets the module’s hardware and software to a known state. See the command index at the beginning of this chapter for the default parameter values used with this command. Analogous to the *RST command.</td></tr>
<tr><td rowspan="2"><b>Examples</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td>RES</td><td><i>(Resets the module)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">*RST</td></tr>
</table>

SENSe:APERture [DEFault | MINimum | MAXimum]

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command sets the counter measurement aperture <time&gt;</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">SENSe:APERture <time>[DEFault | MINimum | MAXimum]</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">&lt;time> = 1e-8 to 9e6</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">1e-1</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">SENSe:APERture? [DEFault | MINimum | MAXimum]</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">This query returns the aperture time set by the most recent SENSe:…:APERture, CONFigure or MEASure command. If one of the optional arguments is used, the DEFault, MINimum or MAXimum value of aperture is returned instead.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command sets the counter measurement aperture <time>. Whether the aperture time is used or not depends on the mode set with one of the SENSe:MODE commands. The default mode is to use an aperture. The units are in seconds and range from 1e-8 to 9e6 in 1e-9 size steps.
CONFigure and MEASure commands can set the aperture as well.
<b>Note</b>: Time Interval with Delay, Phase and Duty Cycle use all available hardware timers. When the counter is in one of these modes the aperture is controlled by software and has a minimum period of approximately 10 ms.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>SENS:APER DEF</code>
<code>SENS:APER?</code></td><td><i>(Returns set aperture to default)</i>
1.000000000000000e-01</td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">CONFigure
MEASure
SENSe:MODE</td></tr>
</table>

SENSe:COUNt [DEFault | MINimum | MAXimum]

Purpose	This command sets the counter to do <array size> number of measurements	
Type	Instrument specific command	
Command Syntax	SENSe:COUNt <array size> [DEFault | MINimum | MAXimum]	
Command Parameters	<array size> = 1 to 1000 If SCALar is specified, this parameter is no longer valid If ARRay is specified, <array size> is a required parameter	
***RST Value**	1	
Query Syntax	SENSe:COUNT? [DEFault | MINimum | MAXimum]	
Query Parameters	N/A	
Query Response	This query returns the currently set <array size> count as set by the most recent SENSe:…:COUNt, CONFigure or MEASure command. If one of the optional arguments is used, the DEFault, MINimum or MAXimum value of the count is returned instead.	
Description	This command sets the counter to do <array size> measurements. CONFigure and MEASure commands also set this count.	
Example	**Command / Query**	**Response *(Description)***
	`SENS:COUNT 100`	*(Set array size to 100 measurements)*
	`SENS:COUN?`	1.000000000000000e+02
Related Commands	CONFigure MEASure	

SENSe:EVENts

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command sets the counter <# of events&gt;</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">SENSe:EVENts <# of events> [DEFault | MINimum | MAXimum]</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">&lt;# of events> = 1 to 9e15</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">1e3</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">SENSe:EVENts? [DEFault | MINimum | MAXimum]</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">This query returns the number of events as set by the most recent SENSe:EVENts command. If one of the optional arguments is used, the DEFault, MINimum or MAXimum value of aperture is returned instead.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command sets the counter <# of events>. If the SENSe:<function>:MODE is set to EVENTs the counter will make a measurement for a number of cycles of the input signal. The range of events is 1 to 9e15, however the measurements must complete in 9e6 seconds (99 days) to avoid errors.
<b>Note</b>: An Event mode with greater than one event is invalid for Time Interval with Delay, Duty Cycle or Phase Angle measurements.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>SENS:EVEN MIN</code>
<code>SENS:EVEN?</code></td><td><i>(Returns set events to minimum)</i>
1.000000000000000e+00 <i>(Queries events value)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

SENSe:MODe

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command sets the counter to make a measurement for a length of time (APERture) or for a number of cycles of the input signal (EVENTs)</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">SENSe:MODe <mode></td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><mode> = APERture | EVENTs</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">APERture</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">SENSe:MODe? [DEFault]</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">This query returns the currently set mode as set by the most recent SENSE:MODE, CONFigure or MEASure command. If the optional DEFault argument is used, then the default value of aperture mode will be returned instead.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command sets the counter to make a measurement for a length of time (APERture) or for a number of cycles of the input signal (EVENTs). Some functions, however, do not have the APERture and/or EVENts modes. Those functions ignore this mode setting.
CONFigure and MEASure commands set the mode to APERture.
<b>Note</b>: Event mode with greater than 1 event is invalid for Time Interval with Delay, Duty Cycle or Phase Angle measurements.</td></tr>
<tr><td rowspan="3"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>SENS:MOD EVEN</code></td><td><i>(Sets mode to events)</i></td></tr>
<tr><td><code>SENS:MOD?</code></td><td>EVEN <i>(Queries for the current mode)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">CONFigure
MEASure</td></tr>
</table>

SENSe:TINTerval:DELay:EVENTs

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command sets the number of events to use for the time interval with delay</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">SENSe:TINTerval:DELay:EVENTs <event delay></td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><event delay> = 1 to 9e15</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">1</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">SENSe:TINTerval:EVENts?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the current value of the time interval delay by events of the default minimum or maximum value.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command sets the number of events to use for the time interval with delay.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>SENS:TINT:DEL:EVEN MIN</code>
<code>SENS:TINT:DEL:EVEN?</code></td><td><i>(Sets event delay to minimum)</i>
1 <i>(Queries event delay)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

SENSe:TINTerval:DELay:TIME

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command sets the delay time for time interval with delay by time function</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">SENSe:TINTerval:DELay:TIME <time delay></td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><time delay> = 1e-9 to 1e6</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">1e-6</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">SENS:TINT:DEL:TIME?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns the current value of the time interval delay by time function of the default minimum or maximum value.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command sets the delay time for time interval with delay by time function.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td>SENS:TINT:DEL:TIME 1e3
SENS:TINT:DEL:TIME?</td><td><i>(Sets time delay to 1000)</i>
1.0000000000000000e+03</td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

SENSe[1|2]:FUNCtion

<table>
<tr><td><b>Purpose</b></td><td colspan="2">This command selects a function and input channel without changing most of the setup of the counter</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">SENSe[1,2]:FUNCtion</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">“DCYCLe”, “FALL:TIME”, “FTIMe”, “NDUTycycle”, “NWIDth”, “PDUTycycle”, “PHASe”, “PWIDth”, “RISE:TIME”, “RTIMe”, “TINTerval”, “VOLTage:AC”, “VOLTage:DC”, “VOLTage:MINimum”, “VOLTage:MAXimum”, “VOLTage:PTPeak”</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">SENSe[1|2]:FUNCTION?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">This query moves the currently selected function to the output buffer. Functions are selected by a SENSe:FUNCtion, CONFigure or MEASure command.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command selects a function and input channel without changing most of the setup of the counter. The input coupling and impedance are not changed by these commands. The user must select the coupling and impedance that makes sense for the input signal. The input attenuation, offset, gain and comparator hysteresis are not changed. However, the comparator slopes and thresholds are changed to defaults. If INPut:SETup:AUTO (autotrigger) is set to ON or ONCE the input attenuation, offset, gain and comparator hysteresis may change when the measurement is started.
The possible parameters for this command are listed above.
<b>Note</b>: “DCYCle” is the same as “PDUTycycle”, “FTIMe” is the same as “FALL:TIME” and “RTIMe” is the same as “RISE:TIME”.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>SENS1:FUNC “FREQ”</code>
<code>SENS:FUNC?</code></td><td><i>(Sets function to frequency)</i>
FREQ <i>(Queries set function)</i></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

SENSe[1|2|3]:FUNCtion

<table>
<tr><td><b>Purpose</b></td><td colspan="2">The SENSe:FUNCtion command selects a function and input channel without changing most of the counter setup</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">SENSe[1|2|3]:FUNCtion</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">“TOTalize”, “FREQuency”, “FREQuency:RATio <second channel>”, “PERiod”</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">SENSe[1|2|3]:FUNCtion?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">This query moves the currently selected function to the output buffer. Functions are selected by a SENSe:FUNCtion, CONFigure or MEASure command.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">The SENSe:FUNCtion command selects a function and input channel without changing most of the counter Setup. The input filtering, coupling and impedance are not changed by these commands. The filtering, coupling and impedance that is appropriate for the input signal must be selected. The input attenuation, offset, gain, and comparator hysteresis are not changed by these commands.
The comparator slopes and thresholds, however, are changed to defaults by these commands. If INPut:SETup:AUTO (autotrigger) is set to ON or ONCE the input attenuation, offset, gain, and comparator hysteresis my change when the measurement is started. See the CONFigure or MEASure command descriptions.
The possible parameters for this command are listed above.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>SENS1:FUNC “FREQ”</code>
<code>SENS:FUNC?</code></td><td><i>(Sets function to frequency)</i>
FREQ <i>(Queries set function)</i></td></tr>
<tr><td><b>Related Command</b></td><td colspan="2">CONFigure</td></tr>
</table>

SENSe[1|2|10|20]:FUNCtion

<table>
<tr><td><b>Purpose</b></td><td colspan="2">The SENSe:FUNCtion command selects a function and input channel without changing most of the counter setup</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">SENSe[1|2|10|20]:FUNCtion</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">“TOTalize”</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">SENSe[1|2|10|20]:FUNCtion?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">This query moves the currently selected function to the output buffer. Functions are selected by a SENSe:FUNCtion, CONFigure or MEASure command.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">The SENSe:FUNCtion command selects a function and input channel without changing most of the counter setup. The input filtering, coupling and impedance are not changed by these commands. The filtering, coupling and impedance that is appropriate for the input signal must be selected by the user. The input attenuation, offset, gain and comparator hysteresis are not changed by these commands.
The comparator slopes and thresholds, however, are changed to default by these commands. If INPut:SETup:AUTO (autotrigger) is set to ON or ONCE, the input attenuation, offset, gain and comparator hysteresis CONFigure or MEASure command descriptions for detail of these commands.
The possible parameters for this command are listed above.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>SENS1:FUNC “TOT”</code>
<code>SENS:FUNC?</code></td><td><i>(Sets function to totalize)</i>
TOT</td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

SOURce:COSCillator[:SOURce]

<table>
<tr><td><b>Purpose</b></td><td colspan="2">The SOURce subsystem commands are used to command the TCXO1 option (if available)</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">SOURce:COSCillator[:SOURce] <source></td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2"><source> = ROSCILLATOR | TCXO1 | OCXO | EXTERNAL</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">ROSCILLATOR, TCXO1 with Option 15 installed</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">SOURce:COSCillator[:SOURce]?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">This query returns the current clock source selected for the counter.</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command selects the source of the counter reference oscillator. Choices are the VM2164 Reference Oscillator (ROSCILLATOR), the Temperature Controlled Crystal Oscillator (TCXO1), the Oven Controlled Crystal Oscillator or an External oscillator source. Specifying TCXO1 as a source will generate an error if Option 15 is not available on the VM2164. A similar error will be produced if OXCO is specified and Option 16 is not installed or if an external clock is not connected to the external reference input.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>*RST</code>
<code>SOUR:COSC?</code></td><td><i>(Resets the module)</i>
TCXO1</td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2"></td></tr>
</table>

SOURce:COSCillator:VALue?

Purpose	This query returns the current oscillator frequency	
Type	Instrument specific query	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	SOURce:COSCillator:VALue?	
Query Parameters	N/A	
Query Response	Returns the current oscillator frequency	
Description	This query returns the current oscillator frequency.	
Example	**Command / Query**	**Response / Description**
	`SOUR:COSC:VAL?`	9.9999999999999900e+06
Related Commands		

TEST?

Purpose	This command performs an internal communication test	
Type	Instrument specific query	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	TEST?	
Query Parameters	N/A	
Query Response	See Description	
Description	This command performs and internal communication test, where a 16 bit BUS is checked. If a 0 is returned, the test is passed. If a non-zero number is returned, the test has failed.	
Example	**Command / Query**	**Response *(Description)***
	TEST?	0 *(Indicates that the test is passed.)*
Related Command	*TST?	

TEST:ALL?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">The Test subsystem handles the self test operations of the instrument</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">TEST:ALL?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Returns pass/fail information</td></tr>
<tr><td><b>Description</b></td><td colspan="2">The TEST subsystem handles the self test operations of the instrument. The counter self test tests the counter memory the Read/Write hardware control registers analog front end and a 2.5 MHz test signal. The query returns pass/fail information. In a failed situation additional failure information can be obtained with the SYStem:ERRor? or query.</td></tr>
<tr><td rowspan="2"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td>TEST:ALL?</td><td>“CTR Self-test Passed”
“CTR Self-test Failed”
<i>(Initiates the counter self test operation and returns either a pass or fail message.)</i></td></tr>
<tr><td><b>Related Command</b></td><td colspan="2">*TST?</td></tr>
</table>

UNIT:ANGLe

<table>
<tr><td><b>Purpose</b></td><td colspan="2">The UNIT subsystem command specifies the units for the phase measurements as either degrees or radians and determines whether the units will be positive or centered around zero</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Instrument specific command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">UNIT:ANGLe <units>[,<zero&gt;]</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">&lt;units> = DEGREE or RADIAN
<zero> = MINIMUM or CENTER or AUTO</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">&lt;units> = RADIAN
<zero> = MINIMUM</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">UNIT:ANGLe?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">DEG or RAD, MIN or CENT or AUT</td></tr>
<tr><td><b>Description</b></td><td colspan="2">This command specifies the units for the phase measurement as either degrees or radians and determines whether the units will be positive or centered around zero.
MINimum will set 0 as the minimum measurement and return measurements as 0 to 360 degrees or 0 to 2π radians.
CENTer will set 0 as the center measurement and return measurements form -180 to +180 degrees or -π to +π radians. Selecting AUTo will start as MINimum, returning positive values only. The instrument will automatically switch to CENTer if crossing 0 degrees (0 radians) in the negative direction and automatically switch back to MINimum if crossing 180 degrees (π radians) in the positive direction.</td></tr>
<tr><td rowspan="3"><b>Example</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>UNIT:ANGL DEG,CENT</code></td><td><i>(Values from -180 to +180)</i></td></tr>
<tr><td><code>UNIT:ANGL?</code></td><td>DEG,CENT</td></tr>
<tr><td><b>Related Command</b></td><td colspan="2">CONFigure|MEASure|SENSe[:…]:PHASe</td></tr>
</table>

REQUIRED SCPI COMMANDS

STATus:OPERation:CONDition?

Purpose	The STATus:OPERation:CONDition query returns the current operational status of the counter
Type	Required SCPI query
Command Syntax	N/A
Command Parameters	N/A
***RST Value**	0
Query Syntax	STATus:OPERation:CONDition?
Query Parameters	N/A
Query Response	This query returns the operational condition register value.
Description	The STATus:OPERation:CONDition query returns the current operational status of the counter. The bit definitions of the value are (bit ( ) = the least significant bit):

Bit	Definition	Function
0	Calibrating	Set when any CALibration operation is running. Cleared when the CALibration operation is complete.
1	Setting	Set when the instrument changes its function or range. Cleared when the all circuitry has settled.
2	Ranging	Set when the instrument is auto-ranging. Cleared when the input range has been found.
3	Sweeping	Not used.
4	Measuring	Set when an INITiate command is executed. Cleared when the command is complete or aborted
5	Triggering	Not used.
6	Arming	Set when the instrument is waiting for an arm signal. Cleared when the arm is received.
7	Correcting	Set when the instrument is performing an auto-zero operation. Cleared when the auto-zero operation is complete.
8	Testing (User 1)	Set when the instrument is performing a self-test. Cleared when the self-test is complete.
9	Testing (User 2)	Set when the instrument is in the process of aborting an operation. Cleared when the abort is complete.
10	User 3	Not used
11	User 4	Not used
12	User 5	Reserved
13	Instrument Summary	Not used
14	Program Running	Not used
15	Reserved	Always 0

	Command / Query	**Response *(Description)***
Example	`STAT:OPER:COND?`	16 *(Makes a measurement (0010 hex)*

Related Commands	MEASure? READ? INITiate ABORt

STATus:OPERation:ENABle

Purpose	Sets the Operation Status Register's enable register	
Type	Required SCPI command	
Command Syntax	STATus:OPERation:ENABle <NRf>	
Command Parameters	<NRf> = numeric ASCII value from 0 to 32767	
***RST Value**	<NRf> must be specified	
Query Syntax	STATus:OPERation:ENABle?	
Query Parameters	N/A	
Query Response	<NRf> = Numeric ASCII value from 0 to 32767	
Description	This command enables bits in the Operation Status Register's enable register to report to the summary bit; sets Status Bytes register bit 7 to true. The query reports the bits enabled in the Operation Status Register's enable register, then clears the register contents and enters the value into the computer.	
Examples	**Command / Query**	**Response *(Description)***
	`STAT:OPER ENAB 33`	*(Enables bit 0 and bit 5)*
	`STAT:OPER:ENAB?`	33 *(Indicates that bit 0 and 5 are enabled)*
Related Commands	STATus:OPERation:CONDition? STATus:OPERation[:EVENt]	

STATus:OPERation:NTR

Purpose	Sets the negative transition filter	
Type	Required SCPI command	
Command Syntax	STATus:OPERation:NTR	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	STATus:OPERation:NTR?	
Query Parameters	N/A	
Query Response	N/A	
Description	Sets the negative transition filter. Setting a bit in the negative transition filter shall cause a 1 to 0 transition in the corresponding bit of the associated condition register to cause a 1 to be written in the associated bit of the corresponding event register. Note that 32767 is the maximum value returned as the most-significant bit of the register cannot be set true.	
Examples	**Command / Query**	**Response *(Description)***
	`STAT:PRES`	
Related Commands	N/A	

STATus:OPERation:PTR

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Sets the positive transition filter</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Required SCPI command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">STATus:OPERation:PTR</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">STATus:OPERation:PTR?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Description</b></td><td colspan="2">Sets the positive transition filter. Setting a bit in the positive transition filter shall cause a 0 to1 transition in the corresponding bit of the associated condition register to cause a 1 to be written in the associated bit of the corresponding event register.

Note that 32767 is the maximum value returned as the most-significant bit of the register cannot be set true.</td></tr>
<tr><td rowspan="2"><b>Examples</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>STAT:OPER:PTR</code></td><td></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">N/A</td></tr>
</table>

STATus:OPERation[:EVENt]?

Purpose	Queries the Operation Status Register's event register	
Type	Required SCPI query	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	STATus:OPERation[:EVENt]?	
Query Parameters	N/A	
Query Response	0	
Description	Queries the bits set in the event register of the Operation Status Register. This command clears all bits in the event register.	
Examples	**Command / Query**	**Response *(Description)***
	`STAT:OPER?`	0
Related Commands	STATus:OPERation:CONDition? STATus:OPERation:ENABle?	

STATus:PRESet

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Presets the Status Registers</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Required SCPI command</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">STATus:PRESet</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Description</b></td><td colspan="2">The Status Preset command presets the Status Registers. The Operational Status Enable Register is set to 0 and the Questionable Status Enable Register is set to 0. This command is provided for SCPI compliance only.</td></tr>
<tr><td rowspan="2"><b>Examples</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>STAT:PRES</code></td><td></td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">N/A</td></tr>
</table>

STATus:QUEStionable:CONDition?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Queries the Questionable Status Condition Register</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Required SCPI query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">STATus:QUEStionable:CONDition?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">0</td></tr>
<tr><td><b>Description</b></td><td colspan="2">The Questionable Status Condition Register query is provided for SCPI compliance only. The VM2164 does not alter any bits in this register and a query always reports a 0.</td></tr>
<tr><td rowspan="2"><b>Examples</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>STAT:QUES:COND?</code></td><td>0</td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">N/A</td></tr>
</table>

STATus:QUEStionable:ENABle

Purpose	Sets the Questionable Status Enable Register	
Type	Required SCPI command	
Command Syntax	STATus:QUEStionable:ENABle <NRf>	
Command Parameters	<NRf> = numeric ASCII value from 0 to 32767	
***RST Value**	<NRf> must be supplied	
Query Syntax	STATus:QUEStionable:ENABle?	
Query Parameters	N/A	
Query Response	<NRf> = Numeric ASCII value from 0 to 32767	
Description	The command sets the bits in the Questionable Data/Signal Register's enable register to be reported to the summary bit (sets Status Byte Register bit 3 to true). The Status Questionable Enable query reports the contents of the Questionable Data/Signal Register's enable register, then clears the register contents and enters the value into the computer.	
Examples	**Command / Query**	**Response *(Description)***
	`STAT:QUES:ENAB 64`	
	`STAT:QUES:ENAB?`	64
Related Commands	N/A	

STATus:QUEStionable[:EVENt]?

<table>
<tr><td><b>Purpose</b></td><td colspan="2">Queries the Questionable Status Event Register</td></tr>
<tr><td><b>Type</b></td><td colspan="2">Required SCPI query</td></tr>
<tr><td><b>Command Syntax</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Command Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>*RST Value</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Syntax</b></td><td colspan="2">STATus:QUEStionable[:EVENt]?</td></tr>
<tr><td><b>Query Parameters</b></td><td colspan="2">N/A</td></tr>
<tr><td><b>Query Response</b></td><td colspan="2">Decimal number</td></tr>
<tr><td><b>Description</b></td><td colspan="2">The query reports the bits set in the event register of the Questionable Data/Signal register. This command reads the event register, then clears all bits in the event register and enters the value into the computer.</td></tr>
<tr><td rowspan="2"><b>Examples</b></td><td><b>Command / Query</b></td><td><b>Response <i>(Description)</i></b></td></tr>
<tr><td><code>STAT:QUES?</code></td><td>0</td></tr>
<tr><td><b>Related Commands</b></td><td colspan="2">N/A</td></tr>
</table>

SECTION 4

CALIBRATION AND VERIFICATION

RELATED DOCUMENTS

Test.FRM Visual Basic Form
Visa32.BAS Visual Basic Module (National Instruments)
Niglobal.BAS (National Instruments)
Vbib-32.BAS (Visual Basic Interface Bus)
MyGlobal.BAS
Vtvm3616.BAS VXI*plug&play* Instrument Driver

EQUIPMENT USED

Synthesizer/Function Generator	
Critical specifications:	Square wave 10 MHz 10,000,000.000 ± 0.001 Hz
Recommended Model:	HP Model 3325A
Voltage Source	
Critical specifications:	Can Source – 20 to 20 VDC ±0.003 Minimum 1 Channel
Recommended Model:	VM3616
VXI Chassis:	VTI CT-100B or equivalent
VXI Slot 0 and associated computer	
300 MHz Oscilloscope:	Tek TDS3032 or equivalent
1x Oscilloscope Probe:	Tek 6101B or equivalent
Function Generator:	HP 3325A or equivalent
Isolated Adjustment Screwdriver:	Voltronics P/N TT-400
Input Capacitance Normalizer:	VTI P/N 52-0303-000
Coax Cable, BNC Plug to SMB Plug:	Pasternack P/N PE3746-36

METHOD

1.1 Remove the sheet metal enclosure surrounding the VMIP module that contains the VM2164 to be calibrated. Install the module in a VXI chassis so that the adjustment points and test points are readily accessible. After powering up the VXI chassis and the associated computer controlling the chassis, set up the VM2164 for the following settings:

Setting	Command
CH 1 Input Impedance: 1 MΩ	INP1:IMP 1e6
CH 2 Input Impedance: 1 MΩ	INP2:IMP 1e6
CH 1 Coupling: DC	INP1:COUP DC
CH 2 Coupling: DC	INP2:COUP DC
CH 1 Attenuator: Minimum	INP1:ATT MIN
CH 2 Attenuator: Minimum	INP2:ATT MIN

1.2 Adjust the function generator for 0.0 V offset and a 6.0 V_{P-P} sine wave at 1 kHz. Note that the function generator will be set to 3.0 V_{P-P} because it expects a 50 Ω load, which is not provided. Connect the function generator to the VM2164 Channel 1 Input. Set the oscilloscope to the 10 mV range and probe TP3 on the VM2164. (Note that there are four test points used in this section of the procedure and each has a square pad that is the measurement point and an adjacent round pad which is a ground return). Using the wider blade end of the adjustment screwdriver, adjust R99 to null out the signal at TP3. Note that using the narrow blade can damage the potentiometer. The resulting signal should have a peak-to-peak amplitude of less than 2 mV, and a DC offset of less than ±0.25 V.

1.3 Move the function generator output to the VM2164 Channel 2 input and repeat the previous steps adjusting R109 and monitoring TP4.

1.4 Adjust the function generator for a 6.0 V_{P-P} square wave at 10 kHz. Apply the function generator output to the VM2164 Channel 1 Input. Adjust C77 using the narrow blade end of the adjustment screwdriver while monitoring TP1. Set the oscilloscope to the 1 V range and adjust C77 for the flattest top of the square wave. Move the function generator output to the VM2164 Channel 2 Input and repeat the previous steps adjusting C69 and monitoring TP2.

1.5 Program the VM2164 for the following settings:

Setting	Command
CH 1 Attenuator: Maximum	INP1:ATT MAX
CH 2 Attenuator: Maximum	INP2:ATT MAX

1.6 Adjust the function generator for 0.0 V offset and 20.0 V_{P-P} square wave at 10 kHz. Apply the function generator output to the VM2164 Channel 1 Input. Adjust C81 using the narrow blade end of the adjustment screwdriver while monitoring TP1. Adjust C81 for the flattest top of the square wave. Install the Input Capacitance Normalizer between the coaxial cable and the Channel 1 Input of the VM2164. Adjust C80 using the narrow blade end of the adjustment screwdriver while monitoring TP1 for the flattest top of the square wave. Note that the amplitude of the signal at TP1 is roughly ½ of what was measured without the Input Capacitance Normalizer installed.

1.7 Move the function generator output to the VM2164 Channel 2 Input and adjust C52 using the narrow blade end of the adjustment screwdriver for the flattest top square wave while monitoring TP2. Install the Input Capacitance Normalizer between the coaxial cable and the Channel 2 Input of the VM2164. Adjust C72 using the narrow blade end of the adjustment screwdriver while monitoring TP2 for the flattest top of the square wave.

1.8 This completes the front end calibration of the VM2164.

2.1 Connect Synthesizer Function Generator oven 10 MHz output (Backside) to UUT External Reference Input through cable BNC Plug to SMB Plug.

2.2 Connect Voltage Source to UUT Channel 1 cable 44-pin connector plug to SMB plug.

2.3 Set UUT Channel 1 to DC Couple by issuing command "`INP1:COUP DC`".

2.4 Apply Voltage Source +3 V to UUT Channel 1.

2.5 Set DAC level at 2048 by issuing command "`MFGTEST:LEVEL`" & Str$(Channel) & " " & Str$(level).

2.6 Compare DAC level with UUT comparator by issuing command "`MFGTEST:COMP?`" & Str$(Channel).

2.7 If compared return value is true, then decreases DAC level by Delta = 1024.
If compared return value is false, then increase DAC level by Delta = 1024.

2.8 Repeat steps 1.4 through 1.6 where Delta = 50% of previous value.
The process continues until Delta approaches or becomes zero. The final DAC level is saved as Level1.

2.9 Apply -3 V from Voltage Source to UUT Channel 1.

2.10 Set DAC level at 2048 by issuing command "`MFGTEST:LEVEL`" & Str$(Channel) & " " & Str$(level).

2.11 Compare DAC level with UUT comparator by issuing command "`MFGTEST:COMP?`" & Str$(Channel).

2.12 If compared return value is true, then decrease DAC level by Delta = 1024.
If compared return value is false, then increased DAC level by Delta = 1024.

2.13 Repeat steps 2.9 through 2.10 with Delta is 50% of previous value.
The process continues until Delta closes to or Zero.
The final DAC level is save as Level2.

2.14 Calculate the Scale and Offset factor of the DAC by using the following equations:
Scale1 = level1 - level2 / (3 -(-3))
Offset1 = level1 - 3 * Scale1

2.15 Send Scale1 to the instrument by issuing command "`CAL:DAC1:SLOPE` " & Str$(Scale1).

2.16 Send Offset1 to the instrument by issuing command "`CAL:DAC1:OFFSET` " & Str$(Offset1).

2.17 Set the attenuation 10 times on the Channel 1 by issuing command "`INP1:ATT` 10".

2.18 Apply Voltage Source +20 V to UUT Channel 1.

2.19 Repeat steps 2.4 through 2.7.

2.20 Apply -20 V from Voltage Source to UUT Channel 1.

2.21 Repeat steps 2.9 through 2.12.

2.22 Calculate the Scale and Offset factor of the DAC by using the following equations:

Scale1 = level1 - level2 / (20 –(-20))
Offset1 = level1 - 20* Scale1

2.23 Send Scale1 to the instrument by issuing command “`CAL:DAC1:SLOPE`“ & Str$(Scale1).

2.24 Send Offset1 to the instrument by issuing command “`CAL:DAC1:OFFSET`“ & Str$(Offset1).

2.25 Connect Voltage Source to UUT Channel 2.

2.26 Set UUT Channel 2 to DC Couple by issuing command “`INP2:COUP DC`”.

2.27 Apply +3 V from Voltage Source to UUT Channel 2.

2.28 Repeat steps 2.4 through 2.7.

2.29 Apply -3 V from Voltage Source to UUT Channel 2.

2.30 Repeat steps 2.9 through 2.13.

2.31 Send Scale1 to the instrument by issuing command “`CAL:DAC2:SLOPE`“ & Str$(Scale1).

2.32 Send Offset1 to the instrument by issuing command “`CAL:DAC2:OFFSET`“ & Str$(Offset1).

2.33 Set the attenuation 10 times on the Channel 2 by issuing command "`INP2:ATT 10`".

2.34 Apply +20 V from Voltage Source to UUT Channel 2.

2.35 Repeat steps 2.4 through 2.7.

2.36 Apply -20 V from Voltage Source to UUT Channel 2.

2.37 Repeat steps 2.9 through 2.12 and step 2.21.

2.38 Send Scale1 to the instrument by issuing command “`CAL:DAC2:SLOPE`“ & Str$(Scale1).

2.39 Send Offset1 to the instrument by issuing command “`CAL:DAC2:OFFSET`“ & Str$(Offset1).

2.40 Store the values in non-volatile memory by issuing the command “`CAL:STORE`”.

3.1 Remove cable 44 pin connector plug to SMB plug from voltage source to UUT Channel 1 and connect Synthesizer Function Generator signal to UUT Channel 1 through cable BNC plug to SMB plug.

3.2 Configure the Counter Timer as below:

Channel 1 Configuration

Frequency measurement by issuing command "`CONF1:FREQ`"
Input impedance 50 Ω by issuing command "`INP1:IMP 50`"
Input AC Coupling by issuing command "`INP1:COUP AC`"
Turn-off filter by issuing command "`INP1:FILT 0`"
Turn-off Auto Trigger by issuing command "`INP1:SETUP:AUTO OFF`"
Set Trigger Level to 0 V by issuing command "`INP1:COMP:LEVEL 0`"

Channel 2 Configuration

Frequency measurement by issuing command "`CONF2:FREQ`"
Input impedance 50 Ω by issuing command "`INP2:IMP 50`"
Input AC Coupling by issuing command "`INP2:COUP AC`"
Disable filter by issuing command "`INP2:FILT 0`"
Disable Auto Trigger by issuing command "`INP2:SETUP:AUTO OFF`"
Set Trigger Level to 0 V by issuing command "`INP2:COMP:LEVEL 0`"

3.3 Configure the Function Generator as below:

Square Wave Function

Frequency	=	10 MHz
Amplitude	=	3 V
DC offset	=	0 V
Phase	=	0°

3.4 Get the X counter value by issuing command "`MFGTEST? 0`" and save in NewX.

3.5 Get the Y counter value by issuing command "`MFGTEST? 1`" and decrement by 1 and save in NewY.

3.6 Get the Start TEC value by issuing command "`MFGTEST? 2`" and save in StartTec.

3.7 Get the Stop TEC value by issuing command "`MFGTEST? 3`" and save in StopTec.

3.8 Repeat steps 3.4 through 3.7 for 3000 readings and record data of NewX, NewY, StarTec, and StopTec in text file to use for next test.

3.9 Get NewX and NewY from previous text file and save as Xcount and Ycount.

3.10 Find the StartTec Minimum and Maximum from previous text file and save in StartTecMin and StartTecMax.

3.11 Find the StopTec Minimum and Maximum from previous text file and save in StopTecMin and StopTecMax.

3.12 Calculate the Tec slope by using the following equations:

$$\text{StartTecSlope} = -\left(\frac{0.000001}{\text{StartTecMax} - \text{StartTecMin}}\right)$$

$$\text{StopTecSlope} = -\left(\frac{0.000001}{\text{StopTecMax} - \text{StopTecMin}}\right)$$

3.13 Absolute value between the StartTecMin and StopTecMin or StartTecMax and StopTecMax should not be greater than 500. Otherwise, the TEC data is corrupt.

3.14 Get the TEC offset constant by issuing command "`CAL:TEC:OFFSET?`" and save in K3.

3.15 Calculate the frequency with XCount, YCount, StarTec and StopTec in previous text file by using the equation:

$$\text{Freq} = \frac{\text{XCount}}{(\text{YCount} \times 0.0000001) + (\text{StartTec} \times \text{StartTecSlope}) - (\text{StopTech} \times \text{StopTechSlope})}$$

3.16 If the frequency is less than 9,999,995 Hz or greater than 10,000,005, then:

$$\text{StartTecSlope} = -\text{StartTecSlope}$$
$$\text{StopTecSlope} = -\text{StopTecSlope}$$

3.17 Repeat steps 3.14 and 3.15 for all data in the previous text file.

3.18 Calculate the frequency with XCount, YCount, StarTec, and StopTec in previous text file by using the equation:

$$\text{Freq} = \frac{\text{XCount}}{(\text{YCount} \times 0.0000001) + (\text{StartTec} \times \text{M1}) - (\text{StopTech} \times \text{M2}) + \text{K3}}$$

where: M1 = StartTecSlope
M2 = StopTecSlope

3.19 Repeat step 3.18 for all data in the previous text file.

3.20 Calculate the average frequency and save as freqavg.

3.21 If freqavg < 10 MHz and sweep = 0, then set K3low = 0.000000005.

3.22 If freqavg > 10 MHz, and sweep = 1, then save K3 as K3high.

3.23 If freqavg is greater than 10 MHz, and sweep = 0, then K3 is decrement by adjust = 0.0000001.

3.24 Set adjust = adjust / 1.5

3.25 Repeat steps 3.20 through 3.24 for 1000 times.

3.26 Set sweep = 1 and K3 = (K3high + K3low) / 2.

3.27 Recalculate the frequency with new K3:

$$\text{Freq} = \frac{\text{XCount}}{(\text{YCount} \times 0.0000001) + (\text{StartTec} \times \text{M1}) - (\text{StopTech} \times \text{M2}) + \text{K3}}$$

where: M1 = StartTecSlope
M2 = StopTecSlope

3.28 Repeat step 3.27 for all data in the previous text file.

3.29 Calculate the average frequency and save as freqavg.

3.30 If freqavg is less than (10 MHz - 0.004) or greater than (10 MHz + 0.004), then the UUT fails TEC calibration test.

3.31 Disable security by issuing command “`CAL:SEC:STAT 0,#0VM2164`”. (Optional)

3.32 Set the TEC StartTec by issuing command “`CAL:TEC:STAR`” & Str$(M1 * 0.000000001). (Optional)

3.33 Set the TEC StopTec by issuing command “`CAL:TEC:STOP`” & Str$(M2 * 0.000000001). (Optional)

3.34 Set the TEC offset by issuing command “`CAL:TEC:OFFS`” & Str$(K3 * 0.000000001). (Optional)

3.35 Set Function Generator as below:

Square Wave Function

Frequency	=	10.000050037 MHz
Amplitude	=	3 V
DC offset	=	0 V
Phase	=	0°

3.36 Measure frequency of function generator by issuing command “`READ?`” and save as freq(1).

3.37 Set Temp = Temp + freq(1)

3.38 Get the X counter value by issuing command "`MFGTEST? 0`" and save in Xcount(0).

3.39 Get the Y counter value by issuing command "`MFGTEST? 1`" and decrement by 1 and save in Ycount(0).

3.40 Get the Start TEC value by issuing command "`MFGTEST? 2`" and save in StartTec(0).

3.41 Get the Stop TEC value by issuing command "`MFGTEST? 3`" and save in StopTec(0).

3.42 Get the TEC StartTec constant by issuing command “`CAL:TEC:STAR?`” and save in M1.

3.43 Get the TEC StopTec constant by issuing command “`CAL:TEC:STOP?`” and save in M2.

3.44 Get the TEC offset constant by issuing command “`CAL:TEC:OFFSET?`” and save in K3.

3.45 Calculate the frequency with these values:

$$\text{Freq}(0) = \frac{\text{XCount0}}{\left(\text{YCount}(0) \times 0.0000001\right) + \left(\text{StartTec}(0) \times \text{M1}\right) - \left(\text{StopTec}(0) \times \text{M2}\right) + \text{K3}}$$

3.46 Compare freq(0) with freq(1) should be less than 0.001 Hz.

3.47 Repeat steps 3.36 through 3.46 for 400 times.

3.48 Calculate TEC offset constant by using these equations:

Temp = Temp / 400
Temp = 1000050.37 – Temp
K3 = K3 – ((Temp * 10) * 0.000000001)

3.49 Turn security off by issuing command “`CAL:SEC:STAT 0,#0VM2164`”.

3.50 Set the TEC offset by issuing command “`CAL:TEC:OFFS`” & Str$(K3).

3.51 Store offset value in non-volatile memory by issuing command “`CAL:STORE`”.

3.52 This process fine-adjust for counter timer.

3.53 Set Function Generator as below:

Square Wave Function

Frequency	=	10 MHz
Amplitude	=	3 V
DC offset	=	0 V
Phase	=	0°

3.54 Measure frequency of function generator by issuing command “`READ?`” and save as freq(phase).

3.55 Find the Minimum and Maximum frequencies and save in FreqMin and FreqMax.

3.56 Get the X counter value by issuing command "`MFGTEST? 0`" and save in XCNTR(phase).

3.57 Get the Y counter value by issuing command "`MFGTEST? 1`" and save in YCNTR(phase).

3.58 Get the Start TEC value by issuing command "`MFGTEST? 2`" and save in TECA(phase).

3.59 Get the Stop TEC value by issuing command "`MFGTEST? 3`" and save in TECB(phase).

3.60 Find the start point and stop point save as phasestart and phasestop.

3.61 Get the TEC StartTec constant by issuing command “`CAL:TEC:STAR?`” and save in CALSTAR and CALStar1.

3.62 Get the TEC StopTec constant by issuing command “`CAL:TEC:STOP?`” and save in CALSTOP and CALStop1.

3.63 Get the TEC offset constant by issuing command “`CAL:TEC:OFFSET?`” and save in CALOFFS.

3.64 Set phase = phasestart.

3.65	Set	SumX	=	0
		SumY	=	0
		SumXY	=	0
		scount	=	1
		SumXX	=	0
		SumYY	=	0

3.66	Set	SumX	=	SumX + scount
		SumXX	=	SumXX + scount^2
		SumY	=	SumY + frequency(phase)
		SumXY	=	SumXY + scount*frequency(phase)

3.67 If phase = 359, then set phase = -1.

3.68 If phase = phasestop, then set phase = 359.

3.69 Repeat steps 3.66 through 3.68 until phase = 359.

3.70 Set scount = scount – 1.

3.71 Calculate the Least Square Fit for the current data using the following equations:

$$\text{M0} = \frac{(\text{scount} \times \text{SumXY}) - (\text{SumX} \times \text{SumY})}{(\text{scount} \times \text{SumXX}) - (\text{SumX} \times \text{SumX})}\ ,\ \text{B0} = \frac{(\text{SumY} \times \text{SumXX}) - (\text{SumX} \times \text{SumXY})}{(\text{scount} \times \text{SumXX}) - (\text{SumX} \times \text{SumX})}$$

3.72 If M0 > -0.000001 and M0 < 0.000001, then set done = 1.

3.73 If done = 0 and M0 ≤ 0, then set CALSTOP = CALSTOP + 5e-16, CALSTAR = CALSTAR - 5e-16.

3.74 If done = 0 and M0 > 0 then set CALSTOP = CALSTOP - 5e-16, CALSTAR = CALSTAR + 5e-16.

3.75 Set phase = phasestart.

3.76 Calculate the frequency using the new CALSTOP using the following equation:

$$\text{Freq(phase)} = \frac{\text{XCNTR(phase)}}{((\text{YCNTR(phase)} - 1) \times 0.0000001) + (\text{TECA(phase)} \times \text{CALTAR}) - (\text{TECB(phase)} \times \text{CALSTOP}) + (\text{CALOFFS})}$$

3.77 If phase = 359 then set phase = -1.

3.78 If phase = phasestop then set phase = 359.

3.79 Repeat steps 3.76 through 3.78 until phase = 359.

3.80	Set	Done	=	0
		Counter	=	0
		Freqsum	=	0
		Freqsumplateau	=	SumXY + scount*frequency(phase)

3.81 Set phase = phasestop + 1.

3.82 Calculate the frequency of the plateau:

$$\text{Freq(phase)} = \frac{\text{XCNTR(phase)}}{\left(\left(\text{YCNTR(phase)} - 1\right) \times 0.0000001\right) + \left(\text{TECA(phase)} \times \text{CALTAR}\right) - \left(\text{TECB(phase)} \times \text{CALSTOP}\right) + \left(\text{CALOFFS}\right)}$$

3.83 Set freqsumplateau = freqsumplateau + frequency(phase).

3.84 If phase = 359 then set phase = -1.

3.85 Set Counter = Counter + 1.

3.86 Repeat steps 3.82 through 3.85 until phase = phasestart - 1.

3.87 Set freqavgplateau = freqsumplateau / Counter.

3.88 Set Counter = 0.

3.89 Set phase = phasestart + 10.

3.90 Calculate the frequency by using the equation:

$$\text{Freq(phase)} = \frac{\text{XCNTR(phase)}}{\left(\left(\text{YCNTR(phase)} - 1\right) \times 0.0000001\right) + \left(\text{TECA(phase)} \times \text{CALTAR}\right) - \left(\text{TECB(phase)} \times \text{CALSTOP}\right) + \left(\text{CALOFFS}\right)}$$

3.91 Set freqsum = freqsum + frequency(phase).

3.92 If phase = 359 then set phase = -1.

3.93 If phase = phasestop - 10, then set phase = 359.

3.94 Set Counter = Counter + 1.

3.95 Repeat steps 3.90 through 3.94 until phase = 359.

3.96 Set freqavg = freqsum / Counter.

3.97 Set Temp = freqavg - freqavgplateau.

3.98 If freqavg > freqavg -0.001 and freqavg < freqavg + 0.001 then set done = 1.

3.99 If done = 0 and freqavgplateau >= freqavg, then CALSTOP = CALSTOP + 0.000000000000001

3.100 If done = 0 and freqavgplateau < freqavg, then CALSTOP = CALSTOP - 0.000000000000001

3.101 Disable security by issuing command “`CAL:SEC:STAT 0,#0VM2164`”.

3.102 Set the TEC StartTec by issuing command “`CAL:TEC:STAR`” & Str$(CALSTAR).

3.103 Set the TEC StopTec by issuing command “`CAL:TEC:STOP`” & Str$(CALSTOP).

3.104 Store offset value in non-volatile memory by issuing command “`CAL:STORE`”.

4.1 Remove cable BNC plug to SMB plug from Synthesizer Function Generator signal to UUT Channel 1.

4.2 Connect Synthesizer Signal through dual channel fixture to both Counter Input Channels 1 and 2 through cable BNC plug to 2 SMB plugs.

4.3 Disable auto trigger for Channel 1 by issuing command "`INP1:SETUP:AUTO OFF`".

4.4 Disable auto trigger for Channel 2 by issuing command "`INP2:SETUP:AUTO OFF`".

4.5 Configure for time interval by issuing command “`CONF:TINT`”.

4.6 Set Function Generator as below:

Square Wave Function

Frequency	=	10 MHz
Amplitude	=	3 V
DC offset	=	0 V
Phase	=	0°

4.7 Set Time Interval offset equal to 0 by issuing command “`CAL:TINT:OFFSET 0`”.

4.8 Set I = 1.

4.9 Start taking reading time interval offset by issuing command “`READ?`”

4.10 Repeat step 3.8 for 3000 times then add all together and save as Summer.

4.11 New Time Interval Offset is determined by the following equation:

Summer = -1 * (Summer / 3000 - 0.0000001)

4.12 Disable security by issuing command “`CAL:SEC:STAT 0,#0VM2164`”.

4.13 Set the time interval offset by issuing command “`CAL:TINT:OFFSET`” & Str$(Summer).

4.14 Store new Time Interval Offset into non-volatile memory by issuing command “`CAL:STORE`”.

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