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VM2710A

6.5 DIGIT MULTIMETER

USER'S MANUAL

P/N: 82-0032-000
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VTI Instruments Corp.

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CERTIFICATION

VTI Instruments Corp. (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 VTI Instruments 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.

VTI Instruments shall not be liable for injury to property other than the goods themselves. Other than the limited warranty stated above, VTI Instruments 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

Use, duplication, or disclosure by the Government is subject to restrictions as set forth in subdivision (b)(3)(ii) of the Rights in Technical Data and Computer Software clause in DFARS 252.227-7013.

VTI Instruments
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	VTI Instruments
MANUFACTURER'S ADDRESS	2031 Main Street Irvine, California 92614-6509
PRODUCT NAME	6.5 Digit Multimeter
MODEL NUMBER(S)	VM2710A
PRODUCT OPTIONS	All
PRODUCT CONFIGURATIONS	All

VTI Instruments 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.

August 2004

CE



Steve Mauga, 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.

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SECTION 1

INTRODUCTION

INTRODUCTION

The VM2710A is a high-performance, autoranging 6.5digit multimeter. It offers dc and ac voltage, dc and ac current, and 2- and 4-wire resistance measurements in a very small footprint. The instrument uses the message-based word serial interface for programming and data movement, as well as supporting register data access for high-speed data access. The VM2710A command set conforms to the SCPI standard for consistency and ease of programming.

The VM2710A is a member of the VXI Technology VMIP™ (*VXI Modular Instrumentation Platform*) family. This gives the user the added flexibility of combining it with other instruments, such as arbitrary waveform generators or digitizers, to create a multi-function C-size card. Finally, users do not need to take up a complete VXIbus card slot for the DMM functionality required, making the VM2710A the ideal choice for data acquisition and ATE. The VM2710A may be combined with any of the other members of the VMIP family 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 VM2710A with two other instrument functions in a single-wide C-size VXIbus module.

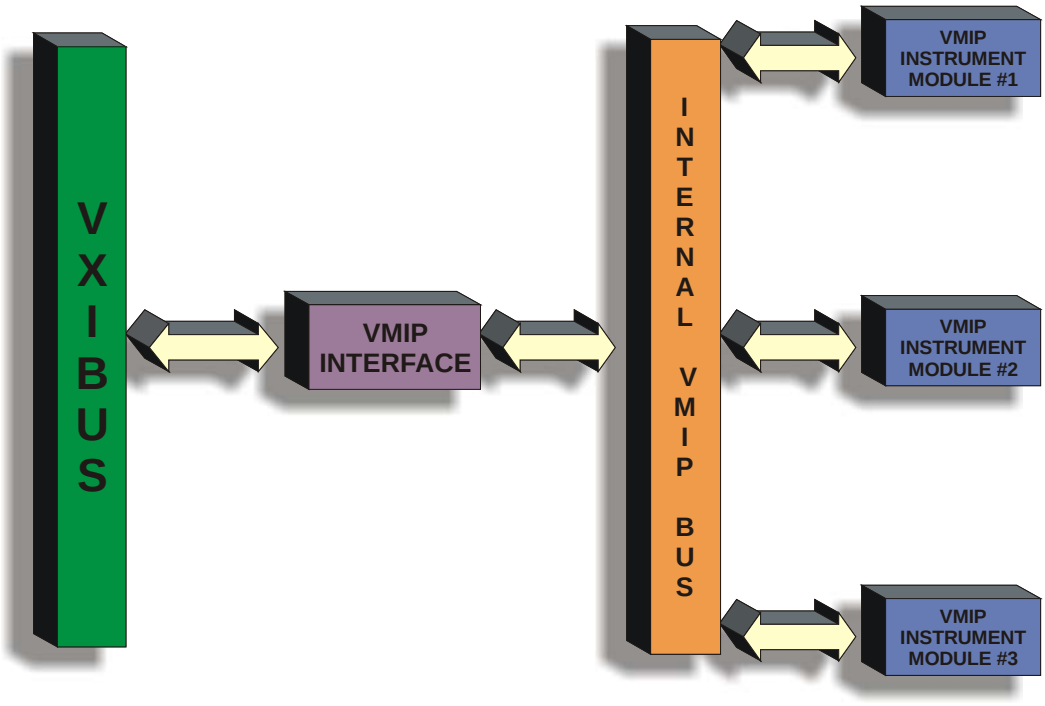
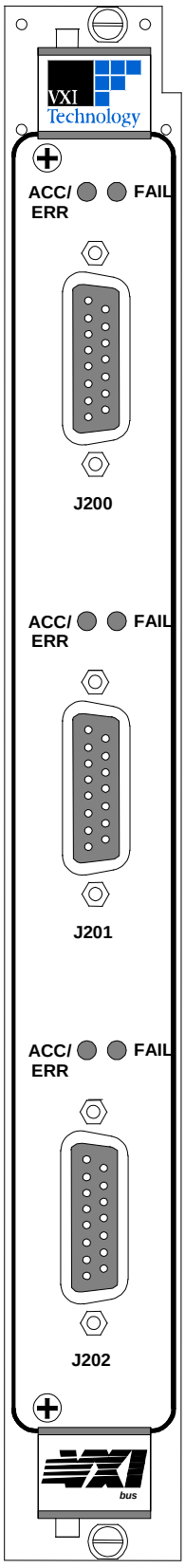


FIGURE 1-1: VMIP™ PLATFORM



Regardless of whether the VM2710A is configured with other VM2710A modules or with other VMIP modules, each DMM is treated as an independent instrument in the VXIbus chassis. Each has its own Unique Logical Address and, as such, its own front panel FAIL and ACCESS indicators.

DESCRIPTION

The VM2710A is designed for fast system throughput with greater than 2000 readings/s across the backplane. For applications that require multiple input monitoring, the VM2710A provides for on-board limit checking and the option of generating VXIbus triggers if the input exceeds these limits. This approach further speeds system throughput by freeing up the VXIbus controller and backplane from having to continuously monitor these limits.

As part of the VMIP family of instruments, the VM2710A can be combined with up to two other modules to form a high-density VXIbus instrument that fully utilizes the capabilities of the VMIP module.

Two differential isolated input channels are provided on the VM2710A to allow one channel to be connected to a scanning multiplexer while the other can be brought directly out for manual testing or precision measurements.

Measurement aperture times may be programmed allowing the choice of resolution, accuracy, and noise rejection (i.e., rejection of 50 Hz or 60 Hz noise). Fast function/range changes allow for optimum measurement throughput. Short aperture times give high-speed readings while longer aperture times give greater accuracy.

The DMM has extensive triggering capabilities including programmable delays to allow synchronization with external devices. It can be triggered from the front panel trigger input, the VXIbus trigger lines or via word-serial protocol.

The VM2710A 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.

The calibration constants 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 (such as during routine calibration cycles). These constants may also be examined at any time via a word serial query and altered via a word serial command. All calibration is done via software, including the ac range. This allows for automated calibration and eliminates the need for removing covers from the unit.

FIGURE 1-2: FRONT PANEL LAYOUT

VM2710A SPECIFICATIONS

GENERAL SPECIFICATIONS	
WARM UP TIME	
	60 min
DMM INPUTS	
Connector	15-Pin “D” Connector
Input Sets	Two input sets consisting of: INPUT HI, INPUT LO, +I, -I, GUARD, TRIGGER INPUT and/or GROUND
MEASUREMENT FUNCTIONS	
	Volts (dc, rms ac) 2-wire ohms 4-wire ohms Current (dc, rms ac)
OTHER FRONT PANEL FEATURES	
	2 A fuse for current function
DATA ACCESS TYPES	
	Register or message-based word serial
MEMORY	
	64,000 readings / 256,000 readings optional
CALIBRATION METHOD	
	Programmable with covers on; calibration constants stored in non-volatile memory
OVERLOAD INDICATION	
	Programmable
AUTORANGING	
Up-Ranges	@ > 120% of range in dc volts, ac volts and current functions @ > 100% of range in ohms function
Down-Ranges	@ < 10% of range in dc volts, ac volts and current functions @ < 9% of range in ohms function
FILTERS	
	AC filter only
MAXIMUM COMMON MODE VOLTAGE	
	350 V dc or rms ac (500 V p)
OPERATING ENVIRONMENT	
	0 °C to 55 °C

DC VOLTAGE SPECIFICATIONS

DC RANGES

0.1, 1.0, 10.0, 100.0, 300.0 V

OVER-RANGE

20% except 300 V range

INPUT IMPEDANCE

0.1 V – 10.0 V Range	1.0 GΩ
100 V & 300 V Range	10.0 MΩ

NORMAL MODE REJECTION @ POWER-LINE FREQUENCY ±0.1%, @ 100, 10 OR 1 PLC

> 70 dB

COMMON-MODE REJECTION, WITH UP TO 1 kΩ IN INPUT LOW LEAD

DC	> 140 dB
50 – 400 Hz @:	
1, 10, 100 PLC	> 120 dB
0.1 PLC	> 80 dB
0.03 PLC	> 70 dB

INPUT BIAS CURRENT

At 23 °C	50 PA maximum
Over Temperature	100 PA maximum

INPUT PROTECTION

300 V on all ranges

RESOLUTION

Range	100 PLC (6.5 Digits)	10 PLC (6.5 Digits)	1 PLC (5.5 Digits)	0.1 PLC (5.5 Digits)	0.03 PLC (4.5 Digits)
0.1 V	100 nV	100 nV	1 μV	1 μV	10 μV
1.0 V	1 μV	1 μV	10 μV	10 μV	100 μV
10.0 V	10 μV	10 μV	100 μV	100 μV	1 mV
100.0 V	100 μV	100 μV	1 mV	1 mV	10 mV
300.0 V	100 μV	100 μV	1 mV	1 mV	10 mV

24 HR ACCURACY ± (%READING + %RANGE) T_{CAL} ±1 °C AFTER 1 HR WARM-UP

Range	100 PLC (6.5 Digits)	10 PLC (6.5 Digits)	1 PLC (5.5 Digits)	0.1 PLC (5.5 Digits)	0.03 PLC (4.5 Digits)
0.1 V	0.001 + 0.002	0.001 + 0.002	0.001 + 0.002	0.001 + 0.005	0.01 + 0.01
1.0 V	0.001 + 0.001	0.001 + 0.001	0.001 + 0.001	0.001 + 0.003	0.01 + 0.01
10.0 V	0.001 + 0.001	0.001 + 0.001	0.001 + 0.001	0.001 + 0.003	0.01 + 0.01
100.0 V	0.001 + 0.001	0.001 + 0.001	0.001 + 0.001	0.001 + 0.003	0.01 + 0.01
300.0 V	0.001 + 0.001	0.001 + 0.001	0.001 + 0.001	0.001 + 0.001	0.01 + 0.01

90 DAY ACCURACY ± (%READING + %RANGE) T_{CAL} ±5 °C AFTER 1 HR WARM-UP AND DC ZERO COMMAND

Range	100 PLC (6.5 Digits)	10 PLC (6.5 Digits)	1 PLC (5.5 Digits)	0.1 PLC (5.5 Digits)	0.03 PLC (4.5 Digits)
0.1 V	0.005 + 0.003	0.005 + 0.003	0.005 + 0.003	0.005 + 0.007	0.02 + 0.02
1.0 V	0.004 + 0.003	0.004 + 0.003	0.004 + 0.003	0.004 + 0.005	0.02 + 0.02
10.0 V	0.005 + 0.003	0.005 + 0.003	0.005 + 0.003	0.005 + 0.005	0.02 + 0.02
100.0 V	0.005 + 0.003	0.005 + 0.003	0.005 + 0.003	0.007 + 0.005	0.02 + 0.02
300.0 V	0.005 + 0.003	0.005 + 0.003	0.005 + 0.003	0.007 + 0.004	0.02 + 0.02

DC VOLTAGE SPECIFICATIONS (CONTINUED)

1 YEAR ACCURACY ± (%READING + %RANGE) T_{CAL} ± 5 °C AFTER 1 HOUR WARM-UP AND DC ZERO COMMAND

Range	100 PLC (6.5 Digits)	10 PLC (6.5 Digits)	1 PLC (5.5 Digits)	0.1 PLC (5.5 Digits)	0.03 PLC (4.5 Digits)
0.1 V	0.007 + 0.005	0.007 + 0.005	0.007 + 0.005	0.007 + 0.009	0.03 + 0.02
1.0 V	0.005 + 0.005	0.005 + 0.005	0.005 + 0.005	0.005 + 0.007	0.03 + 0.02
10.0 V	0.007 + 0.005	0.007 + 0.005	0.007 + 0.005	0.007 + 0.007	0.03 + 0.02
100.0 V	0.008 + 0.005	0.008 + 0.005	0.008 + 0.005	0.010 + 0.007	0.03 + 0.02
300.0 V	0.008 + 0.005	0.008 + 0.005	0.008 + 0.005	0.010 + 0.006	0.03 + 0.02

TEMPERATURE COEFFICIENT: 0 °C - 18 °C AND 28 °C - 55 °C; ±(%READING + %RANGE) / °C

0.1 V	0.0003 + 0.0005
1.0 V	0.0002 + 0.0001
10.0 V	0.0003 + 0.0001
100.0 V	0.0007 + 0.0001
300.0 V	0.0007 + 0.0001

DC Current Specifications

Current Ranges	
	10 mA, 100 mA, and 1.0 A
Over-Range	
	20% on all ranges
Shunt Resistors	
1.0 A Range	0.1 Ω
10 mA, 100 mA Range	8.1 Ω
Burden Voltage	
10 mA	≤ 100 mV
100 mA	≤ 1.0 V
1.0 A	≤ 120 mV
Overcurrent Protection	
	2.0 A fuse
Resolution	

Range	100 PLC (6.5 Digi□s)	10 PLC (6.5 Digits)	1 PLC (5.5 Digits)	0.1 PLC (5.5 Digits)	0.03 PLC (4.5 Digits)
10 mA	10 nA	10 nA	100 nA	100 nA	1 μA
100 mA	100 nA	100 nA	1 μA	1 μA	10 μA
1.0 A	1 μA	1 μA	10 μA	10 μA	100 μA

24 Hour Accuracy ±(%Reading + %Range) T_{CAL} ±1 °C after 1 Hr Warm-up

Range	100 PLC (6.5 Digits)	10 PLC (6.5 Digits)	1 PLC (5.5 Digits)	0.1 PLC (5.5 Digits)	0.03 PLC (4.5 Digits)
10 mA	0.005 + 0.005	0.005 + 0.005	0.005 + 0.005	0.005 + 0.005	0.010 + 0.010
100 mA	0.005 + 0.001	0.005 + 0.001	0.005 + 0.001	0.005 + 0.005	0.010 + 0.010
1.0 A	0.005 + 0.005	0.005 + 0.005	0.005 + 0.005	0.005 + 0.005	0.010 + 0.010

90 Day Accuracy ±(%Reading + %Range) T_{CAL} ±5 °C after 1 Hr Warm-up and DC ZERO command

Range	100 PLC (6.5 Digits)	10 PLC (6.5 Digits)	1 PLC (5.5 Digits)	0.1 PLC (5.5 Digits)	0.03 PLC (4.5 Digits)
10 mA	0.015 + 0.010	0.015 + 0.010	0.015 + 0.010	0.015 + 0.010	0.030 + 0.050
100 mA	0.015 + 0.004	0.015 + 0.004	0.015 + 0.004	0.015 + 0.004	0.030 + 0.030
1.0 A	0.015 + 0.010	0.015 + 0.010	0.015 + 0.010	0.015 + 0.010	0.030 + 0.050

1 Year Accuracy ±(%Reading + %Range) T_{CAL} ±5 °C after 1 Hr Warm-up

Range	100 PLC (6.5 Digits)	10 PLC (6.5 Digits)	1 PLC (5.5 Digits)	0.1 PLC (5.5 Digits)	0.03 PLC (4.5 Digits)
10 mA	0.020 + 0.015	0.020 + 0.015	0.020 + 0.015	0.020 + 0.015	0.05 + 0.05
100 mA	0.020 + 0.008	0.020 + 0.008	0.020 + 0.008	0.020 + 0.01	0.05 + 0.05
1.0 A	0.020 + 0.015	0.020 + 0.015	0.020 + 0.015	0.020 + 0.015	0.05 + 0.05

Temperature Coefficient: 0 °C - 18 °C and 28 °C - 55 °C; (%Reading + %Range) / °C	
10 mA	0.002 + 0.0005
100 mA	0.001 + 0.0005
1.0 A	0.002 + 0.0005

AC VOLTAGE SPECIFICATIONS

MEASUREMENT METHOD

AC-coupled true rms

AC RANGES

0.1, 1.0, 10.0, 100.0, 300.0 VAC

OVERRANGE

20% except 300 V range

INPUT IMPEDANCE

1 MΩ in parallel with < 50 pF

CREST FACTOR

5:1 maximum

ADDITIONAL CREST FACTOR ERROR

Crest Factor	
1 - 2	Add 0.05% of reading
2 - 3	Add 0.15% of reading
3 - 4	Add 0.30% of reading
4 - 5	Add 0.40% of reading

AC COMMON-MODE REJECTION WITH 100 Ω IN LOW LEAD

70 dB

MAXIMUM INPUT VOLTAGE

dc + ac = 300 V_{rms}

RESOLUTION

Range	100 PLC (6.5 Digits)	10 PLC (6.5 Digits)	1 PLC (5.5 Digits)	0.1 PLC (5.5 Digits)	0.03 PLC (4.5 Digits)
0.1 V	1 μV	1 μV	1 μV	10 μV	10 μV
1.0 V	10 μV	10 μV	10 μV	100 μV	100 μ□
10.0 V	100 μV	100 μV	100 μV	1 mV	1 mV
100.0 V	1 mV	1 mV	1 mV	10 mV	10 mV
300.0 V	1 mV	1 mV	1 mV	10 mV	10 mV

ACCURACY @ 100, 10, AND 1 PLC FOR 24 HR @ T_{CAL} ±1 °C AFTER 1 HR WARM-UP; ±(%READING + %RANGE): SINE-WAVE INPUT ≥ 5% FULL SCALE (F.S.), LOW-FREQUENCY FILTER ON

Range	0.1 V Range	1.0 V – 300.0 V Ranges : (V_{IN} x Freq. ≤ $1.5x10^7$)
20 Hz – 30 Hz	1.00 + 0.15	1.00 + 0.02
30 Hz – 50 Hz	0.50 + 0.15	0.50 + 0.02
50 Hz – 200 Hz	0.20 + 0.15	0.20 + 0.02
200 Hz – 10 kHz	0.05 + 0.15	0.02 + 0.02
10 kHz – 50 kHz	0.20 + 0.15	0.05 + 0.04
50 kHz – 100 kHz	0.60 + 0.20	0.30 + 0.10
100 kHz – 300 kHz	3.00 + 0.50	3.00 + 0.50

ACCURACY @ 100, 10 AND 1 PLC FOR 90 DAYS @ T_{CAL} ±5 °C AFTER 1 HR WARM-UP; ±(%READING + %RANGE): SINE-WAVE INPUT ≥ 5% F.S., LOW-FREQUENCY FILTER ON

Range	0.1 V Range	1.0 V – 300.0 V Ranges : (V_{IN} x Freq. ≤ $1.5x10^7$)
20 Hz – 30 Hz	1.10 + 0.15	1.10 + 0.03
30 Hz – 50 Hz	0.55 + 0.15	0.55 + 0.03
50 Hz – 200 Hz	0.23 + 0.15	0.23 + 0.03
200 Hz – 10 kHz	0.08 + 0.15	0.05 + 0.03
10 kHz – 50 kHz	0.23 + 0.15	0.10 + 0.05
50 kHz – 100 kHz	0.70 + 0.25	0.40 + 0.15
100 kHz – 300 kHz	4.00 + 0.60	4.00 + 0.60

AC VOLTAGE SPECIFICATIONS (CONTINUED)

ACCURACY @ 100, 10 AND 1 PLC FOR 1 YR @ T_{CAL} ±5 °C AFTER 1-HR WARM-UP; ±(%READING + %RANGE): SINE-WAVE INPUT ≥ 5% F.S., LOW-FREQUENCY FILTER ON

Range	0.1 V Range	1.0 V – 300.0 V Ranges : (V_{IN} x Freq. ≤ $1.5x10^7$)
20 Hz – 30 Hz	1.12 + 0.15	1.12 + 0.04
30 Hz – 50 Hz	0.57 + 0.15	0.57 + 0.04
50 Hz – 200 Hz	0.25 + 0.15	0.25 + 0.04
200 Hz – 10 kHz	0.10 + 0.15	0.07 + 0.04
10 kHz – 50 kHz	0.25 + 0.15	0.12 + 0.06
50 kHz – 100 kHz	0.75 + 0.25	0.45 + 0.20
100 kHz – 300 kHz	4.00 + 0.60	4.00 + 0.60

TEMPERATURE COEFFICIENT; 0 °C - 18 °C AND 28 °C - 55 °C; ±(%READING + %RANGE) / °C

20 Hz – 30 Hz	0.020 + 0.001
30 Hz – 50 Hz	0.010 + 0.001
50 Hz – 200 Hz	0.005 + 0.001
200 Hz – 10 kHz	0.005 + 0.001
10 kHz – 50 kHz	0.005 + 0.001
50 kHz – 100 kHz	0.020 + 0.010

***Note**: Add 0.005% Reading/°C in 100.0 V and 300.0 V ranges*

AC Current Specifications

Measurement Method

Direct coupled to fuse and shunt, ac-coupled true rms measurement

Current Ranges

10 mA, 100 mA, and 1.0 A rms

Over-Range

20%

Shunt Resistors

1.0 A Range	0.1 Ω
10 mA & 100 mA Range	8.1 Ω

Burden Voltage

10 mA	≤ 100 mV
100 mA	≤ 1.0 V
1.0 A	≤ 120 mV

Over-current Protection

2.0 A fuse

Resolution

Range	100 PLC (6.5 Digits)	10 PLC (6.5 Digits)	1 PLC (5.5 Digits)	0.1 PLC (5.5 Digits)	0.03 PLC (4.5 Digits)
10 mA	100 nA	100 nA	1 μA	1 μA	1 μA
100 mA	1 μA	1 μA	1 μA	10 μA	10 μA
1.0□A	10 μA	10 μA	10 μA	100 μA	100 μA

24 hr Accuracy[1]

Range	10 mA Range	100 mA Range	1.0 A Range
20 Hz – 30 Hz	1.00 + 0.20	1.00 + 0.04	1.00 + 0.20
30 Hz – 50 Hz	0.50 + 0.20	0.50 + 0.04	0.50 + 0.20
50 Hz – 1k Hz	0.20 + 0.20	0.20 + 0.04	0.20 + 0.20
1k Hz – 5kHz	0.17 + 0.20	0.17 + 0.20	0.17 + 0.20
5kHz – 10kHz	0.55 + 0.30	0.55 + 0.30	3.0 + 0.30

90 day Accuracy[2]

Range	10 mA Range	100 mA Range	1.0 A Range
20 Hz – 30 Hz	1.10 + 0.20	1.10 + 0.05	1.10 + 0.20
30 Hz – 50 Hz	0.60 + 0.20	0.60 + 0.05	0.60 + 0.20
50 Hz – 1kHz	0.30 + 0.20	0.30 + 0.05	0.30 + 0.20
1kHz – 5kHz	0.27 + 0.20	0.27 + 0.20	0.27 + 0.20
5kHz – 10kHz	0.65 + 0.30	0.65 + 0.30	3.1 + 0.30

1 yr Accuracy[2]

Range	10 mA Range	100 mA Range	1.0 A Range
20 Hz – 30 Hz	1.12 + 0.20	1.12 + 0.06	1.12 + 0.20
30 Hz – 50 Hz	0.62 + 0.20	0.62 + 0.06	0.62 + 0.20
50 Hz – 1kHz	0.32 + 0.20	0.32 + 0.06	0.32 + 0.20
1kHz – 5kHz	0.29 + 0.20	0.29 + 0.20	0.29 + 0.20
5kHz – 10kHz	0.67 + 0.30	0.67 + 0.30	3.12 + 0.30

Temperature Coefficient: 0 °C - 18 °C and 28 °C - 55 °C; (%Reading + %Range) / °C

20 Hz – 30 Hz	0.020 + 0.001
30 Hz – 50 Hz	0.010 + 0.001
50 Hz – 10kHz	0.006 + 0.001

RESISTANCE SPECIFICATIONS

RESISTANCE RANGES	
	20 Ω, 200 Ω, 2 kΩ, 20 kΩ, 200 kΩ, 2 MΩ, 20 MΩ
OVER-RANGE	
	None
VOLTAGE ACROSS UNKNOWN	
20 Ω & 200 Ω Ranges	240 mV nominal at full scale
All Other Ranges	2.4 V nominal at full scale
LEAD WIRE RESISTANCE	
20 Ω & 200 Ω Ranges	10.0 Ω maximum
All Other Ranges	100.0 Ω maximum
VOLTAGE PROTECTION	
	300 V dc or peak ac
OPEN CIRCUIT VOLTAGE	
20 Ω & 200 Ω Ranges	+8 V max. in 20 Ω and 200 Ω range
2 kΩ & 20 MΩ Ranges	+9 V max. in 2 kΩ and 20 MΩ range
MEASUREMENTCURRENTS	
Range	Current
20 Ω	12 mA
200 Ω	1.2 mA
2 kΩ	1.2 mA
20 kΩ	100 μA
200 kΩ	12 μA
2 MΩ	1.2 μA
20 MΩ	120 nA
RESOLUTION	

Range	100 PLC (6.5 Digits)	10 PLC (6.5 Digits)	1 PLC (5.5 Digits)	0.1 PLC (5.5 Digits)	0.03 PLC (4.5 Digits)
20 Ω	100 μΩ	100 μΩ	100 μΩ	1 mΩ	1 mΩ
200 Ω	100 μΩ	1 mΩ	1 mΩ	10 mΩ	10 mΩ
2 kΩ	1 mΩ	1 mΩ	10 mΩ	100 mΩ	100 mΩ
20 kΩ	10 mΩ	10 mΩ	100 mΩ	1.0 Ω	1.0 Ω
200 kΩ	100 mΩ	100 mΩ	1.0 Ω	10 Ω	10 Ω
2 MΩ	1.0 Ω	1.0 Ω	10 Ω	100 Ω	100 Ω
20 MΩ	100 Ω	100 Ω	1 kΩ	1 kΩ	1 kΩ

4-WIRE - 24 HOUR ACCURACY ± (%READING + %RANGE) T_{CAL} ±1 °C AFTER 1 HOUR WARM-UP[3]

Range	100 PLC	10 PLC	1 PLC	0.1 PLC	0.03 PLC
20 Ω	0.001 + 0.007	0.001 + 0.007	0.001 + 0.007	0.001 + 0.007	0.01 + 0.02
200 Ω	0.001 + 0.007	0.001 + 0.007	0.001 + 0.007	0.001 + 0.007	0.01 + 0.02
2 kΩ	0.001 + 0.001	0.001 + 0.001	0.001 + 0.003	0.001 + 0.005	0.01 + 0.02
20 kΩ	0.001 + 0.002	0.001 + 0.002	0.001 + 0.003	0.001 + 0.005	0.01 + 0.02
200 kΩ	0.001 + 0.002	0.001 + 0.002	0.001 + 0.003	0.001 + 0.005	0.01 + 0.02
2 MΩ	0.001 + 0.002	0.001 + 0.002	0.001 + 0.003	0.040 + 0.005	0.03 + 0.02
20 MΩ	0.010 + 0.002	0.010 + 0.002	0.010 + 0.003	0.200 + 0.005	0.20 + 0.02

Resistance Specifications (Continued)

4-Wire: 90 Day Accuracy ±(%Reading + %Range) T_{CAL} ±5 °C after 1 Hr Warm-up[3]

Range	100 PLC	10 PLC	1 PLC	0.1 PLC	0.03 PLC
20 Ω	0.005 + 0.008	0.005 + 0.008	0.005 + 0.008	0.005 + 0.010	0.02 + 0.02
200 Ω	0.005 + 0.008	0.007 + 0.008	0.007 + 0.008	0.007 + 0.010	0.02 + 0.02
2 kΩ	0.005 + 0.002	0.007 + 0.003	0.007 + 0.005	0.007 + 0.007	0.02 + 0.02
20 kΩ	0.005 + 0.003	0.007 + 0.003	0.007 + 0.005	0.007 + 0.007	0.02 + 0.02
200 kΩ	0.005 + 0.003	0.007 + 0.003	0.007 + 0.005	0.007 + 0.007	0.02 + 0.02
2 MΩ	0.010 + 0.003	0.010 + 0.003	0.010 + 0.005	0.050 + 0.007	0.04 + 0.03
20 MΩ	0.020 + 0.003	0.020 + 0.003	0.020 + 0.005	0.200 + 0.007	0.20 + 0.05

4-Wire: 1 Yr Accuracy ±(%Reading + %Range) T_{CAL} ±5 °C after 1 Hr Warm-up[3]

Range	100 PLC	10 PLC	1 PLC	0.1 PLC	0.03 PLC
20 Ω	0.010 + 0.010	0.010 + 0.010	0.010 + 0.010	0.010 + 0.015	0.03 + 0.03
200 Ω	0.010 + 0.010	0.010 + 0.010	0.010 + 0.010	0.010 + 0.010	0.03 + 0.03
2 kΩ	0.010 + 0.005	0.010 + 0.005	0.010 + 0.007	0.010 + 0.007	0.03 + 0.03
20 kΩ	0.010 + 0.005	0.010 + 0.005	0.010 + 0.007	0.010 + 0.007	0.03 + 0.03
200 kΩ	0.010 + 0.005	0.010 + 0.005	0.010 + 0.007	0.010 + 0.007	0.03 + 0.03
2 MΩ	0.015 + 0.005	0.015 + 0.005	0.015 + 0.010	0.060 + 0.010	0.05 + 0.04
20 MΩ	0.025 + 0.005	0.025 + 0.005	0.025 + 0.010	0.210 + 0.010	0.22 + 0.05

Temperature Coefficient; 0 °C - 18 °C and 28 °C - 55 °C; ±(%Reading + %Range) / °C

Range	
20 Ω	0.0007 + 0.0002
200 Ω	0.0007 + 0.0002
2 kΩ	0.0006 + 0.0001
20 kΩ	0.0006 + 0.0002
200 kΩ	0.0006 + 0.0002
2 MΩ	0.0015 + 0.0004
20 MΩ	0.0035 + 0.0004

Reading Rate Specifications

Resistance Ranges

Read Rates (60 Hz)					
Readings/s	0.5	5.0	50.0	500.0	2000.0
Aperture Times	100 PLC	10 PLC	1 PLC	0.1 PLC	0.03 PLC
Read Rates (70 Hz)					
Readings/s	0.4	4.0	45.0	450.0	2000.0
Aperture Times	100 PLC	10 PLC	1 PLC	0.1 PLC	0.03 PLC

Note

[1]Accuracy @ 100, 10 and 1 PLC @ T_{CAL} ±1 °C after 1 hr warm-up; ±(%Reading + %Range), Sine-wave input ≥ 5% F.S., Low-Frequency Filter ON

[2]Accuracy @ 100, 10 and 1 PLC @ T_{CAL} ± 5 °C after 1 hr warm-up; ±(%Reading + %Range), Sine-wave input ≥ 5% F.S., Low-Frequency Filter ON

[3]2-wire accuracy is the same as that shown for 4-wire measurements after performing a math null measurement. Without setting the null, readings will include lead resistance, which is application specific, and add 0.2 Ω of additional error for contact resistance. Typical 24 AWG stranded wire is 0.03 Ω/ft.

SECTION 2

PREPARATION FOR USE

INSTALLATION

When the VM2710A is unpacked from its shipping carton, the contents should include the following items:

(1) VM2710A VXIbus module
(1) VM2710A 6.5 Digit Multimeter User's Manual (this manual)

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

Once the VM2710A is assessed to be in good condition, it may be installed into an appropriate C-size or D-size VXIbus chassis in any slot other than slot zero. The chassis should be checked to ensure that it is capable of providing adequate power and cooling for the VM2710A. Once the chassis is found adequate, the VM2710A's logical address and the chassis' backplane jumpers should be configured prior to the VM2710A's installation.

CALCULATING SYSTEM POWER AND COOLING REQUIREMENTS

It is imperative that the chassis provide adequate power and cooling for this module. Referring to the chassis user's 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.



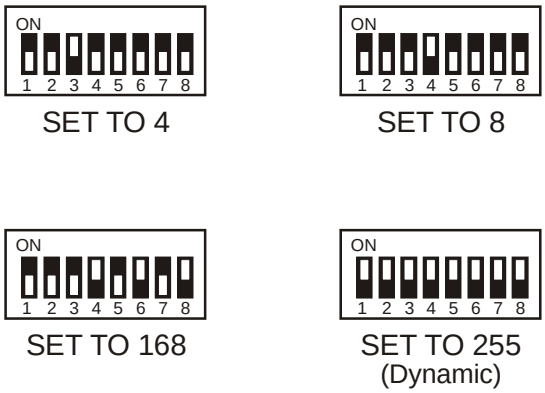
It should be noted that if the chassis cannot provide adequate power to the module, the instrument may not perform to specification or possibly not operate at all. In addition, if adequate cooling is not provided, the reliability of the instrument will be jeopardized and permanent damage may occur. Damage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

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 VM2710A 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. (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.

FRONT PANEL INTERFACE WIRING

The VM2710A's interface is made available on the front panel of the instrument. The VM2710A-1 will have J201 that contains all signals for this instrument. The VM2710A-2 will have J201 and J202, while the VM2710A-3 will have J200, J201, and J202. The wiring for each of these connectors is identical and since each group is treated as a separate instrument, the module will have three A channels and three B channels.

TABLE 2-1: DIGIT MULTIMETER PIN OUTS

PIN NUMBER	SIGNAL
1	FRONT PANEL TRIGGER INPUT
2	GUARD CHAN B (Shield)
3	INPUT CHAN B LOW
4	INPUT CHAN B HIGH
5	GUARD CHAN B (Shield)
6	INPUT CHAN A LOW
7	INPUT CHAN A HIGH
8	GUARD CHAN A (Shield)
9	GROUND
10	GUARD CHAN B (Shield)
11	-I: CHAN B (ac / dc current and 4-wire ohms)
12	+I: CHAN B (ac / dc current and 4-wire ohms)
13	GUARD CHAN A (Shield)
14	-I: CHAN A (ac / dc current and 4-wire ohms)
15	+I: CHAN A (ac / dc current and 4-wire ohms)

The pin locations for J200, J201, and J202 are shown in Figure 2-2:

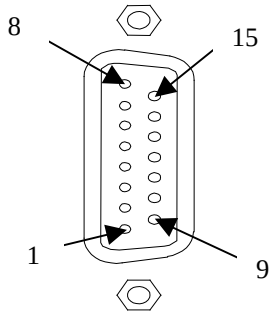


FIGURE 2-2: J200, J201, AND J202 PIN LOCATIONS

SECTION 3

PROGRAMMING

INTRODUCTION

The VM2710A is a VXIbus message-based device whose command set is compliant with the Standard Command for Programmable Instruments (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 module recognizes SCPI commands. SCPI 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. As an example, **DELay:AUTOmatic**, **SLOPe**, and **SOURce** are all branches off the **TRIGger:** trunk and can be combined as follows:

```
TRIGger:DELay:AUTOmatic;SLOPe POS;SOURce EXT
```

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

```
TRIGger:DELay:AUTOmatic
TRIGger:SLOPe POS
TRIGger:SOURce EXT
```

See the Standard Command 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:

```
TRIGger:SOURce EXTernal
trigger:source external
TRIGGER:SOURCE EXTERNAL
TRIG:SOURce EXTernal
TRIG:SOUR EXTernal
TRIG:SOUR EXT
trig:sour EXT
trig:sour ext
```

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

TRIGG:SOUR EXT ***(incorrect syntax - extra "G"- only trig or trigger 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.

When character data is used for a parameter, both short and long forms are recognized. If the command has a query form with character response data, the short form is always returned in upper case. As an example, to find out what the current trigger source setting is use the following command:

```
TRIG:SOUR?
```

The response would be:

```
EXT
```

This tells the user that the trigger is set to an external source.

Multiple commands can also be combined on one line. To do this, terminate one command with a semicolon and start the next command with a colon. As an example, the trigger source can be set to a positive edge and an output trigger line can be enabled as follows:

```
TRIG:SOUR EXT;:OUTPUT:TTLTRG1 ON
```

The IEEE-STD-488.2 Common Commands can be placed anywhere set off from the rest of the command by a semicolon. They can also be placed alone on a line. For example, place the ***RST** command in front of a setting string as follows:

```
*RST;OUTP:TTLT 3;POL POS
```

Note that the **OUTP:TTLT** command set did not require a leading colon (:) because there was no prior trunk of the SCPI tree.

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.

REGISTER ACCESS

The VM2710A provides pseudo register access for high-speed data retrieval. The register is read only and has 32-bit information accessible in two 16-bit parts.

There are two methods for accessing the 32-bit information. One method is to access the information as a 32-bit data value with data-high and data-low retrieved from two 16-bit locations. The second method is 32-bit access from one 16-bit location with the data-high/data-low information alternating (data-high is first). This second method of data retrieval must be properly synchronized otherwise the data would all be offset by 16 bits. The register map is specified in Table 3-2.

The eight most significant bits of data-high contain data status and instrument function information. The eight LSB of data-high, along with all 16 bits of data-low, contain the data collected. **Figure 3-1** defines the 32 data bit assignments in the register. The instrument Function and Range information (bits 24 through 28) is defined in **Table 3-1**.

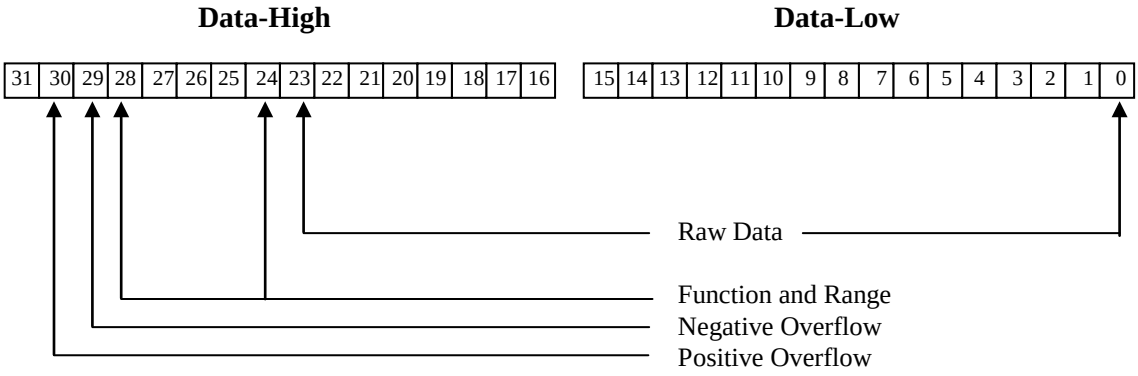


FIGURE 3-1: REGISTER ACCESS - 32-BIT

TABLE 3-1: FUNCTION AND RANGE

Value	Function	Scale	Offset
0	PON/Test	N/A	N/A
1	0.1 V dc	3.00000e-8	0x00400000
2	1.0 V dc	3.00000e-7	0x00400000
3	10 V dc	3.00000e-6	0x00400000
4	100 V dc	3.00000e-5	0x00400000
5	300 V dc	7.50000e-5	0x00400000
6	0.1 V ac	1.50000e-8	0x00000000
7	1.0 V ac	1.50000e-7	0x00000000
8	10 V ac	1.50000e-6	0x00000000
9	100 V ac	1.50000e-5	0x00000000
10	300 V ac	3.70000e-5	0x00000000
11	20 Ω	2.50000e-6	0x00000000
12	200 Ω	2.50000e-5	0x00000000
13	2 kΩ	2.50000e-4	0x00000000
14	20 kΩ	2.50000e-3	0x00000000
15	200 kΩ	2.50000e-2	0x00000000
16	2 MΩ	2.50000e-1	0x00000000
17	20 MΩ	2.50000e+0	0x00000000
18	20 4-Wire Ω	2.50000e-6	0x00000000
19	200 4-Wire Ω	2.50000e-5	0x00000000
20	2 k 4-Wire Ω	2.50000e-4	0x00000000
21	20 k 4-Wire Ω	2.50000e-3	0x00000000
22	200 k 4-Wire Ω	2.50000e-2	0x00000000
23	2 M 4-Wire Ω	2.50000e-1	0x00000000
24	20 M 4-Wire Ω	2.50000e+0	0x00000000
25	10 mA dc	3.00000e-9	0x00400000
26	100 mA dc	3.00000e-8	0x00400000
27	1 A dc	3.00000e-7	0x00400000
28	10 mA ac	1.50000e-9	0x00000000
29	100 mA ac	1.50000e-8	0x00000000
30	1 A ac	1.50000e-7	0x00000000

The VM2710A supports data access by way of the Device Dependent Registers of the VXIbus interface. The following table shows A16 Memory and the VM2710A Data Map.

TABLE 3-2: READ ONLY REGISTERS - A16 ADDRESS SPACE

Offset	Description
3E	
3C	
3A	
38	
36	
34	
32	
30	
2E	Write Pointer-Low
2C	Write Pointer-High
2A	Read Pointer-Low
28	Read Pointer-High
26	Data / 16-Bit
24	FIFO Status
22	Data-Low / 32-Bit
20	Data-High / 32-Bit
1E	
1C	
1A	
18	
16	[A32 Pointer Low]
14	[A32 Pointer High]
12	[A24 Pointer Low]
10	[A24 Pointer High]
E	Data Low
C	Data High
A	Response [/ Data Extended]
8	Protocol [/ Signal] Register
6	[Offset Register]
4	Status / Control Register
2	Device Type
0	ID Register

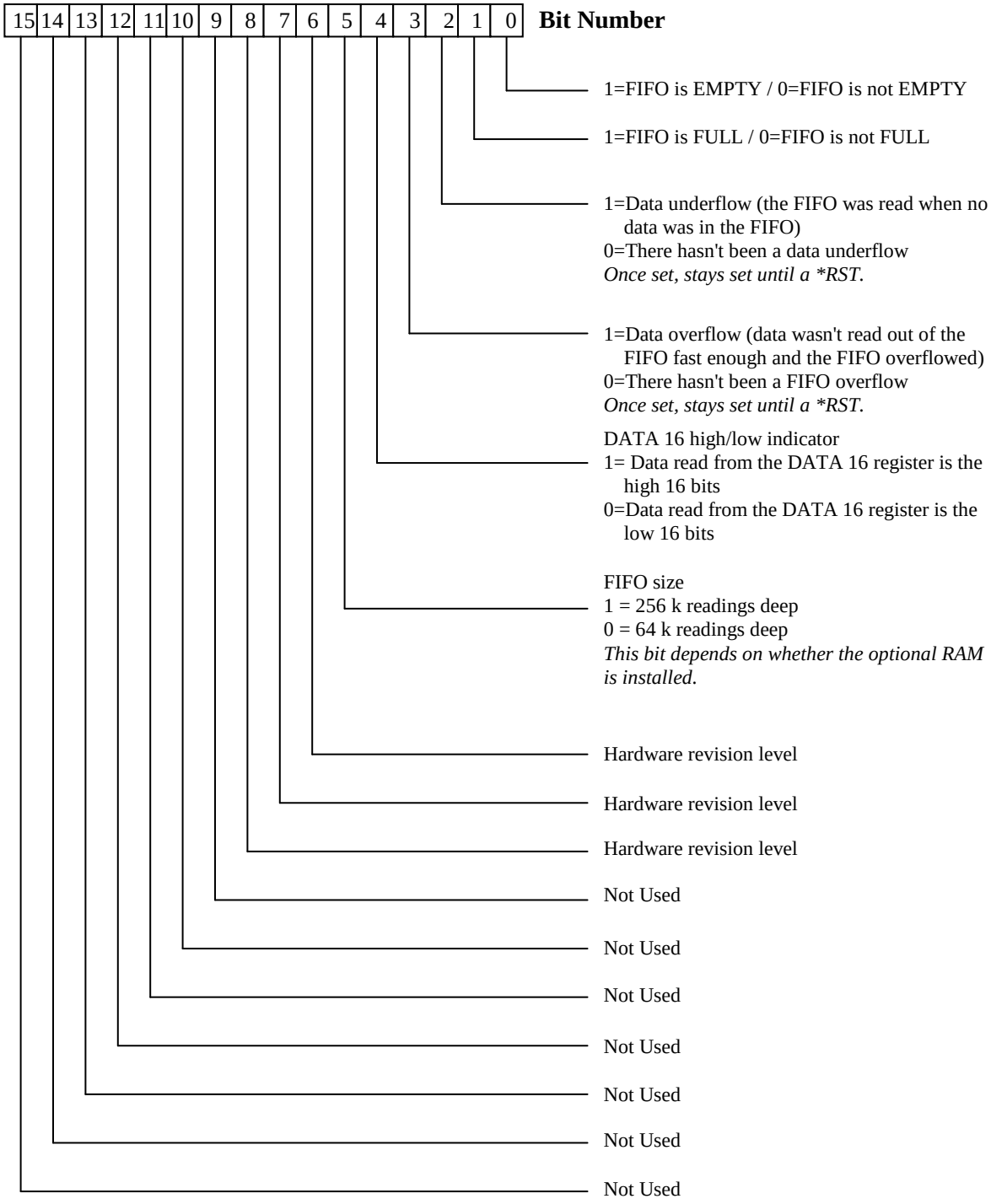


FIGURE 3-2: FIFO STATUS REGISTER

REGISTER ACCESS PROGRAMMING EXAMPLE

The following register access example includes parameter set-up, testing and data retrieval:

```
#include <utility.h>
#include <ansi_c.h>
#include <nivxi.h>
#include "stdio.h"
#include <userint.h>
#include "vxitech.h"
static double volt, voltmin, voltmax, accumulate;
static char *reg_base;

int main()
{
    static INT16 addr = 9;
    static UINT32 i, window, value;
    static INT32 int_value;
    static NIVXI_STATUS ret;
    static double delta_time, del_time;
    static UINT8 buf[100];

    /* Register access variables */
    static UINT16 *data_hi, *data_lo, temp;

    ClrScr ();

    /* Initialize the library */
    ret = InitVXIlibrary ();

    /* Put in a known state */
    vxiwrt(addr, "*rst");
    vxiwrt(addr, "conf:volt:dc 10");
    vxiwrt(addr, "volt:nplc 1");

    /* Ask the instrument how big an integration time it is using */
    vxiwrtrd(addr, "volt:nplc?", buf);

    /* Compute a delay time of one integration value */
    del_time = atof(buf) * 0.0166667;
```

```
/* Tell the VM2710A to start and how to run */
vxiwrt(addr, "trace:feed reg");
vxiwrt(addr, "trig:coun 0");
vxiwrt(addr, "init");

/* Remember the current time for later */
delta_time = Timer();

/* Loop sending "trig" and doing a delay until a key is hit */
while (KeyHit () == 0)

    {
    vxiwrt(addr, "trig");
    Delay(del_time);
    }

/* Wait for instrument to catch up with all the "trig" commands */
vxiwrtrd(addr, "*opc?", buf);

/* Find out how much time it took for the triggers */
delta_time = Timer() - delta_time;
printf("Time spent triggering: %f seconds\n", delta_time);

/* Map the A16 address space into our space for quick register access */
reg_base = (char *)MapVXIAddress (1, 0, 1000, &window, &ret) + 0xc000 + addr*0x40;

/* Initialize two pointers for easy access */
data_hi = (INT16*)(reg_base + 0x0020);
data_lo = (INT16*)(reg_base + 0x0022);

/* Initialize some variables for measurement statistics */
voltmin = 999.0;
voltmax = -999.0;
accumulate = 0.0;
i = 0;

/* Remember the current time for later */
delta_time = Timer();

/* Repeat while the register at 0x20 is non-zero */
while ((temp = *data_hi) != 0)

    {
```

```
        /* We already have the high data; get the low and combine into 32 bits */
        value = (temp << 16) | *data_lo;

        /* Isolate the actual measurement part (remove the rest) */
        int_value = value & 0x00ffffff;

        /* Convert from an unsigned integer to a signed integer and sign extend */
        if (int_value > 0xbfffff) int_value -= 0x1000000;
        int_value = int_value - 0x00400000;     /* Subtract the offset */
        volt = (double)int_value * 3.0e-6;  /* Multiply by the scale factor */

        /* Gather the statistics: high, low and average */
        accumulate = accumulate + volt;

            if (volt < voltmin)
                {
                voltmin = volt;
                }

            if (volt > voltmax)
                {
                voltmax = volt;
                }

        /* Keep track of how many readings we read */
        i++;
        }

    /* Find out how much time it took to get the readings */
    delta_time = Timer() - delta_time;

    /* Compute the average */
    accumulate = accumulate / i;

    /* Print the information */
    printf("Count = %d on %s at %s  Elapsed time: %f seconds\n",
    i, DateStr (), TimeStr (), delta_time);

    printf("Average loop time: %f seconds per reading\n", delta_time/i);

    printf("Average read rate: %f readings per second\n", i/delta_time);

    printf("Readings Min: %f  Average: %f  Max: %f\n", voltmin, accumulate, voltmax);
```

```
    printf("Min delta: %f  Max delta: %f  Delta hi to lo: %f\n", accumulate-voltmin, voltmax-accumulate, voltmax-
    voltmin);

    /* Return the mapping window to the system */
    ret = UnMapVXIAddress (window);

    /* Close the library */
    ret = CloseVXIlibrary ();

    /* Exit with no error */
    return(0);
}
```

CALIBRATION

The following is a summary of the CALibration commands that may be useful in calibrating the VM2710A. These commands are described in more detail in the *Command Dictionary* section of this manual. Some of these commands, if used improperly, can **destroy** the calibration of the VM2710A. Use these commands with **caution**.



The following commands should be used with caution and onlu be done by qualified personnel. If used improperly, some of these commands can destroy the calibration of the VM2710A.

CALIBRATION COMMANDS

CALibration:CONVert:GAIN?	*Reports the gain of the current function and range setting of the VM2710A. See the Scale column in Table 3-1 Function and Range. This query returns the constants for the currently set range and function.*
CALibration:CONVert:GAIN:CURRent:AC?	*Reports the gain for a specified range in the ac Current function. See the Scale column in Table* 3-1 *Function and Range.*
CALibration:CONVert:GAIN:CURRent[:DC]?	*Reports the gain for a specified range in the dc current function. See the Scale column in Table* 3-1 *Function and Range.*
CALibration:CONVert:GAIN:FRESistance?	*Reports the gain for a specified range in the 4-wire ohms function. See the Scale column in Table* 3-1 *Function and Range.*
CALibration:CONVert:GAIN:RESistance?	*Reports the gain for a specified range in the 2-wire ohms function. See the Scale column in Table* 3-1 *Function and Range.*
CALibration:CONVert:GAIN:VOLTage:AC?	*Reports the gain for a specified range in the ac voltage function. See the Scale column in Table* 3-1 *Function and Range.*
CALibration:CONVert:GAIN:VOLTage[:DC]?	*Reports the gain for a specified range in the dc voltage function. See the Scale column in Table* 3-1 *Function and Range.*

CALibration:CONVert:OFFSet?	*Reports the offset of the current function and range setting of the VM2710A. See the Offset column in Table* 3-1 *Function and Range. This query returns the constants for the currently set range and function.*
CALibration:CONVert:OFFSet:CURRent:AC?	*Reports the offset for a specified range in the ac Current function. See the Offset column in Table* 3-1 *Function and Range.*
CALibration:CONVert:OFFSet:CURRent[:DC]?	*Reports the offset for a specified range in the dc current function. See the Offset column in Table* 3-1 *Function and Range.*
CALibration:CONVert:OFFSet:FRESistance?	*Reports the offset for a specified range in the 4-wire ohms function. See the Offset column in Table* 3-1 *Function and Range.*
CALibration:CONVert:OFFSet:RESistance?	*Reports the offset for a specified range in the 2-wire ohms function. See the Offset column in Table* 3-1 *Function and Range.*
CALibration:CONVert:OFFSet:VOLTage:AC?	*Reports the offset for a specified range in the ac voltage function. See the Offset column in Table* 3-1 *Function and Range.*
CALibration:CONVert:OFFSet:VOLTage[:DC]?	*Reports the offset for a specified range in the dc voltage function. See the Offset column in Table* 3-1 *Function and Range.*
CALibration:DEFault	*This command sets the Gain and Offset values to their respective default values. This command is issued by the driver function vtvm2710_calDef. Note that CAL:SEC:STAT must first be OFF.*
CALibration:LFRequency	*The Calibration Line Frequency command selects the line frequency reference used by the A/D converter. The command parameters are as follows:* *50 selects 50 Hz line freq. ref.* *60 selects 60 Hz line freq. ref.* *400 actually uses 50 Hz reference; however, since 50 Hz is a sub-harmonic of 400 Hz, it provides normal mode rejection of power line related noise* *MINimum Selects 50 Hz line freq. ref.* *MAXimum Selects 60 Hz line freq. ref.* *This command set can be overridden by a 50 Hz or 60 Hz aperture time set; the last command executed has priority. The *RST command has no affect on this setting since it is stored in non-volatile memory.*

CALibration:LFRequency?	*The query will report the current frequency setting of 50 Hz or 60 Hz. If MINimum or MAXimum is specified, it will report the values available, which are 50 Hz or 60 Hz, respectively.*
CALibration:NUMBer?	*The Calibration Number is the number of times the device has been calibrated. This number is incremented each time the CAL:STORE command is issued to the device.*
CALibration:RESet	*This command will load the Calibration DACs from the calibration constants stored in non-volatile memory. This allows the user to modify Calibration DAC values with the ability to restore the original values. Note that CAL:SEC:STAT must first be OFF.*
CALibration:SECure:CODE	*This command/query sets or queries the CALibration:SECure:CODE. Both the command and query require the CALibration:SECure:STATe to be OFF. There is no driver function for this command/query.*
CALibration:SECure[:STATe]	*This command disables or enables the Calibration Secure state. This command is NOT dependant on any other settings on the VM2710A other than the CALibration:SECure:CODE. This command is performed by the driver function vtvm2710_enableDisableSecState.*
CALibration:STORe	*This command stores the currently loaded calibration values into Non-volatile memory. Before this command is issued, the instrument will use the currently loaded values, but will not save these values after power is removed, or a reset is issued. The vtvm2710_storeCalibrationData driver function performs this command. Note that CAL:SEC:STAT must first be OFF.*
CALibration:ZERO	*Sets the range for the zero measurement in the dc voltage function and takes a zero reading. If no value is entered, then the VM2710A will take a zero measurement for each of the voltage ranges, thus taking more time.*
CALibration:ZERO:UPDate	*Updates the current zero measurements to later be stored using the Calibration Store command.*

See the *Command Dictionary* section for more information on the Calibration commands.

MFGTEST COMMANDS

The following are low-level commands that may be used in calibrating the VM2710A. They are described here as an aid in understanding the VM2710A calibration programs. Most users will never need to use these commands. Some of these commands, if used improperly, can **destroy** the calibration of the VM2710A. Use these commands with **caution**.



The following commands should be used with caution and onlu be done by qualified personnel. If used improperly, some of these commands can destroy the calibration of the VM2710A.

MFGTEST 0 #O	*This command sets the CAL register in the converter, where #O is the value to be set, and is dependant only on the Aperture setting.*
MFGTEST 1 #S	*This command sets the SCALE register in the converter, where #S is the value to be set, and is only on the Aperture setting.*
MFGTEST 2 #H0120	*This command writes to the COMMAND register in the converter.*
MFGTEST? 2 #addr	*Read a Flash byte; used to read headers.*
MFGTEST 4 #F	*This command writes to the ac DAC, where #F is a value between 1 and 128. The equivalent command is MFGTEST:ACDAC #F.*
MFGTEST? 4	*Reports the ac DAC value. The equivalent command is MFGTEST:ACDAC?.*
MFGTEST 5 #S	*Sets the gain slope, where #S is the Calibration constant for the Slope setting, and is dependent on the settings for the Aperture, Measurement Function, and range. The equivalent command is MFGTEST:CAL_SCALE #S.*
MFGTEST? 5	*Reports the gain slope value. The equivalent command is MFGTEST:CAL_SCALE?.*
MFGTEST 6 #O	*Sets the offset, where #O is the Calibration constant for the offset setting, and is dependent on the settings for the Aperture, Measurement Function, and range. The equivalent command is MFGTEST:CAL_OFFSET #O.*

MFGTEST? 6	*Reports the offset value. The equvalent command is MFGTEST:CAL_OFFSET?.*
MFGTEST 7 #S	*Sets the converter scale value for non-vol, where #S is the value to be set.*
MFGTEST? 7	*Reports the converter scale value.*
MFGTEST 8 #O	*Sets the converter offset value for non-vol, where #O is the value to be set.*
MFGTEST? 8	*Reports the converter offset value.*
MFGTEST 10 #?	*Sets the readings per trigger.*
MFGTEST 10 #L #C	*Sets a linearization reference point.*
MFGTEST? 10 #L	*Reports the linearization reference pint value.*
MFGTEST 11 #L #C	*Sets a linearization slope. There are 16 linearization constants (0 - 15) for each aperture setting. #L indicates which linearization segment is being set, and #C is the constant to be loaded for the selected linearization segment in the set aperture.*
MFGTEST? 11 #L	*Reports the linearization slope value.*
MFGTEST 12 #L #C	*Sets a linearization offset. There are 16 linearization constants (0 - 15) for each aperture setting. #L indicates which linearization segment is being set, and #C is the constant to be loaded for the selected linearization segment in the set aperture.*
MFGTEST? 12 #L	*Reports the linearization offset value.*
MFGTEST 15 #count	*Increment or decrement the gain slope by #count, where #count is a positive (increment) or negative (decrement) integer. See MFGTEST 5.*
MFGTEST 16 #count	*Increment or decrement the offset by #count, where #count is a positive (increment) or negative (decrement) integer. See MFGTEST 6.*
MFGTEST 17 #count	*Increment or decrement the converter scale value by #count, where #count is a positive (increment) or negative (decrement) integer. See MFGTEST 7.*
MFGTEST 18 #count	*Increment or decrement the converter offset value by #count, where #count is a positive (increment) or negative (decrement) integer. See MFGTEST 8.*

MFGTEST 20 <boolean>	*Set to 0 the ‘251 processor scaling is OFF; set to 1 the ‘251 processor scaling is ON.*
MFGTEST? 20	*Reports which processor is doing the corrections; ‘251 or “340.*
MFGTEST 22 <boolean>	*Set to 0 (OFF) there is no overflow processing, no math, and no scale factors for range.*
MFGTEST? 22	*Reports if overflow processing, math functions, and range scale factors are enabled (1) or disabled (0).*
MFGTEST 23 <boolean>	*Set to 0 the ‘340 processor linearization is OFF; set to 1 the ‘340 processor linearization is ON.*
MFGTEST? 23	*Reports if the ‘340 processor linearization is ON (1) or OFF (0).*
MFGTEST? 30	*Read the CAL register in the converter.*
MFGTEST? 31	*Read the SCALE register in the converter.*
MFGTEST 32 <boolean>	*Set to 0 the ‘251 processor linearization is OFF; set to 1 the ‘251 processor linearization is ON.*
MFGTEST? 32	*Read the ‘251 main header pointer; can be used to get the file revision of the ‘251 code.*
MFGTEST? 33	*Read the ‘251 subs header pointer; can be used to get the file revision of the ‘251 code.*
MFGTEST? 34	*Read the ‘251 equ header pointer; can be used to get the file revision of the ‘251 code.*
MFGTEST? 35	*Read the ‘251 math header pointer; can be used to get the file revision of the ‘251 code.*

SECTION 4

COMMAND DICTIONARY

INTRODUCTION

This section presents the instrument command set. It begins with an alphabetical list of all the commands supported by the VM2710A divided into three sections: IEEE 488.2 commands, the instrument specific or device dependent SCPI commands, and the required SCPI commands. With each command is a brief description of its function.

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.

ALPHABETICAL COMMAND LISTING

The following tables provide an alphabetical listing of each command supported by the VM2710A along with a brief definition. If an X is found in the column titled ***RST**, then the value or setting controlled by this command is possibly changed by the execution of the ***RST** command. If no X is found, then ***RST** has no effect. The **Reset Value** column gives the value of each command's setting when the unit is powered up or when a ***RST** command is executed.

The following table lists the IEEE 488.2 Common (*) Commands. *See the IEEE Standard 488.2 for more information on these commands.*

TABLE 4-1: IEEE 488.2 COMMON COMMANDS

Command	Description	*RST	*RST Value
*CLS	Clears the Status Register	X	
*ESE	Sets the Event Status Enable Register	X	
*ESR?	Query the Standard Event Status Register		N/A
*IDN?	Query the module identification string		N/A
*OPC	Set the OPC bit in the Event Status Register		N/A
*RST	Resets the module to a known state		N/A
*SRE	Set the service request enable register		N/A
*STB?	Query the Status Byte Register		N/A
*TRG	Causes a trigger event to occur		N/A
*TST?	Starts and reports a self-test procedure		N/A
*WAI	Halts execution and queries	X	

TABLE 4-2: INSTRUMENT SPECIFIC SCPI COMMANDS

Command	Description	*RST	Reset Value
ABORt	Return to idle state		N/A
CALCulate:[FUNCtion:]AVERage:AVERage?	Reports the average reading		N/A
CALCulate:[FUNCtion:]AVERage:COUNt?	Reports the number of readings		N/A
CALCulate:[FUNCtion:]AVERage:MAXimum?	Reports the highest reading		N/A
CALCulate:[FUNCtion:]AVERage:MINimum?	Reports the lowest reading		N/A
CALCulate:[FUNCtion:]FUNCtion	Sets the CALCulate function	X	NULL
CALCulate:[FUNCtion:]LIMit:LOWer	Sets the lower limit value	X	0
CALCulate:[FUNCtion:]LIMit:LOWer:TTLTrg	Sets the trigger line	X	NONE
CALCulate:[FUNCtion:]LIMit:UPPer	Sets the upper limit value	X	0
CALCulate:[FUNCtion:]LIMit:UPPer:TTLTrg	Sets the trigger line	X	NONE
CALCulate:NORead	Returns only the calculation values	X	0
CALCulate:[FUNCtion:]NULL:OFFSet	Sets the offset value	X	0
CALCulate:STATe	Enables/disables the CALCulate function	X	0
CALibration:CONVert:GAIN?	Reports current function gain		N/A
CALibration:CONVert:GAIN:CURRent:AC?	Reports ac current gain		N/A
CALibration:CONVert:GAIN:CURRent[:DC]?	Reports dc current gain		N/A
CALibration:CONVert:GAIN:FRESistance?	Reports 4-wire ohms gain		N/A
CALibration:CONVert:GAIN:RESistance?	Reports 2-wire ohms gain		N/A
CALibration:CONVert:GAIN:VOLTage:AC?	Reports ac voltage gain		N/A
CALibration:CONVert:GAIN:VOLTage[:DC]?	Reports dc voltage gain		N/A
CALibration:CONVert:OFFSet?	Reports current function offset		N/A
CALibration:CONVert:OFFSet:CURRent:AC?	Reports ac current offset		N/A
CALibration:CONVert:OFFSet:CURRent[:DC]?	Reports dc current offset		N/A
CALibration:CONVert:OFFSet:FRESistance?	Reports 4-wire ohms offset		N/A
CALibration:CONVert:OFFSet:RESistance?	Reports 2-wire ohms offset		N/A
CALibration:CONVert:OFFSet:VOLTage:AC?	Reports ac voltage offset		N/A
CALibration:CONVert:OFFSet:VOLTage[:DC]?	Reports dc voltage offset		N/A
CALibration:DEFault	Sets calibration values to defaults		N/A
CALibration:LFRequency	Selects line frequency reference used by the multimeter's A/D converter		N/A
CALibration:NUMBer?	Reports the number of times the multimeter has been calibrated		N/A
CALibration:RESet	Restores calibration DAC values		N/A
CALibration:SECure:CODE	Calibration security password		N/A
CALibration:SECure[:STATe]	Enable/disables calibration security	X	1
CALibration:STORe	Saves the current calibration constants into non-volatile memory		N/A
CALibration:ZERO	Sets the range for the zero measurement	X	ALL Ranges
CALibration:ZERO:UPDate	Updates the current zero measurements		N/A
CONFigure?	Reports the most recent configuration set		N/A
CONFigure:CURRent:AC	Selects the ac Current function	X	Autoranging 1 PLC
CONFigure:CURRent[:DC]	Selects the dc current function	X	Autoranging 1 PLC
CONFigure:FRESistance	Selects 4-wire ohms function	X	Autoranging 1 PLC
CONFigure:RESistance	Selects the 2-wire ohms function	X	Autoranging 1 PLC

Command	Description	*RST	Reset Value
CONFigure:VOLTage:AC	Selects the ac-coupled rns voltage function	X	Autoranging 1 PLC
CONFigure:VOLTage[:DC]	Selects the dc voltage function	X	Autoranging 1 PLC
FETCh?	Retrieves most recent measurements stored by last INITiate command		N/A
FORMat	Sets the measurement data format	X	Exponential format
FORMat:OVERflow	Sets the OVERflow function	X	NONE
INITiate[:IMMediate]	Places the multimeter in the wait-for-trigger state	X	Idle state
INPut:SOURce	Selects input channel	X	Input A
MATH	Selects math function	X	0
MATH:FACTor	Sets the factor value	X	1
MATH:OFFSet	Sets the offset value	X	0
MEASure:CURRent:AC?	Selects the ac current function	X	Autoranging 1 PLC
MEASure:CURRent[:DC]?	Selects the dc current function	X	Autoranging 1 PLC
MEASure:FRESistance?	Selects 4-wire ohms function	X	Autoranging 1 PLC
MEASure:RESistance?	Selects the 2-wire ohms function	X	Autoranging 1 PLC
MEASure:VOLTage:AC?	Selects the ac-coupled rms voltage function	X	Autoranging 1 PLC
MEASure:VOLTage[:DC]?	Selects the dc voltage function	X	Autoranging 1 PLC
MFGTEST 99	Enables or disables the ohms current function	X	1
OUTPut:TTLTrg	Selects the a specified VXIbus trigger line (0-7)	X	0 (lines 0 - 7 off)
OUTPut[:TTLTrg]:POLarity	Sets the output signal polarity	X	NEG
RANGe:AUTOmatic	Enables the autoranging function	X	1
RANGe:DELay	Sets the delay (settling) time after a function and/or range change	X	Default Delay - see command
RANGe:DELay:AUTOmatic	Uses the default delay times	X	1
READ?	Transfers the readings to the output buffer		N/A
SAMPle:COUNt	Sets the number of readings per trigger	X	1
SAMPle:SOURce	Selects the pacing source for the sample rate	X	IMM
SAMPle:TIMer	Sets the period between readings	X	0.0
[SENSe:]BANDwidth:DETector	Selects slow, medium or fast measurement mode	X	20 (slow mode)
[SENSe:]CURRent:AC:RANGe	Selects the ac current range	X	Autoranging
[SENSe:]CURRent:APERture	Sets the integration time for current measurements	X	1.67E-02 (60 Hz) or 2E-02 (50 Hz)
[SENSe:]CURRent[:DC]:RANGe	Selects the dc current range	X	Autoranging
[SENSe:]CURRent:NPLC	Sets the integration time in Power Line Cycles (PLCs)	X	1
[SENSe:]CURRent:RANGe:AUTOmatic	Enables the autoranging function	X	1

Command	Description	*RST	Reset Value
[SENSe:]CURRent:RANGe:DELay:AUTOmatic	Enables the default delay times	X	1
[SENSe:]CURRent:RESolution:AC	Selects the resolution for ac measurements	X	Default Autoranging
[SENSe:]CURRent:RESolution[:DC]	Selects the resolution for dc measurements	X	Default Autoranging
[SENSe:]FUNCtion	Selects the measurement function	X	VOLTage[:DC]
[SENSe:]RESistance:APERture	Sets the integration time for resistance measurements	X	1.67E-02 (60 Hz) or 2E-02 (50 Hz)
[SENSe:]RESistance:NEGative	Enables or disables negative resistance value reporting	X	0
[SENSe:]RESistance:NPLC	Sets the integration time in Power Line Cycles (PLCs)	X	1
[SENSe:]RESistance:RANGe	Selects the range for resistance measurements	X	Autoranging
[SENSe:]RESistance:RANGe:AUTOmatic	Enables/disables the autorange function	X	1
[SENSe:]RESistance:RANGe:DELay:AUTOmatic	Sets the delay time to the default values	X	1
[SENSe:]RESistance:RESolution	Selects the resolution for resistance measurements	X	Default Autoranging
[SENSe:]VOLTage:AC:RANGe	Selects the range for ac voltage measurements	X	Autoranging
[SENSe:]VOLTage:APERture	Sets the integration time for voltage measurements	X	1.67E-02 (60 Hz) or 2E-02 (50 Hz)
[SENSe:]VOLTage[:DC]:RANGe	Selects the range for dc voltage measurements	X	Autoranging
[SENSe:]VOLTage:NPLC	Sets the integration time in Power Line Cycles (PLCs)	X	1
[SENSe:]VOLTage:RANGe:AUTOmatic	Enables/disables the autorange function	X	1
[SENSe:]VOLTage:RANGe:DELay:AUTOmatic	Sets the delay time to the default values	X	1
[SENSe:]VOLTage:RESolution:AC	Selects the resolution for ac voltage measurements	X	Default Autoranging
[SENSe:]VOLTage:RESolution[:DC]	Selects the resolution for dc voltage measurements	X	Default Autoranging
TEST?	Performs self-test and reports results		N/A
TRACe:FEED	Sets data retrieval method	X	OFF
TRIGger:BUFFered	Enables/disables the multimeter's trigger buffer	X	0
TRIGger:COUNt	Sets the number of triggers	X	1
TRIGger:DELay	Sets the delay period between trigger and the start of the measurement	X	TRIG:DEL:AUTO
TRIGger:DELay:AUTOmatic	Enables/disables automatic trigger delay	X	1
TRIGger[:IMMediate]	Causes the multimeter to trigger immediately when in the wait-for-trigger mode		N/A
TRIGger:SLOPe	Selects rising or falling edge of trigger signal	X	NEG
TRIGger:SOURce	Selects trigger source	X	IMM

TABLE 4-3: REQUIRED SCPI COMMANDS

Command	Description	*RST	*RST Value
STATus:OPERation:CONDition?	Queries the Operation Status Condition Register.	X	
STATus:OPERation:ENABle	Sets the Operation Status Enable Register.	X	
STATus:OPERation[:EVENt]?	Queries the Operation Status Event Register.	X	
STATus:PRESet	Presets the Status Register.	X	
STATus:QUEStionable:CONDition?	Queries the Questionable Status Condition Register.	X	
STATus:QUEStionable:ENABle	Sets the Questionable Status Enable Register.	X	
STATus:QUEStionable[:EVENt]?	Queries the Questionable Status Event Register.	X	
SYSTem:ERRor?	Queries the Error Queue.	X	Clears queue
SYSTem:VERsion?	Queries which version of the SCPI standard to which the module complies.		N/A

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 items are described:

Purpose	Describes the purpose of the command.
Type	Describes the type of command such as an event or setting.
Command Syntax	Details the exact command format.
Command Parameters	Describes the parameters sent with the command and their legal range.
Reset Value	Describes the values assumed when the *RST 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	Present 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

Purpose	Clears all status and event registers	
Type	IEEE 488.2 Common Command	
Command Syntax	*CLS	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	N/A	
Query Parameters	N/A	
Query Response	N/A	
Description	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).	
Examples	**Command / Query**	**Response *(Description)***
	*CLS	*(Clears all status and event registers)*
Related Commands	N/A	

*ESE

Purpose	Sets the bits of the Event Status Enable Register
Type	IEEE 488.2 Common Command
Command Syntax	*ESE <mask>
Command Parameters	<mask> = numeric ASCII value
***RST Value**	N/A, the parameter is required
Query Syntax	*ESE?
Query Parameters	N/A
Query Response	Numeric ASCII value from 0 to 255
Description	The Event Status Enable 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 ESB (Event Status Bit) in the Status Byte by the corresponding bit in the ESR. If the ESB is set in the 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.

Examples	**Command / Query**	**Response *(Description)***
	`*ESE 36` `*ESE?`	 36
Related Commands	*ESR?	

*ESR?

Purpose	Queries and clears the Standard Event Status Register
Type	IEEE 488.2 Common Command
Command Syntax	N/A
Command Parameters	N/A
***RST Value**	N/A
Query Syntax	ESR?
Query Parameters	N/A
Query Response	Numeric ASCII value from 0 to 255
Description	The Event Status Register 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 ESB (Event Status Bit) 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.

Examples	**Command / Query**	**Response *(Description)***
	*ESR?	*(Clears all status and event registers)*
Related Commands	*ESE	

*IDN?

Purpose	Queries the module for its identification string	
Type	IEEE 488.2 Common Command	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	*IDN?	
Query Parameters	N/A	
Query Response	ASCII character string	
Description	The Identification 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).	
Examples	**Command / Query**	**Response *(Description)***
	*IDN?	VTI Instruments,VM2710A,0,1.0 *(The revision listed here is for reference only; the response will always be the instrument's current revision.)*
Related Commands	N/A	

*OPC

Purpose	Sets the OPC bit in the Event Status Register	
Type	IEEE 488.2 Common Command	
Command Syntax	*OPC	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	*OPC?	
Query Parameters	N/A	
Query Response	1	
Description	The Operation Complete command sets the OPC bit in the Event Status Register when all pending operations have completed. The Operation Complete query will return a 1 to the output queue when all pending operations have completed.	
Examples	**Command / Query**	**Response *(Description)***
	*OPC *OPC?	 1
Related Commands	*WAI	

*RST

Purpose	Resets the module's hardware and software to a known state	
Type	IEEE 488.2 Common Command	
Command Syntax	*RST	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	N/A	
Query Parameters	N/A	
Query Response	N/A	
Description	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.	
Examples	**Command / Query**	**Response *(Description)***
	*RST	
Related Commands	N/A	

*SRE

Purpose	Sets the service request enable register
Type	IEEE 488.2 Common Command
Command Syntax	*SRE <mask>
Command Parameters	<mask> = Numeric ASCII value from 0 to 255
***RST Value**	TBD
Query Syntax	*SRE?
Query Parameters	N/A
Query Response	Numeric ASCII value from 0 to 255
Description	The service request enable mask is used to control which bits in the status byte generate backplane 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. **Note**: 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 Bit 7 - Operation Status Summary

Examples	**Command / Query**	**Response *(Description)***
	*SRE 4 *SRE?	 4
Related Commands	N/A	

*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 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
Related Commands	N/A	

*TRG

Purpose	Causes a trigger event to occur	
Type	IEEE 488.2 Common Command	
Command Syntax	*TRG	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	N/A	
Query Parameters	N/A	
Query Response	N/A	
Description	The Trigger command causes a trigger event to occur.	
Examples	**Command / Query**	**Response *(Description)***
	*TRG	
Related Commands	N/A	

*TST?

Purpose	Causes a self-test procedure to occur and queries the results	
Type	IEEE 488.2 Common Command	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	*TST?	
Query Parameters	N/A	
Query Response	Numeric ASCII value from 0 to 143	
Description	The Self-Test query causes the VM2710A to run its self-test procedures and report on the results. A value of 0 means there were no errors, all tests passed. A non-zero value is composed of the following: 1 – Non-volatile memory test failure 2 – FPGA data path failure 4 – Internal resistance measurement failure The value returned is the sum of all failures.	
Examples	**Command / Query**	**Response *(Description)***
	*TST?	
Related Commands	N/A	

*WAI

Purpose	Halts execution of additional commands and queries until the No Operation Pending message is true	
Type	IEEE 488.2 Common Command	
Command Syntax	*WAI	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	N/A	
Query Parameters	N/A	
Query Response	N/A	
Description	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.	
Examples	**Command / Query**	**Response *(Description)***
	*WAI	
Related Commands	*OPC	

INSTRUMENT SPECIFIC SCPI COMMANDS

ABORt

Purpose	Removes the multimeter from the wait-for-trigger state and places it in the idle state	
Type	Device dependent SCPI 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	The ABORt command removes the VM2710A from the wait-for-trigger state and places it in the idle state. This command can only be used when the trigger source is set to BUS or HOLD. ABORt does not affect any other settings. When the INITiate command is sent, the trigger system will respond as it did before. When the trigger source is set to BUS or HOLD, the ABORt command places the VM2710A in idle state. Subsequent triggers sent are ignored and the "Trigger ignored" error is generated.	
Examples	**Command / Query**	**Response *(Description)***
	ABOR	
Related Commands	INITiate TRIGger:SOURce	

CALCulate:AVERage:MAXimum?

Purpose	Reports the highest reading	
Type	Query	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	CALCulate:AVERage:MAXimum?	
Query Parameters	N/A	
Query Response	number	
Description	Queries and reports the highest reading value that has been taken. The CALCulate:FUNCtion must first be set to AVERage.	
Examples	**Command / Query**	**Response *(Description)***
	CALC:AVER	*(Sets the calculate function to keep track on reading averages.)*
	CALC:AVER:MAX?	*(Reports the highest reading value)*
Related Commands	CALCulate:[FUNCtion:]AVERage:AVERage? CALCulate:[FUNCtion:]AVERage:COUNt? CALCulate:[FUNCtion:]AVERage:MINimum? CALCulate:[FUNCtion:]FUNCtion CALCulate:[FUNCtion:]STATe	

CALCulate:AVERage:MINimum?

Purpose	Reports the lowest reading	
Type	Query	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	CALCulate:AVERage:MINimum?	
Query Parameters	N/A	
Query Response	number	
Description	Queries and reports the lowest reading that has been taken. The CALCulate:FUNCtion must first be set to AVERage.	
Examples	**Command / Query**	**Response *(Description)***
	CALC:FUNC:AVER	*Sets the calculate function to keep track of reading averages.*
	CALC:AVER:MIN?	*(Reports the lowest reading value)*
Related Commands	CALCulate:[FUNCtion:]AVERage:AVERage? CALCulate:[FUNCtion:]AVERage:COUNt? CALCulate:[FUNCtion:]AVERage:MAXimum? CALCulate:[FUNCtion:]FUNCtion CALCulate:[FUNCtion:]STATe	

CALCulate:FUNCtion

Purpose	Sets the calculate function	
Type	Setting	
Command Syntax	CALCulate:FUNCtion <function>	
Command Parameters	<function> = AVERage | LIMit | NULL	
***RST Value**	NULL	
Query Syntax	CALCulate:FUNCtion?	
Query Parameters	N/A	
Query Response	AVER | LIM | NULL	
Description	This command sets the calculate function to either AVERage, LIMit or NULL. The reset value is NULL.	
Examples	**Command / Query**	**Response *(Description)***
	CALC:FUNC:AVER	*(Sets the calculate function to keep track of reading averages.)*
Related Commands	CALCulate:[FUNCtion:]AVERage CALCulate:[FUNCtion:]LIMit CALCulate:[FUNCtion:]NULL CALCulate:[FUNCtion:]STATe	

CALCulate:[FUNCtion:]AVERage:AVERage?

Purpose	Reports the average reading
Type	Query
Command Syntax	N/A
Command Parameters	N/A
***RST Value**	N/A
Query Syntax	CALCulate:[FUNCtion:]AVERage:AVERage?
Query Parameters	N/A
Query Response	This query returns the sum of the readings taken divided by the number of reading counts.
Description	Queries and reports the average reading taken. The CALCulate:FUNCtion must first be set to AVERage.

Examples	**Command / Query**	**Response *(Description)***
	CALC:AVER	*(Sets the calculate function to keep track of readings averages)*
	CALC:AVER:AVER?	(readings sum)/(readings count) *(Reports the average reading taken)*

Related Commands	CALCulate:[FUNCtion:]AVERage:COUNt? CALCulate:[FUNCtion:]AVERage:MAXimum? CALCulate:[FUNCtion:]AVERage:MINimum? CALCulate:[FUNCtion:]FUNCtion CALCulate:[FUNCtion:]STATe

CALCulate:[FUNCtion:]AVERage:COUNt?

Purpose	Reports the reading count
Type	Query
Command Syntax	N/A
Command Parameters	N/A
***RST Value**	N/A
Query Syntax	CALCulate:[FUNCtion:]AVERage:COUNt?
Query Parameters	N/A
Query Response	Returns the number of reading counts taken while the VM2701A has been CALCulate:FUNCtion:AVERage mode
Description	Queries and reports the reading count; the number of readings that have been taken. The CALCulate:FUNCtion must first be set to AVERage.

Examples	**Command / Query**	**Response *(Description)***
	CALC:AVER	*(Sets the calculate function to keep track of reading averages)*
	CALC:COUN?	*(Reports the reading count)*

Related Commands	CALCulate:[FUNCtion:]AVERage:AVERage? CALCulate:[FUNCtion:]AVERage:MAXimum? CALCulate:[FUNCtion:]AVERage:MINimum? CALCulate:[FUNCtion:]FUNCtion CALCulate:[FUNCtion:]STATe

CALCulate:[FUNCtion:]LIMit:LOWer

Purpose	Sets the lower limit value	
Type	Setting	
Command Syntax	CALCulate:[FUNCtion:]LIMit:LOWer <limit>	
Command Parameters	<limit> = number | MAXimum | MINimum | LAST	
***RST Value**	0	
Query Syntax	CALCulate:[FUNCtion:]LIMit:LOWer?	
Query Parameters	N/A	
Query Response	number	
Description	This command sets the lower reading limit for the current function and range. If a measurement is below this set limit, the limit low failure bit would be set in the Status Questionable register: Limit Low Failure: 0x0800 Limit Low Failure Pulse: 0x2000	
Examples	**Command / Query**	**Response *(Description)***
	CALC:LIM:LOW 3.5	*(Sets the lower limit to 3.5 V in the 10 V range)*
	CALC:LIM:LOW LAST	*(Sets the lower limit to the value of the last measurement)*
Related Commands	CALCulate:FUNCtion CALCulate:[FUNCtion:]LIMit:LOWer:TTLTrg CALCulate:[FUNCtion:]LIMit:UPPer	

CALCulate:[FUNCtion:]LIMit:LOWer:TTLTrg

Purpose	Sets the trigger line	
Type	Setting	
Command Syntax	CALCulate:[FUNCtion:]LIMit:LOWer:TTLTrg <trigger line>	
Command Parameters	<trigger line> = 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | NONE	
***RST Value**	NONE	
Query Syntax	CALCulate:[FUNCtion:]LIMit:LOWer:TTLTrg?	
Query Parameters	N/A	
Query Response	0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | NONE	
Description	This command enables the below limit failure to also be read off one of the backplane trigger lines (0 - 7). The default value is NONE.	
Examples	**Command / Query**	**Response *(Description)***
	CALC:LIM:LOW:TTLT 3	*(Enables the below limit failure to be captured from the backplane trigger line #3)*
Related Commands	CALCulate:FUNCtion CALCulate:[FUNCtion:]LIMit:LOWer	

CALCulate:[FUNCtion:]LIMit:UPPer

Purpose	Sets the upper limit value	
Type	Setting	
Command Syntax	CALCulate:[FUNCtion:]LIMit:UPPer <limit>	
Command Parameters	<limit> = number | MAXimum | MINimum | LAST	
***RST Value**	0	
Query Syntax	CALCulate:[FUNCtion:]LIMit:UPPer?	
Query Parameters	N/A	
Query Response	Number	
Description	This command sets the upper reading limit for the current function and range. If a measurement is above this set limit, the limit high failure bit would be set in the Status Questionable register: Limit High Failure: 0x1000 Limit High Failure Pulse: 0x4000	
Examples	**Command / Query**	**Response *(Description)***
	CALC:LIM:UPP 8.8	*(Sets the upper limit to 8.8 V in the 10 V range)*
	CALC:LIM:UPP LAST	*(Sets the upper limit to the value of the last measurement)*
Related Commands	CALCulate:FUNCtion CALCulate:[FUNCtion:]LIMit:LOWer CALCulate:[FUNCtion:]LIMit:UPPer:TTLTrg	

CALCulate:[FUNCtion:]LIMit:UPPer:TTLTrg

Purpose	Sets the trigger line	
Type	Setting	
Command Syntax	CALCulate:[FUNCtion:]LIMit:UPPer:TTLTrg <trigger line>	
Command Parameters	<trigger line> = 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | NONE	
***RST Value**	NONE	
Query Syntax	CALCulate:[FUNCtion:]LIMit:UPPer:TTLTrg?	
Query Parameters	N/A	
Query Response	0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | NONE	
Description	This command enables the above limit failure to also be read off one of the backplane trigger lines (0 - 7). The default value is NONE.	
Examples	**Command / Query**	**Response *(Description)***
	CALC:LIM:UPP:TTLT 3	*(Enables the above limit failure to be captured from the backplane trigger line #3)*
Related Commands	CALCulate:FUNCtion CALCulate:[FUNCtion:]LIMit:UPPer	

CALCulate:[FUNCtion:]NULL:OFFSet

Purpose	Sets the offset value	
Type	Setting	
Command Syntax	CALCulate:[FUNCtion:]NULL:OFFSet <value>	
Command Parameters	<value> = number | MAXimum | MINimum | LAST	
***RST Value**	0	
Query Syntax	CALCulate:[FUNCtion:]NULL:OFFSet?	
Query Parameters	N/A	
Query Response	number	
Description	Sets the calculate offset value. The default value is zero (0).	
Examples	**Command / Query**	**Response *(Description)***
	CALC:NULL:OFFS LAST	*(Sets the last measurement value as the offset value.)*
Related Commands	CALCulate:FUNCtion	

CALCulate:NORead

Purpose	Returns only the calculation values	
Type	Setting	
Command Syntax	CALCulate:NORead <boolean>	
Command Parameters	<boolean> = 0 | 1 | OFF | ON	
***RST Value**	0	
Query Syntax	CALCulate:NORead?	
Query Parameters	N/A	
Query Response	0 | 1	
Description	The Calculate NoRead command sets the instrument such that a read only returns the calculation values rather than returning all data. The default setting is OFF (0), which returns all data when a read is made.	
Examples	**Command / Query**	**Response *(Description)***
	CALC:NOR 1	*(Sets the instrument to only return the calculate values)*
Related Commands	N/A	

CALCulate:STATe

Purpose	Enables and disables the calculate function.	
Type	Setting	
Command Syntax	CALCulate:STATe <boolean>	
Command Parameters	<boolean> = 0 | 1 | OFF | ON	
***RST Value**	0	
Query Syntax	CALCulate:STATe?	
Query Parameters	N/A	
Query Response	0 | 1	
Description	This command enables or disables the calculate function.	
Examples	**Command / Query**	**Response *(Description)***
	CALC:STAT 1	*(Enables the calculate function)*
Related Commands	CALCulate:FUNCtion	

CALibration:CONVert:GAIN?

Purpose	Reports the calibration gain value	
Type	Query	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	CALibration:CONVert:GAIN?	
Query Parameters	N/A	
Query Response	See Table 3-1: Function and Range.	
Description	Reports the gain of the current function and range setting of the VM2710A. See the Scale column in Table 3-1: Function and Range. **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)***
	CONV:GAIN?	*(Queries and reports the gain for the current function and range setting.)*
Related Commands	CALibration:CONVert:GAIN:CURRent:AC? CALibration:CONVert:GAIN:CURRent[:DC]? CALibration:CONVert:GAIN:FRESistance? CALibration:CONVert:GAIN:RESistance? CALibration:CONVert:GAIN:VOLTage:AC? CALibration:CONVert:GAIN:VOLTage[:DC]?	

CALibration:CONVert:GAIN:CURRent:AC?

Purpose	Reports the calibration gain value
Type	Query
Command Syntax	N/A
Command Parameters	N/A
***RST Value**	N/A
Query Syntax	CALibration:CONVert:GAIN:CURRent:AC? <range>
Query Parameters	<range> = 0.01 | 0.1 | 1.0
Query Response	See Table 3-1: Function and Range
Description	Reports the gain for a specified range in the ac Current function. See the Scale column in Table 3-1: Function and Range. **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:CONV:GAIN:CURR:AC 1	*(Queries and reports the gain for the 1 A range.)*

Related Commands	CALibration:CONVert:GAIN? CALibration:CONVert:GAIN:CURRent[:DC]? CALibration:CONVert:GAIN:FRESistance? CALibration:CONVert:GAIN:RESistance? CALibration:CONVert:GAIN:VOLTage:AC? CALibration:CONVert:GAIN:VOLTage[:DC]?

CALibration:CONVert:GAIN:CURRent[:DC]?

Purpose	Reports the calibration gain value
Type	Query
Command Syntax	N/A
Command Parameters	N/A
***RST Value**	N/A
Query Syntax	CALibration:CONVert:GAIN:CURRent[:DC]? <range>
Query Parameters	<range> = 0.01 | 0.1 | 1.0
Query Response	See Table 3-1: Function and Range
Description	Reports the gain for a specified range in the dc current function. See the Scale column in Table 3-1: Function and Range.  **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:CONV:GAIN:CURR:DC 1	*(Qureies and reports the gain for the 1 A range.)*

Related Commands	CALibration:CONVert:GAIN? CALibration:CONVert:GAIN:CURRent:AC? CALibration:CONVert:GAIN:FRESistance? CALibration:CONVert:GAIN:RESistance? CALibration:CONVert:GAIN:VOLTage:AC? CALibration:CONVert:GAIN:VOLTage[:DC]?

CALibration:CONVert:GAIN:FRESistance?

Purpose	Reports the calibration gain value
Type	Query
Command Syntax	N/A
Command Parameters	N/A
***RST Value**	N/A
Query Syntax	CALibration:CONVert:GAIN:FRESistance? <range>
Query Parameters	<range> = 20 Ω | 200 Ω | 2 kΩ | 20 kΩ | 200 kΩ | 2 MΩ | 20 MΩ
Query Response	See Table 3-1: Function and Range
Description	Reports the gain for a specified range in the 4-wire ohms function. See the Scale column in Table 3-1: Function and Range. **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:CONV:GAIN:FRES? 20000	*(Queries and reports the gain for the 20 kΩ range.)*

Related Commands	CALibration:CONVert:GAIN? CALibration:CONVert:GAIN:CURRent:AC? CALibration:CONVert:GAIN:CURRent[:DC]? CALibration:CONVert:GAIN:RESistance? CALibration:CONVert:GAIN:VOLTage:AC? CALibration:CONVert:GAIN:VOLTage[:DC]?

CALibration:CONVert:GAIN:RESistance?

Purpose	Reports the calibration gain value	
Type	Query	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	CALibration:CONVert:GAIN:RESistance? <range>	
Query Parameters	<range> = 20 Ω | 200 Ω | 2 kΩ | 20 kΩ | 200 kΩ | 2 MΩ | 20 MΩ	
Query Response	See Table 3-1: Function and Range	
Description	Reports the gain for a specified range in the 2-wire ohms function. See the Scale column in Table 3-1: Function and Range. **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:CONV:GAIN:RES? 20000	*(Qureies and reports the gain for the 20 kΩ range.)*
Related Commands	CALibration:CONVert:GAIN? CALibration:CONVert:GAIN:CURRent:AC? CALibration:CONVert:GAIN:CURRent[:DC]? CALibration:CONVert:GAIN:FRESistance? CALibration:CONVert:GAIN:VOLTage:AC? CALibration:CONVert:GAIN:VOLTage[:DC]?	

CALibration:CONVert:GAIN:VOLTage:AC?

Purpose	Reports the calibration gain value
Type	Query
Command Syntax	N/A
Command Parameters	N/A
***RST Value**	N/A
Query Syntax	CALibration:CONVert:GAIN:VOLTage:AC? <range>
Query Parameters	<range> = 0.1 V | 1.0 V | 10.0 V | 100.0 V | 300.0 V
Query Response	See Table 3-1: Function and Range
Description	Reports the gain for a specified range in the ac voltage function. See the Scale column in Table 3-1: Function and Range. **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:CONV:GAIN:VOLT:AC? 10	*(Queries and reports the gain for the 10 V range.)*

Related Commands	CALibration:CONVert:GAIN? CALibration:CONVert:GAIN:CURRent:AC? CALibration:CONVert:GAIN:CURRent[:DC]? CALibration:CONVert:GAIN:FRESistance? CALibration:CONVert:GAIN:RESistance? CALibration:CONVert:GAIN:VOLTage[:DC]?

CALibration:CONVert:GAIN:VOLTage[:DC]?

Purpose	Reports the calibration gain value	
Type	Query	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	CALibration:CONVert:GAIN:VOLTage:DC? <range>	
Query Parameters	<range> = 0.1 V | 1.0 V | 10.0 V | 100.0 V | 300.0 V	
Query Response	See Table 3-1: Function and Range	
Description	Reports the gain for a specified range in the dc voltage function. See the Scale column in Table 3-1: Function and Range.  **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:CONV:GAIN:VOLT:DC? 10	*(Queries and reports the gain for the 10 V range)*
Related Commands	CALibration:CONVert:GAIN? CALibration:CONVert:GAIN:CURRent:AC? CALibration:CONVert:GAIN:CURRent[:DC]? CALibration:CONVert:GAIN:FRESistance? CALibration:CONVert:GAIN:RESistance? CALibration:CONVert:GAIN:VOLTage:AC?	

CALibration:CONVert:OFFSet?

Purpose	Reports the calibration offset value
Type	Query
Command Syntax	N/A
Command Parameters	N/A
***RST Value**	N/A
Query Syntax	CALibration:CONVert:OFFSet?
Query Parameters	N/A
Query Response	See Table 3-1: Function and Range
Description	Reports the offset of the current function and range setting of the VM2710A. See the Offset column in Table 3-1: Function and Range.  **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)***
	CONV:OFFS?	*(Queires and reports the offset for the current function and range setting.)*

Related Commands	CALibration:CONVert:OFFSet:CURRent:AC? CALibration:CONVert:OFFSet:CURRent[:DC]? CALibration:CONVert:OFFSet:FRESistance? CALibration:CONVert:OFFSet:RESistance? CALibration:CONVert:OFFSet:VOLTage:AC? CALibration:CONVert:OFFSet:VOLTage[:DC]?

CALibration:CONVert:OFFSet:CURRent:AC?

Purpose	Reports the calibration offset value	
Type	Query	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	CALibration:CONVert:OFFSet:CURRent:AC? <range>	
Query Parameters	<range> = 0.01 | 0.1 | 1.0	
Query Response	See Table 3-1: Function and Range	
Description	Reports the offset for a specified range in the ac Current function. See the Offset column in Table 3-1: Function and Range.  **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:CONV:OFFS:CURR:AC 1	*(Queires and reports the offset for the 1 A range)*
Related Commands	CALibration:CONVert:OFFSet? CALibration:CONVert:OFFSet:CURRent[:DC]? CALibration:CONVert:OFFSet:FRESistance? CALibration:CONVert:OFFSet:RESistance? CALibration:CONVert:OFFSet:VOLTage:AC? CALibration:CONVert:OFFSet:VOLTage[:DC]?	

CALibration:CONVert:OFFSet:CURRent[:DC]?

Purpose	Reports the calibration offset value	
Type	Query	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	CALibration:CONVert:OFFSet:CURRent:DC? <range>	
Query Parameters	<range> = 0.01 | 0.1 | 1.0	
Query Response	See Table 3-1: Function and Range	
Description	Reports the offset for a specified range in the dc current function. See the Offset column in Table 3-1: Function and Range. **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:CONV:OFFS:CURR:DC 1	*(Queries and reports the offset for the 1 A range.)*
Related Commands	CALibration:CONVert:OFFSet? CALibration:CONVert:OFFSet:CURRent:AC? CALibration:CONVert:OFFSet:FRESistance? CALibration:CONVert:OFFSet:RESistance? CALibration:CONVert:OFFSet:VOLTage:AC? CALibration:CONVert:OFFSet:VOLTage[:DC]?	

CALibration:CONVert:OFFSet:FRESistance?

Purpose	Reports the calibration offset value
Type	Query
Command Syntax	N/A
Command Parameters	N/A
***RST Value**	N/A
Query Syntax	CALibration:CONVert:OFFSet:FRESistance? <range>
Query Parameters	<range> = 20 Ω | 200 Ω | 2 kΩ | 20 kΩ | 200 kΩ | 2 MΩ | 20 MΩ
Query Response	See Table 3-1: Function and Range
Description	Reports the offset for a specified range in the 4-wire ohms function. See the Offset column in Table 3-1: Function and Range. **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:CONV:OFFS:FRES? 20000	*(Queries and reports the gain for the 20 kΩ range.)*

Related Commands	CALibration:CONVert:OFFSet? CALibration:CONVert:OFFSet:CURRent:AC? CALibration:CONVert:OFFSet:CURRent[:DC]? CALibration:CONVert:OFFSet:RESistance? CALibration:CONVert:OFFSet:VOLTage:AC? CALibration:CONVert:OFFSet:VOLTage[:DC]?

CALibration:CONVert:OFFSet:RESistance?

Purpose	Reports the calibration offset value
Type	Query
Command Syntax	N/A
Command Parameters	N/A
***RST Value**	N/A
Query Syntax	CALibration:CONVert:OFFSet:RESistance? <range>
Query Parameters	<range> = 20 Ω | 200 Ω | 2 kΩ | 20 kΩ | 200 kΩ | 2 MΩ | 20 MΩ
Query Response	See Table 3-1: Function and Range
Description	Reports the offset for a specified range in the 2-wire ohms function. See the Offset column in Table 3-1: Function and Range. **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:CONV:OFFS:RES? 20000	*(Queries and reports the gain for the 20 kΩ range)*

Related Commands	CALibration:CONVert:OFFSet? CALibration:CONVert:OFFSet:CURRent:AC? CALibration:CONVert:OFFSet:CURRent[:DC]? CALibration:CONVert:OFFSet:FRESistance? CALibration:CONVert:OFFSet:VOLTage:AC? CALibration:CONVert:OFFSet:VOLTage[:DC]?

CALibration:CONVert:OFFSet:VOLTage:AC?

Purpose	Reports the calibration offset value	
Type	Query	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	CALibration:CONVert:OFFSetVOLTage:AC? <range>	
Query Parameters	<range> = 0.1 V | 1.0 V | 10.0 V | 100.0 V | 300.0 V	
Query Response	See Table 3-1: Function and Range	
Description	Reports the offset for a specified range in the ac voltage function. See the Offset column in Table 3-1: Function and Range. **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:CONV:OFFS:VOLT:AC? 10	*(Queries and reports the gain for the 10 V range.)*
Related Commands	CALibration:CONVert:OFFSet? CALibration:CONVert:OFFSet:CURRent:AC? CALibration:CONVert:OFFSet:CURRent[:DC]? CALibration:CONVert:OFFSet:FRESistance? CALibration:CONVert:OFFSet:RESistance? CALibration:CONVert:OFFSet:VOLTage[:DC]?	

CALibration:CONVert:OFFSet:VOLTage[:DC]?

Purpose	Reports the calibration offset value
Type	Query
Command Syntax	N/A
Command Parameters	N/A
***RST Value**	N/A
Query Syntax	CALibration:CONVert:OFFSetVOLTage:DC? <range>
Query Parameters	<range> = 0.1 V | 1.0 V | 10.0 V | 100.0 V | 300.0 V
Query Response	See Table 3-1: Function and Range
Description	Reports the offset for a specified range in the dc voltage function. See the Offset column in Table 3-1: Function and Range. **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:CONV:OFFS:VOLT:DC? 10	*(Queries and reports the gain for the 10 V range.)*

Related Commands	CALibration:CONVert:OFFSet? CALibration:CONVert:OFFSet:CURRent:AC? CALibration:CONVert:OFFSet:CURRent[:DC]? CALibration:CONVert:OFFSet:FRESistance? CALibration:CONVert:OFFSet:RESistance? CALibration:CONVert:OFFSet:VOLTage:AC?

CALibration:DEFault

Purpose	Sets calibration values to defaults	
Type	Event	
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	The Calibration Default command sets all the calibration gain and offset values to their respective default 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	
Related Commands	N/A	

CALibration:LFRequency

Purpose	Selects the reference line frequency used by the A/D converter
Type	Setting
Command Syntax	CALibration:LFRequency <line frequency>
Command Parameters	<frequency> = 50 | 60 | 400 | MIN | MAX
***RST Value**	N/A
Query Syntax	CALibration:LFRequency? <MIN | MAX>
Query Parameters	MIN = 50, MAX = 60
Query Response	50 | 60
Description	The Calibration Line Frequency command selects the line frequency reference used by the A/D converter. The command parameters are as follows: **50** *Selects 50 Hz line frequency reference* **60** *Selects 60 Hz line frequency reference* **400** *Actually uses 50 Hz reference; however, since 50 Hz is a sub-harmonic of 400 Hz, it provides normal mode rejection of power line related noise.* **MINimum** *Selects 50 Hz line frequency reference* **MAXimum** *Selects 60 Hz line frequency reference* This command set can be overridden by a 50 Hz or 60 Hz aperture time set; the last command executed has priority. The ***RST** command has no affect on this setting since it is stored in non-volatile memory. The query will report the current frequency setting of 50 Hz or 60 Hz; or, if MINimum or MAXimum is specified, it will report the values available: 50 Hz or 60 Hz, respectively.  **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:LFR 50	*(Sets the line frequency reference to 50 Hz.)*
	CAL:LFR? MAX	60 *(Reports the maximum line frequency available is 60 Hz.)*

Related Commands	[SENSe:]RESistance:APERture [SENSe:]VOLTage:APERture

CALibration:NUMBer?

Purpose	Reports the number of times the multimeter has been calibrated	
Type	Query	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	CALibration:NUMBer?	
Query Parameters	N/A	
Query Response	Decimal number 0 to 32,767	
Description	The Calibration Number query reports the number of times the multimeter has been calibrated in a decimal value. The number is sent to the output buffer. The calibration number is stored in non-volatile memory and is not affected by a reset command.  **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:NUMB?	97
Related Commands	N/A	

CALibration:RESet

Purpose	Restores calibration DAC values from non-volatile memory	
Type	Event	
Command Syntax	CALibration:RESet	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	N/A	
Query Parameters	N/A	
Query Response	N/A	
Description	This command will load the Calibration DACs from the calibration constants stored in non-volatile memory. This allows the user to modify Calibration DAC values with the ability to restore the original 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:RES	
Related Commands	N/A	

CALibration:SECure:CODE

Purpose	Sets the code required to disable calibration security	
Type	Setting	
Command Syntax	CALibration:SECure:CODE #	
Command Parameters	# = 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	
***RST Value**	N/A	
Query Syntax	CALibration:SECure:CODE?	
Query Parameters	N/A	
Query Response	#	
Description	Calibration security must first be disabled before the code can be changed. Before shipping the instrument, the factory sets the code to VM2710.  **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:SEC:CODE #16VM2710	
Related Commands	CALibration:SECure[:STATe]	

CALibration:SECure[:STATe]

Purpose	Enable or disable calibration security
Type	Setting
Command Syntax	CALibration:SECure[:STATe] <mode>, #
Command Parameters	<mode> = boolean - 0 | 1 | OFF | ON # = The code must be present to disable the security or it will generate an error.
***RST Value**	1
Query Syntax	CALibration:SECure[:STATe]?
Query Parameters	N/A
Query Response	0 | 1
Description	The module powers up with the secure state enabled. While security is on, no stores to non-volatile memory are allowed. This command turns the state on or off. In order to disable the security state, the current security code must be supplied. To turn on security, code does not need to be supplied. If it is supplied the code is checked. The security code must be supplied in IEEE 488.2 definite or indefinite length arbitrary block format.  **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:SEC OFF #16VM2710	*(Disable security mode)*
	CAL:SEC:STAT 1	*(Turns calibration security back on again.)*
	CAL:SEC?	*(Indicates the calibration security is enabled so that no new information can be stored in non-volatile memory.)*

Related Commands	CALibration:SECure:CODE

CALibration:STORe

Purpose	Saves the current calibration constants into non-volatile memory	
Type	Event	
Command Syntax	CALibration:STORe	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	N/A	
Query Parameters	N/A	
Query Response	N/A	
Description	The **Calibration Secure State** must be disabled before initiating a Calibration Store command.  **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:STOR	
Related Commands	CALibration:SECure[:STATe]	

CALibration:ZERO

Purpose	Sets the range for the zero measurement.
Type	Setting
Command Syntax	CALibration:ZERO <range>
Command Parameters	<range> = expected dc range: 0.1 | 1.0 | 10.0 | 100.0 | 300.0
***RST Value**	ALL ranges
Query Syntax	CALibration:ZERO? <range>
Query Parameters	<range> = expected dc range: 0.1 | 1.0 | 10.0 | 100.0 | 300.0
Query Response	number
Description	Sets the range for the zero measurement in the dc voltage function. If no value is entered, then the VM2710A will take a zero measurement for each of the voltage ranges thus taking more time. Note that this command can only be issued for DC voltages and can only be run when the aperture is set to at least 1 PLC. Also note that, if the resolution is set to $1x10^{-6}$ V or more by the CONF:VOLT, the CAL:ZERO command will not work unless the user manual adjusts the aperture to 1 PLC. **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:ZERO 0.1	*(Sets the VM2710A to take one zero measurement in the 0.1 range.)*
	CAL:ZERO 0.1?	*(Zero measurement taken in 0.1 range.)*
Related Commands	N/A	

CALibration:ZERO:UPDate

Purpose	Updates the current zero measurements	
Type	Event	
Command Syntax	CALibration:ZERO:UPDate	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	N/A	
Query Parameters	N/A	
Query Response	N/A	
Description	Updates the current zero measurements to later be stored using the Calibration Store command.  **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:ZERO:UPD	
Related Commands	CALibration:STORe	

CONFigure?

Purpose	Reports the most recent configuration set	
Type	Query	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	CONFigure?	
Query Parameters	N/A	
Query Response	Current function, range, and resolution parameters	
Description	The CONfigure? query reports the multimeter's current configuration set be the most recent Configure or Measure command and returns these values in quotation marks.	
Examples	**Command / Query**	**Response *(Description)***
	CONF:VOLT:AC 100,0.001 CONF?	"VOLT:AC 1.000000E+002,1.000000E-003" *(Indicates that the device is con figured for volts ac in the 100 V range at a resolution of 1 mV.)*
Related Commands	CONFigure:CURRent:AC CONFigure:CURRent[:DC] CONFigure:VOLTage:AC CONFigure:VOLTage[:DC] CONFigure:FRESistance CONFigure:RESistance MEASure:CURRent:AC MEASure:CURRent[:DC] MEASure:VOLTage:AC MEASure:VOLTage[:DC] MEASure:FRESistance MEASure:RESistance	

CONFigure:CURRent:AC

Purpose	Selects the ac current function
Type	Setting
Command Syntax	CONFigure:CURRent:AC [<expected value>[, <resolution>]]
Command Parameters	<expected value> = 0.01 | 0.1 | 1 | AUTO | DEF | MIN | MAX <resolution> = 1e-7 | 1e-6 | 1e-5 | 1e-4 | DEF | MIN | MAX Refer to the *AC Current Specifications*
***RST Value**	DEFault - Autoranging / 1e-5
Query Syntax	N/A
Query Parameters	N/A
Query Response	N/A
Description	This command selects the ac Current function. It also allows you to set parameters for an expected current and resolution. When a specific current value is specified, the multimeter will automatically selects the correct range. If autoranging is selected, the only valid parameters for resolution are **MINimum** or **MAXimum**. To input a resolution parameter, a current parameter must be specified first. Valid parameter combinations are: no parameter, a current parameter only, or both a current parameter and a resolution parameter. Refer to the *AC Current Specificaitons* in Section 1 for allowed range and resolution values. The input parameters are as follows: <u><expected value></u> 0.01 | 0.1 | 1 — *Specific expected current value in amps* AUTOmatic — *Autoranging* DEFault — *Autoranging* MINimum — *0.01 (0.01 A or 10 mA)* MAXimum — *1 (1A)* [no value specified] — *Autoranging* <u>Resolution</u> 1e-7 | 1e-6 | 1e-5 | 1e-4 — *A value specified for resolution* in amps DEFault — *1e-5* MINimum — *1e-4 (Dependant on Range setting)* MAXimum — *1e-7 (Dependant on Range setting)* [no specified value] — *1e5 (Dependant on Range setting)*

Examples	**Command / Query**	**Response *(Description)***
	CONF:CURR:AC MAX,MAX	*(Selects 1 A and 10 µA resolution.)*
	CONF:CURR:AC 0.1,1E-6	*(Selects the 0.1 A range ata 1 µA resolution.)*

Related Commands	FETCh? INITiate READ? CONFigure?

CONFigure:CURRent[:DC]

Purpose	Selects the dc current function
Type	Setting
Command Syntax	CONFigure:CURRent[:DC] [<expected value>[<resolution>]]
Command Parameters	<expected value> = 0.01 | 0.1 | 1 | AUTO | DEF | MIN | MAX <resolution> = 1e-7 | 1e-6 | 1e-5 | 1e-4 | DEF | MIN | MAX Refer to the *DC Current Specifications*
***RST Value**	DEFault - Autoranging / 1e-5
Query Syntax	N/A
Query Parameters	N/A
Query Response	N/A
Description	This command selects the dc current function. It also allows you to set parameters for an expected current and resolution. When a specific current value is specified, the multimeter will automatically selects the correct range. If autoranging is selected, the only valid parameters for resolution are **MINimum** or **MAXimum**. To input a resolution parameter, a current parameter must be specified first. Valid parameter combinations are: no parameter, a current parameter only, or both a current parameter and a resolution parameter. Refer to the *DC Current Specifications* in Section 1 for allowed range and resolution values. The input parameters are as follows: <u><expected vlaue></u> 0.01 | 0.1 | 1 — *Specific expected current value in amps* AUTOmatic — *Autoranging* DEFault — *Autoranging* MINimum — *0.01 (0.01 A or 10 mA)* MAXimum — *1 (1 A)* [no value specified] — *Autoranging* <u>Resolution</u> 1e-7 | 1e-6 | 1e-5 | 1e-4 — *A value specified for resolution in amps* DEFault — *1e-5* MINimum — *1e-4 (Dependant on Range setting)* MAXimum — *1e-7 (Dependant on Range setting)* [no specified value] — *1e5 (Dependant on Range setting)*

Examples

Command / Query	**Response *(Description)***
CONF:CUR MAX,MAX	*(Selects 1 A at 10 µA resolution.)*
CONF:CURR 0.1,1E-6	*(Selects the 0.1 A range and 1 µA resolution.)*

Related Commands	FETCh? INITiate READ? CONFigure?

CONFigure:FRESistance

Purpose	Selects 4-wire ohms function
Type	Setting
Command Syntax	CONFigure:FRESistance [<expected value>[, <resolution>]]
Command Parameters	<expected value> = 0 Ω through 20 MΩ | AUTO | DEF | MIN | MAX <resolution> = 1e-4 | 1e-3 | 1e-2 | 1e-1 | 1 | 10 | 100 | 1e3 | DEF | MIN | MAX Refer to the *Resistance Specifications*
***RST Value**	DEFault - Autoranging / 1 Ω
Query Syntax	N/A
Query Parameters	N/A
Query Response	N/A
Description	This command selects the 4-wire ohms function. It also allows the user to specify an expected value and desired resolution. When a specific resistance value is specified, the multimeter will automatically selects the correct range. If autoranging is selected, the only valid parameters for resolution are **MINimum** or **MAXimum**. To input a resolution parameter, a resistance parameter must be specified first. Valid parameter combinations are: no parameter, a resistance parameter only, or both a resistance parameter and a resolution parameter. Refer to the *Resistance Specifications* in Section 1 for allowed range and resolution values. The input parameters are as follows: <u><expected value></u> 0 Ω - 20 MΩ — *Specific expected resistance value in ohms* AUTOmatic — *Autoranging* DEFault — *Autoranging* MINimum — *0 Ω* MAXimum — *20 MΩ* [no value specified] — *Autoranging* <u>Resolution</u> 1e-4 | 1e-3 | 1e-2 | 1e-1 | 1 | 10 | 100 | 1000 — *A value specified for resolution in ohms* DEFault — *1 Ω* MINimum — *(Dependant on Range)* MAXimum — *(Dependant on Range)* [no specified value] — *1 Ω (Dependant on Range)*

Examples	**Command / Query**	**Response *(Description)***
	CONF:FRES MAX,MAX	*Selects 20 MΩ at 100 Ω resolution*
	CONF:FRES 10,0.001	*Selects the 20 Ω range at 0.001 Ω resolution*

Related Commands	FETCh? INITiate READ? CONFigure?

CONFigure:RESistance

Purpose	Selects the 2-wire ohms function
Type	Setting
Command Syntax	CONFigure:RESistance [<expected value>[, <resolution>]]
Command Parameters	<expected value> = 0 Ω through 20 MΩ | AUTO | DEF | MIN | MAX <resolution> = 1e-4 | 1e-3 | 1e-2 | 1e-1 | 1 | 10 | 100 | 1000 | DEF | MIN | MAX Refer to the *Resistance Specifications*
***RST Value**	DEFault - Autoranging / 1 Ω
Query Syntax	N/A
Query Parameters	N/A
Query Response	N/A
Description	This command selects the 2-wire ohms function. It also allows the user to specify an expected value and desired resolution. When a specific resistance value is specified, the multimeter will automatically selects the correct range. If autoranging is selected, the only valid parameters for resolution are **MINimum** or **MAXimum**. To input a resolution parameter, a resistance parameter must be specified first. Valid parameter combinations are: no parameter, a resistance parameter only, or both a resistance parameter and a resolution parameter. Refer to the *Resistance Specifications* in Section 1 for allowed range and resolution values. The input parameters are as follows: <u><expected value></u> 0 Ω - 20 MΩ — *Specific expected resistance value in ohms* AUTOmatic — *Autoranging* DEFault — *Autoranging* MINimum — *0 Ω* MAXimum — *20 MΩ* [no value specified] — *Autoranging* <u>Resolution</u> 1e-4 | 1e-3 | 1e-2 | 1e-1 | 1 | 10 | 100 | 1000 — *A value specified for resolution in ohms* DEFault — *1 Ω* MINimum — *(Dependant on Range)* MAXimum — *(Dependant on Range)* [no specified value] — *1 Ω (Dependant on Range)*

Examples

Command / Query	**Response *(Description)***
CONF:RES:MAX,MAX	*(Selects 20 MΩ at 100 Ω resolution.)*
CONF:RES 10,0.001	*(Selects the 20 Ω range at 0.001 Ω resolution.)*

Related Commands	FETCh? INITiate READ? CONFigure?

CONFigure:VOLTage:AC

Purpose	Selects the ac-coupled rms voltage function
Type	Setting
Command Syntax	CONFigure:VOLTage:AC [<expected value>[, <resolution>]]
Command Parameters	<expected value> = 0 V through ±300 V | AUTO | DEF | MIN | MAX <resolution> = 1e-6 | 1e-5 | 1e-4 | 1e-3 | 1e-2 | DEF | MIN | MAX Refer to the *AC Voltage Specifications*
***RST Value**	DEFault - Autoranging / 1e-3
Query Syntax	N/A
Query Parameters	N/A
Query Response	N/A
Description	This command selects the ac-coupled rms voltage function. It also allows you to set parameters for an expected voltage and resolution. When a specific voltage value is specified, the multimeter will automatically selects the correct range. If autoranging is selected, the only valid parameters for resolution are **MINimum** or **MAXimum**. To input a resolution parameter, a voltage parameter must be specified first. Valid parameter combinations are: no parameter, a voltage parameter only, or both a voltage parameter and a resolution parameter. Refer to the *AC Voltage Specifications* in Section 1 for allowed range and resolution values. The input parameters are as follows: <u><expected value></u> 0 V - ±300 V — *Specific expected voltage value in volts* AUTOmatic — *Autoranging* DEFault — *Autoranging* MINimum — *0 V* MAXimum — *±300 V* [no value specified] — *Autoranging* <u>Resolution</u> 1e-6 | 1e-5 | 1e-4 | 1e-3 | 1e-2 — *A value specified for resolution in volts* DEFault — *1e-3* MINimum — *(Dependant on Range)* MAXimum — *(Dependant on Range)* [no specified value] — *1e-3 (Dependant on Range)*

Examples	**Command / Query**	**Response *(Description)***
	CONF:VOLT:AC MAX,MAX	*(Selects ±300 V at 1 mV resolution.)*
	CONF:VOLT:AC 12,1E-2	*(Selects the 100 V range at 10 mV resolution.)*

Related Commands	FETCh? INITiate READ? CONF?

CONFigure:VOLTage[:DC]

Purpose	Selects the dc voltage function
Type	Setting
Command Syntax	CONFigure:VOLTage[:DC] [<expected value>[<resolution>]]
Command Parameters	<expected value> = 0 V through ±300 V | AUTO | DEF | MIN | MAX <resolution> = 1e-6 | 1e-5 | 1e-4 | 1e-3 | 1e-2 | DEF | MIN | MAX Refer to the *DC Voltage Specifications* for more details
***RST Value**	DEFault - Autoranging / 1e-3
Query Syntax	N/A
Query Parameters	N/A
Query Response	N/A
Description	This command selects the dc voltage function. It also allows you to set parameters for an expected voltage and resolution. When a specific voltage value is specified, the multimeter will automatically selects the correct range. If autoranging is selected, the only valid parameters for resolution are **MINimum** or **MAXimum**. To input a resolution parameter, a voltage parameter must be specified first. Valid parameter combinations are: no parameter, a voltage parameter only, or both a voltage parameter and a resolution parameter. Refer to the *DC Voltage Specifications* in Section 1 for allowed range and resolution values. The input parameters are as follows: <expected value> 0 V - ±300 V — *Specific expected voltage value in volts* AUTOmatic — *Autoranging* DEFault — *Autoranging* MINimum — *0 V* MAXimum — *±300 V* [no value specified] — *Autoranging* Resolution 1e-6 | 1e-5 | 1e-4 | 1e-3 | 1e-2 — *A value specified for resolution in volts* DEFault — *1e-3* MINimum — *(Dependant on range)* MAXimum — *(Dependant on range)* [no specified value] — *1e-3 (Dependant on range)*

Examples	**Command / Query**	**Response *(Description)***
	CONF:VOLT:AC MAX,MAX	*(Selects ±300 V at 1 mV resolution.)*
	CONF:VOLT:AC 12,1E-2	*(Selects 100 V range at 10 mV resolution.)*

Related Commands	FETCh? INITiate READ? CONF?

FETCh?

Purpose	Retrieves the most recent measurements stored by the last INITiate command	
Type	Query	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	FETCh?	
Query Parameters	N/A	
Query Response	Real ASCII format	
Description	This command retrieves measurements stored in memory by the most recent INITiate command and places then in the output buffer. The INITiate command must be executed before each FETCh? query otherwise it would generate an error. Each reading consists of a reading in real ASCII format. If multiple readings are returned, they are separated by commas. A Line Feed (LF) and an END-or-Identify (EOF) signal follow the last reading. The output format is dependent on the FORMat command.	
Examples	**Command / Query**	**Response *(Description)***
	FETC?	±1.234567E±123*LF*
Related Commands	CONFigure FORMat INITiate READ?	

FORMat

Purpose	Sets the measurement data format.	
Type	Setting	
Command Syntax	FORMat <format>	
Command Parameters	<format> = decimal or C string	
***RST Value**	C string - exponential format: %e	
Query Syntax	FORMat?	
Query Parameters	N/A	
Query Response	C string format	
Description	The Format command sets the data format for the voltage, current, and resistance measurement functions. The format parameter can be entered as a decimal number or a C string which sets the measurement reading format; a format query always returns a C string. The default setting is exponential format. For the decimal format, the range is [0-4].[0-9] (i.e., the maximum value allowed is 4.9)	
Examples	**Command / Query**	**Response *(Description)***
	FORM 1.4	*(Sets the data format to decimal #.####, at least 1 digit before and 4 digits after the decimal.)*
	FORM?	#15%6.4F *(The measurement data format is decimal, but the format query still returns a C string. A voltage measurement of 12.3456789 would read: 12.3457 (only 4 digits after the decimal). Also note that the last digit has been rounded.)*
	FORM #16%10.2E	
	FORM?	#16%10.2E *(A voltage measurement of 12.3456789 would read: 12.3E+001.)*
	*RST	
	FORM?	#12%E *(The default is a C string in exponential format. A voltage measurement of 12.3456789 would read: 1.234568E+001 (the default precision is 6. Note that the "7" has been rounded to an "8".)*
Related Commands	N/A	

FORMat:OVERflow

Purpose	Sets the overflow function	
Type	Setting	
Command Syntax	FORMat:OVERflow <overflow format>	
Command Parameters	<overflow format> = NONE | BIPolar | UNIPolar	
***RST Value**	NONE	
Query Syntax	FORMat:OVERflow?	
Query Parameters	N/A	
Query Response	NONE | BIP | UNIP	
Description	The FORMat:OVERflow command sets the format of how the user is notified of an overflow (or "over-range"). NONE: This is the default. UNIPolar: The system would return a **9.9e37** to alert the user of an overflow. BIPolar: The system would return a **9.9e37** for positive overflows, and **-9.9e37** for negative overflows.	
Examples	**Command / Query**	**Response *(Description)***
	FORM:OVER BIP	*(Sets the overflow format to alert the user of overflow in both the positive and negative values.)*
Related Commands	N/A	

INITiate[:IMMediate]

Purpose	Places the multimeter in the wait-for-trigger state	
Type	Event	
Command Syntax	INITiate[:IMMediate]	
Command Parameters	N/A	
***RST Value**	Idle state	
Query Syntax	N/A	
Query Parameters	N/A	
Query Response	N/A	
Description	This command places the multimeter in the wait-for-trigger state and stores the readings into memory when a trigger occurs. Readings previously stored are replaced by the new ones.	
Examples	**Command / Query**	**Response *(Description)***
	INIT	
Related Commands	ABORt CONFigure FETCh? READ?	

INPut:SOURce

Purpose	Selects input channel	
Type	Setting	
Command Syntax	INPut:SOURce <source>	
Command Parameters	<source> = A | B	
***RST Value**	A	
Query Syntax	INPut:SOURce?	
Query Parameters	N/A	
Query Response	A | B	
Description	This command selects the input source used: A or B.	
Examples	**Command / Query**	**Response *(Description)***
	INP:SOUR B INP:SOUR?	 B
Related Commands	N/A	

MATH

Purpose	Selects math function	
Type	Setting	
Command Syntax	MATH <boolean>	
Command Parameters	<boolean> = 0 | 1 | OFF | ON	
***RST Value**	0	
Query Syntax	MATH?	
Query Parameters	N/A	
Query Response	0 | 1	
Description	The Math command turns the math function ON or OFF.	
Examples	**Command / Query**	**Response *(Description)***
	MATH 1 MATH?	*(Enables the math function for this module.)* 1 *(Indicates that the math function has been truned on.)*
Related Commands	MATH:FACTor MATH:FACTor LAST MATH:OFFSet MATH:OFFSet LAST	

MATH:FACTor

Purpose	Sets the factor value	
Type	Setting	
Command Syntax	MATH:FACTor <value> | LAST	
Command Parameters	<value> = decimal number	
***RST Value**	1	
Query Syntax	MATH:FACTor?	
Query Parameters	N/A	
Query Response	decimal number	
Description	This command sets the factor Value (reading * factor) - offset. Math Factor **LAST** takes the last measured reading and sets it as the factor value.	
Examples	**Command / Query**	**Response *(Description)***
	MATH:FACT 2 MATH:FACT?	 2
Related Commands	MATH MATH:OFFSet	

MATH:OFFSet

Purpose	Sets the offset value	
Type	Setting	
Command Syntax	MATH:OFFSet <value> | LAST	
Command Parameters	<value> = decimal number	
***RST Value**	0	
Query Syntax	MATH:OFFSet?	
Query Parameters	N/A	
Query Response	Returns the value currently set for the <value> parameter	
Description	This command sets the offset Value (reading * factor) - offset. Math Offset **LAST** takes the last measured reading and sets it as the offset value.	
Examples	**Command / Query**	**Response *(Description)***
	MATH:OFFS 1 MATH:OFFS?	 1
Related Commands	MATH MATH:FACTor	

MEASure:CURRent:AC?

Purpose	Selects the ac current function
Type	Setting
Command Syntax	MEASure:CURRent:AC [<expected value>[, <resolution>]]
Command Parameters	<expected value> =0.01 | 0.1 | 1 | AUTO | DEF | MIN | MAX <resolution> = 1e-7 | 1e-6 | 1e-5 | 1e-4 | DEF | MIN | MAX Refer to the *AC Current Specifications*
***RST Value**	DEFault - Autoranging / 1e-5
Query Syntax	N/A
Query Parameters	N/A
Query Response	N/A
Description	This command selects the ac Current function. It also allows you to set parameters for an expected current and resolution. When a specific current value is specified, the multimeter will automatically selects the correct range. If autoranging is selected, the only valid parameters for resolution are **MINimum** or **MAXimum**. To input a resolution parameter, a current parameter must be specified first. Valid parameter combinations are: no parameter, a current parameter only, or both a current parameter and a resolution parameter. See the *AC Current Specifications* in Section 1 for allowed range and resolution values. The input parameters are as follows: <u><expected value></u> 0.01 | 0.1 | 1 — *Specific expected current value in amps* AUTOmatic — *Autoranging* DEFault — *Autoranging* MINimum — *0.01 (0.01 A or 10 mA)* MAXimum — *1 (1.0 A)* [no value specified] — *Autoranging* <u>Resolution</u> 1e-7 | 1e-6 | 1e-5 | 1e-4 — *A value specified for resolution* DEFault — *1e-5* MINimum — *1e-4 (Dependant on range setting)* MAXimum — *1e-7 (Dependant on range setting)* [no specified value] — *1e5 (Dependant on range setting)*

Examples	**Command / Query**	**Response *(Description)***
	MEAS:CURR:AC MAX,MAX	*(Selects 1 A at 10 µA resolution.)*
	MEAS:CURR:AC 0.1,1E-6	*(Selects the 0.1 A range at 1 µA resolution.)*

Related Commands	READ?

MEASure:CURRent[:DC]?

Purpose	Selects the dc current function
Type	Setting
Command Syntax	MEASure:CURRent[:DC] [<expected value>[<resolution>]]
Command Parameters	<expected value> = 0.01 | 0.1 | 1 | AUTO | DEF | MIN | MAX <resolution> = 1e-7 | 1e-6 | 1e-5 | 1e-4 | DEF | MIN | MAX Refer to the *DC Current Specifications*
***RST Value**	DEFault – Autoranging / 1e-5
Query Syntax	N/A
Query Parameters	N/A
Query Response	N/A
Description	This command selects the dc current function. It also allows you to set parameters for an expected current and resolution. When a specific current value is specified, the multimeter will automatically selects the correct range. If autoranging is selected, the only valid parameters for resolution are **MINimum** or **MAXimum**. To input a resolution parameter, a current parameter must be specified first. Valid parameter combinations are: no parameter, a current parameter only, or both a current parameter and a resolution parameter. See the *DC Current Specifications* in Section 1 for allowed range and resolution values. The input parameters are as follows: <u><expected value></u> 0.01 | 0.1 | 1 — *Specific expected current value in amps* AUTOmatic — *Autoranging* DEFault — *Autoranging* MINimum — *0.01 (0.01A or 10mA)* MAXimum — *1 (1.0 A)* [no value specified] — *Autoranging* <u>Resolution</u> 1e-7 | 1e-6 | 1e-5 | 1e-4 — *A value specified for resolution* DEFault — *1e-5* MINimum — *1e-4 (Dependant on Range setting)* MAXimum — *1e-7 (Dependant on Range setting)* [no specified value] — *1e5 (Dependant on Range setting)*

Examples	**Command / Query**	**Response *(Description)***
	MEAS:CURR MAX,MAX	*(Selects 1 A at 10 µA resolution.)*
	MEAS:CURR 0.1,1E-6	*(Selects the 0.1 A range at 1 µA resolution.)*

Related Commands	READ?

MEASure:FRESistance?

Purpose	Selects the 4-wire ohms function
Type	Query
Command Syntax	N/A
Command Parameters	N/A
***RST Value**	DEFault - Autoranging / 1 PLC
Query Syntax	MEASure:FRESistance? [<expected value>[, <resolution>]]
Query Parameters	<expected value> = 0 Ω through 20 MΩ | AUTO | DEF | MIN | MAX <resolution> = 1e-4 | 1e-3 | 1e-2 | 1e-1 | 1 | 10 | 100 | 1000 | DEF | MIN | MAX
Query Response	Numeric
Description	This command selects the 4-wire ohms function. It also allows the user to specify an expected value and desired resolution. When a specific resistance value is specified, the multimeter will automatically selects the correct range. If autoranging is selected, the only valid parameters for resolution are **MINimum** or **MAXimum**. To input a resolution parameter, a resistance parameter must be specified first. Valid parameter combinations are: no parameter, a resistance parameter only, or both a resistance parameter and a resolution parameter. See the *Resistance Specifications* in Section 1 for allowed range and resolution values. The input parameters are as follows: Resistance 0 Ω - 20 MΩ — *Specific expected resistance value* AUTOmatic — *Autoranging* DEFault — *Autoranging* MINimum — *0 Ω* MAXimum — *20 MΩ* [no value specified] — *Autoranging* Resolution 1e-4 | 1e-3 | 1e-2 | 1e-1 | 1 | 10 | 100 | 1000 — *A value specified for Resolution* DEFault — *1 Ω* MINimum — *(Dependant on Range)* MAXimum — *(Dependant on Range)* [no specified value] — *1 Ω (Dependant on Range)*
Examples	**Command / Query** — **Response *(Description)*** MEAS:FRES MAX,MAX — *(Selects 20 MΩ at 100 Ω resolution.)* MEAS:FRES 10,0.001 — *(Selects the 20 Ω range at 0.001 Ω resolution.)*
Related Commands	READ?

MEASure:RESistance?

Purpose	Selects the 2-wire ohms function
Type	Query
Command Syntax	N/A
Command Parameters	N/A
***RST Value**	DEFault - Autoranging / 1 PLC
Query Syntax	MEASure:RESistance? [<expected value>[, <resolution>]]
Query Parameters	<expected value> = 0 Ω through 20 MΩ | AUTO | DEF | MIN | MAX <resolution> = 1e-4 | 1e-3 | 1e-2 | 1e-1 | 1 | 10 | 100 | 1000 | DEF | MIN | MAX
Query Response	numeric
Description	This command selects the 2-wire ohms function. It also allows the user to specify an expected value and desired resolution. When a specific resistance value is specified, the multimeter will automatically selects the correct range. If autoranging is selected, the only valid parameters for resolution are **MINimum** or **MAXimum**. To input a resolution parameter, a resistance parameter must be specified first. Valid parameter combinations are: no parameter, a resistance parameter only, or both a resistance parameter and a resolution parameter. See the *Resistance Specifications* in Section 1 for allowed range and resolution values. The input parameters are as follows: Resistance 0 Ω - 20 MΩ — *Specific expected resistance value* AUTOmatic — *Autoranging* DEFault — *Autoranging* MINimum — *0 Ω* MAXimum — *20 MΩ* [no value specified] — *Autoranging* Resolution 1e-4 | 1e-3 | 1e-2 | 1e-1 | 1 | 10 | 100 | 1000 — *A value specified for Resolution* DEFault — *1 Ω* MINimum — *(Dependant on Range)* MAXimum — *(Dependant on Range)* [no specified value] — *1 Ω (Dependant on Range)*
Examples	**Command / Query** — **Response *(Description)*** MEAS:RES MAX,MAX — *(Selects 20 MΩ at 100 Ω resolution.)* MEAS:RES 10,0.001 — *(Selects the 20 Ω range at 0.001 Ω resolution.)*
Related Commands	READ?

MEASure:VOLTage:AC?

Purpose	Selects the ac-coupled rms voltage function
Type	Setting
Command Syntax	MEASure:VOLTage:AC [<expected value>[, <resolution>]]
Command Parameters	<expected value> = 0 V through ±300 V | AUTO | DEF | MIN | MAX <resolution> = 1e-6 | 1e-5 | 1e-4 | 1e-3 | 1e-2 | DEF | MIN | MAX Refer to the *AC Voltage Specificaiotns*
***RST Value**	DEFault - Autoranging / 1e-3
Query Syntax	N/A
Query Parameters	N/A
Query Response	N/A
Description	This command selects the ac-coupled rms voltage function. It also allows you to set parameters for an expected voltage and resolution. When a specific voltage value is specified, the multimeter will automatically selects the correct range. If autoranging is selected, the only valid parameters for resolution are **MINimum** or **MAXimum**. To input a resolution parameter, a voltage parameter must be specified first. Valid parameter combinations are: no parameter, a voltage parameter only, or both a voltage parameter and a resolution parameter. See the *AC Voltage Specificaiotns* for range and resolution values allowed. The input parameters are as follows: Voltage 0 V - ±300 V — *Specific expected voltage value* AUTOmatic — *Autoranging* DEFault — *Autoranging* MINimum — *0 V* MAXimum — *±300 V* [no value specified] — *Autoranging* Resolution 1e-6 | 1e-5 | 1e-4 | 1e-3 | 1e-2 — *A value specified for resolution* DEFault — *1e-3* MINimum — *(Dependant on Range)* MAXimum — *(Dependant on Range)* [no specified value] — *1e-3 (Dependant on Range)*

Examples	**Command / Query**	**Response *(Description)***
	MEAS:VOLT:AC MAX,MAX	*(Selects ±300 V at 1 mV resolution.)*
	MEAS:VOLT:AC 12,1E-2	*(Selects the 100 V range at 10 mV resolution.)*

Related Commands	READ?

MEASure:VOLTage[:DC]?

Purpose	Selects the dc voltage function
Type	Setting
Command Syntax	MEASure:VOLTage[:DC] [<expected value>[<resolution>]]
Command Parameters	<expected value> = 0 V through ±300 V | AUTO | DEF | MIN | MAX <resolution> = 1e-6 | 1e-5 | 1e-4 | 1e-3 | 1e-2 | DEF | MIN | MAX Refer to the *DC Voltage Specifications*
***RST Value**	DEFault - Autoranging / 1e-3
Query Syntax	N/A
Query Parameters	N/A
Query Response	N/A
Description	This command selects the dc voltage function. It also allows you to set parameters for an expected voltage and resolution. When a specific voltage value is specified, the multimeter will automatically selects the correct range. If autoranging is selected, the only valid parameters for resolution are **MINimum** or **MAXimum**. To input a resolution parameter, a voltage parameter must be specified first. Valid parameter combinations are: no parameter, a voltage parameter only, or both a voltage parameter and a resolution parameter. See the *DC Voltage Specifications* in Section 1 for allowed range and resolution values. The input parameters are as follows: <u>Voltage</u> 0 V - ±300 V — *Specific expected voltage value* AUTOmatic — *Autoranging* DEFault — *Autoranging* MINimum — *0 V* MAXimum — *±300 V* [no value specified] — *Autoranging* <u>Resolution</u> 1e-6 | 1e-5 | 1e-4 | 1e-3 | 1e-2 — *A value specified for resolution* DEFault — *1e-3* MINimum — *(Dependant on Range)* MAXimum — *(Dependant on Range)* [no specified value] — *1e-3 (Dependant on Range)*

Examples	**Command / Query**	**Response *(Description)***
	CONF:VOLT:AC MAX,MAX	*(Selects ±300 V at 1 mV resolution.)*
	CONF:VOLT:AC 12,1E-2	*(Selects the 100 V range at 10 mV resolution.)*
Related Commands	READ?	

MFGTEST 99

Purpose	Enables or disables the ohms current function	
Type	Setting	
Command Syntax	MFGTEST 99 <boolean>	
Command Parameters	<boolean> = ON | OFF | 1 | 0	
***RST Value**	1	
Query Syntax	MFGTEST? 99	
Query Parameters	N/A	
Query Response	0 | 1	
Description	The MFGTEST 99 command enables or disables the ohms current function. This can be used to help measure resistance in a circuit with other currents flowing. The default setting is enabled.	
Examples	**Command / Query**	**Response *(Description)***
	MFGTEST 99 0 MFGTEST? 99	*(Disables the ohmes current function.)* *0 (Verifies that the ohms current function is disabled)*
Related Commands	N/A	

OUTPut:TTLTrg

Purpose	Selects the specified VXIbus trigger line	
Type	Setting	
Command Syntax	OUTPut:TTLTrg <trigger line>[:STATe] <boolean>	
Command Parameters	<trigger line> = 0 through 7 <boolean> = ON | OFF | 1 | 0	
***RST Value**	0 (lines 0 - 7 off)	
Query Syntax	OUTPut:TTLTrg <trigger line>[:STATe]?	
Query Parameters	<trigger line> = 0 through 7	
Query Response	0 | 1	
Description	This command enables or disables routing of the *voltmeter complete* signal to a VXIbus trigger line on the backplane. The trigger line parameter specifies which trigger line (0 - 7) is used. The backplane trigger line enable is an additional output to the front panel trigger line that is always present.	
Examples	**Command / Query**	**Response *(Description)***
	OUTP:TTLT 4 ON OUTP:TTL 4?	 1
Related Commands	OUTPut[:TTLTrig]:POLarity	

OUTPut[:TTLTrg]:POLarity

Purpose	Sets the output signal polarity	
Type	Setting	
Command Syntax	OUTPut[:TTLTrig]:POLarity <polarity>	
Command Parameters	<polarity> = POS | NEG	
***RST Value**	NEG	
Query Syntax	OUTPut[:TTLTrig]:POLarity?	
Query Parameters	N/A	
Query Response	POS | NEG	
Description	Sets the polarity of the voltmeter-completed signal to the VXIbus trigger lines.	
Examples	**Command / Query**	**Response *(Description)***
	OUTP:POL POS OUTP:POL?	 POS
Related Commands	OUTPut:TTLTrg	

RANGe:AUTOmatic

Purpose	Enables or disables the autorange function
Type	Setting
Command Syntax	RANGe:AUTOmatic <boolean>
Command Parameters	<boolean> = 0 | 1 | OFF | ON
***RST Value**	1
Query Syntax	RANGe:AUTOmatic?
Query Parameters	N/A
Query Response	0 | 1
Description	This command enables or disables the autorange function. When autoranging is on, the multimeter samples the input before each measurement and selects the appropriate range. Autoranging is automatically disabled if a range is explicitly selected. Four different command branches control this one enable/disable autorange function: RANGe:AUTOmatic [SENSe:]CURRent:RANGe:AUTOmatic [SENSe:]RESistance:RANGe:AUTOmatic [SENSe:]VOLTage:RANGe:AUTOmatic The default setting for this function is ON.
Examples	**Command / Query** / **Response *(Description)***
	RANG:AUTO OFF RANG:AUTO? / 0
Related Commands	[SENSe:]CURRent:RANGe:AUTOmatic [SENSe:]RESistance:RANGe:AUTOmatic [SENSe:]VOLTage:RANGe:AUTOmatic

RANGe:DELay

Purpose	Sets the settling time before reading measurements.
Type	Setting
Command Syntax	RANGe:DELay <time>
Command Parameters	<time> = 1 µs to 2000 s (*value entered in seconds)*
***RST Value**	**Function** — **Range** — **Time** Voltage (dc) — ALL — 5 ms Voltage (ac) — ALL — AC filter settling time[1] Ohms 2 & 4 wire — 20 Ω to 200 kΩ — 5 ms 2 MΩ — 50 ms 20 MΩ — 500 ms Current (dc) — ALL — 5 ms Current (ac) — ALL — AC Filter settling time[1] **Low** — **Mid** — **High** [1]AC Filter settling time — 800 ms — 250 ms — 60 ms
Query Syntax	RANGe:DELay?
Query Parameters	N/A
Query Response	1 µs to 2000 s
Description	This command sets the delay (settling) time between changing functions or ranges. The VM2710A will delay this specified amount of time, after a function and/or range change, before starting to take readings. Setting a delay time will disable the RANGe:DELay:AUTOmatic function.
Examples	**Command / Query** — **Response *(Description)***
	RANG:DEL 0.000001 — *(Sets the delay time to the shortest time possible: i.e., 1 µs.)*
Related Commands	RANGe:DELay:AUTOmatic

RANGe:DELay:AUTOmatic

Purpose	Enables the default delay times.
Type	Setting
Command Syntax	RANGe:DELay:AUTOmatic <boolean>
Command Parameters	<boolean> = 0 | 1 | OFF | ON
***RST Value**	1
Query Syntax	RANGe:DELay:AUTOmatic?
Query Parameters	N/A
Query Response	0 | 1
Description	This command enables or disables the default delay times without having to perform a unit reset. Default times are as follows: **Function** — **Range** — **Time** Voltage (dc) — ALL — 5 ms Voltage (ac) — ALL — AC Filter settling time[1] 2- & 4-wire ohms — 20 Ω to 200 kΩ — 5 ms 2 MΩ — 50 ms 20 MΩ — 500 ms Current (dc) — ALL — 5 ms Current (ac) — ALL — AC Filter settling time[1] **Low** — **Mid** — **High** [1]AC Filter settling time — 800 ms — 250 ms — 60 ms
Examples	**Command / Query** → **Response *(Description)*** RANG:DEL:AUTO RANG:DEL:AUTO? → 1
Related Commands	RANGe:DELay [SENSe:]CURRent:RANGe:DELay:AUTOmatic [SENSe:]RESistance:RANGe:DELay:AUTOmatic [SENSe:]VOLTage:RANGe:DELay:AUTOmatic

READ?

Purpose	Transfers the readings to the output buffer	
Type	Query	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	READ?	
Query Parameters	N/A	
Query Response	ASCII data	
Description	The READ? command places the multimeter in wait-for-trigger state to make the measurements, then formats and sends readings to the output buffer. This command is slower than using INITiate or FETCh?; however, the READ? command does not use multimeter memory so the sample count and trigger count are not limited. Each reading sent to the output buffer consists of 15 bytes (characters) in real ASCII format: ±1.234567E± 123 *LF* A Line Feed and an EOF signal follows the last reading instead of a comma. The multimeter will remain busy until the readings are removed from the output buffer. Any new data sent to the output buffer would overwrite data sent from previous commands. In continuous mode, readings continue unitl an ABORt command is received.	
Examples	**Command / Query**	**Response *(Description)***
	READ?	*(Places the multimeter in wait-for-trigger state and make measurements. Send readings to output buffer. Trigger source is IMMediate by default.)*
Related Commands	CONFigure FETCh? INITiate TRIGger:COUNt	

SAMPle:COUNt

Purpose	Sets the number of readings per trigger	
Type	Setting	
Command Syntax	SAMPle:COUNt <n>	
Command Parameters	<n> = 1 through 16,777,215 | MIN | MAX	
***RST Value**	1	
Query Syntax	SAMPle:COUNt? [<MIN | MAX>]	
Query Parameters	<MIN | MAX> = specify MIN or MAX available	
Query Response	1 through 16,777,215, or 1 if MIN specified, or 16,777,215 if MAX specified	
Description	The Sample Count command sets the number of readings per trigger. If MINimum or MAXimum is specified, the command sets (or the query returns) the value of 1 for MIN, and the value of 16,777,215 for MAX. The default value is 1.	
Examples	**Command / Query**	**Response *(Description)***
	SAMP:COUN 12 SAMP:COUN?	 12
Related Commands	N/A	

SAMPle:SOURce

Purpose	Selects the pacing source for the sample rate	
Type	Setting	
Command Syntax	SAMPle:SOURce <source>	
Command Parameters	<source> = IMMediate | TIMer	
***RST Value**	IMMediate	
Query Syntax	SAMPle:SOURce?	
Query Parameters	N/A	
Query Response	IMM | TIM	
Description	Sets the pacing source for the sample rate when the SAMPle:COUNt is set greater than 1. IMMediate initiates a reading when the multimeter is not busy. TIMer specifies to use the TIMer rate setting that is set with the SAMPle:TIMer command. The default setting is IMMediate.	
Examples	**Command / Query**	**Response *(Description)***
	SAMP:SOUR TIM SAMP:SOUR?	 TIM
Related Commands	SAMPle:COUNt SAMPle:TIMer	

SAMPle:TIMer

Purpose	Sets the period between readings
Type	Setting
Command Syntax	SAMPle:TIMer <period>
Command Parameters	<period> = 0 through 2100 seconds (in decimal numbers) | MIN | MAX
***RST Value**	0.0
Query Syntax	SAMPle:TIMer?[<MIN | MAX>]
Query Parameters	<MIN | MAX> = specify MIN or MAX available
Query Response	0 through 2100 seconds | 0.0 if MIN specified | 2100 if MAX specified

Description

The Sample Timer command defines the period between readings in a burst of readings. This setting is only used when **SAMPle:COUNt** is set greater than **1** and **SAMPle:SOURce** is set to **TIMer**.

When using this command, the first measurement occurs without the specified period; however; you can insert a time interval before the first reading using TRIGger:DELay.

The following table is a guideline for sample rate settings. The aperture time and sample rate shown assume a fixed range and auto-zero off.

Sample Rate Setting vs. Reading Sample Intervals when SAMPle:COUNt = 2

Aperture Time	*Samples every reading*	*on every other interval (skip 1-sample 2)*	*on every 3rd interval (skip 2-sample 2)*	*on every 4th interval (skip 3-sample 2)*	*on every 5th interval (skip 4-sample 2)*
2.0 s	2.0 s	4.0 s	6.0s	8.0s	10.0s
1.67 s	1.67 s	3.34 s	5.01 s	6.68 s	8.35 s
200 ms	200 ms	400 ms	600 ms	800 ms	1.0 s
167 ms	167 ms	334 ms	501 ms	668 ms	835 ms
20 ms	20 ms	40 ms	60 ms	80 ms	100 ms
16.7 ms	16.7 ms	33.4 ms	50.1 ms	66.8 ms	83.5 ms
2.0 ms	2.0 ms	4.0 ms	6.0 ms	8.0 ms	10.0 ms
1.67 ms	1.67 ms	3.34 ms	5.01 ms	6.68 ms	8.35 ms
0.5 ms	0.5 ms	1 ms	1.5 ms	2.0 ms	2.5 ms

The sample rate can be set for every 6th, 7th, 8th…interval, and so on. The same would be true if the SAMPle:COUNt were 3, 4, 5, …, etc.

Examples

Command / Query	**Response *(Description)***
SAMP:TIM 0.02	*Sets the sample time to every 10th interval (aperture time is 2.0 ms).*

Related Commands

SAMPle:COUNt
SAMPle:SOURce

[SENSe:]BANDwidth:DETector

Purpose	Selects slow, medium or fast measurement mode	
Type	Setting	
Command Syntax	[SENSe:]BANDwidth:DETector <frequency>	
Command Parameters	<frequency> = numeric value: < 100 (slow mode) *Query returns 20* 100 - 499 (medium mode) *Query returns 100* ≥ 500 (fast mode) *Query returns 500*	
***RST Value**	20 (slow mode)	
Query Syntax	[SENSe:]BANDwidth:DETector?	
Query Parameters	N/A	
Query Response	20 | 100 | 500	
Description	This command selects the frequency range, or measurement mode, for ac voltage. The multimeter will automatically set the correct mode (slow, medium or fast) by entering the expected frequency of the input signal.	
Examples	**Command / Query**	**Response *(Description)***
	BAND:DET 400	*(Automatically selects medium mode.)*
	BAND:DET?	100
Related Commands	N/A	

[SENSe:]CURRent:AC:RANGe

Purpose	Selects the range for ac current measurements	
Type	Setting	
Command Syntax	[SENSe:]CURRent:AC:RANGe <expected value>	
Command Parameters	<expected value> = 0.01 | 0.1 | 1 | AUTO | DEF | MIN | MAX	
***RST Value**	DEFault = Autoranging	
Query Syntax	[SENSe:]CURRent:AC:RANGe? [<MIN | MAX>]	
Query Parameters	<MIN> = Causes the query to report the minimum value (0.01 A) <MAX> = Causes the query to report the maximum value (1.0 A)	
Query Response	0.01 | 0.1 | 1	
Description	This command selects the range for ac current measurements. To select a standard measurement range, specify the *expected value* of the input signal's maximum expected current. The multimeter then selects the correct range. MINimum selects 0.01 A (10 mA range) and MAXimum selects 1 A. This command overrides any setting by a previous CONFigure command specifying the same function. With the new range, a new resolution is also selected; however, this resolution is based on the aperture time set by the CONFigure command. Specifying a fixed range also disables the autorange mode.	
Examples	**Command / Query**	**Response *(Description)***
	CURR:AC:RANG MAX CURR:AC:RANG?	 1
Related Commands	CONFigure	

[SENSe:]CURRent:APERture

Purpose	Sets the integration time for current measurements
Type	Setting
Command Syntax	[SENSe:]CURRent:APERture <aperture time>
Command Parameters	<aperture time> = 2.0 s | 1.67 s | 200 ms | 167 ms | 20 ms | 16.7 ms | 2.0 ms | 1.67 ms | 500 μs | DEF | MIN | MAX
***RST Value**	1.67E-02 (60 Hz) or 2E-02 (50 Hz)
Query Syntax	[SENSe:]CURRent:APERture? [<MIN | MAX>]
Query Parameters	<MIN> = Causes the query to report the minimum value (500 μs) <MAX> = Causes the query to report the maximum value (2.0 s)
Query Response	2E+00 | 1.67E+00 | 2E-01 | 1.67E-01 | 2E-02 | 1.67E-02 | 2E-03 | 1.67E-03 | 5E-04
Description	This command sets the integration time (in seconds) for current measurements. Values are rounded to the nearest aperture time as shown in the table below. Setting to MINimum sets the value to 500 μs; setting to MAXimum sets the value to 2.0 seconds. The greater the aperture time setting, the greater the normal mode rejection and the lower the reading rate.

Aperture Time	Value Entered (or returned)	Frequency
2.0 s	2E+00	50 Hz
1.67 s	1.67E+00	60 Hz
200 ms	2E-01	50 Hz
167 ms	1.67E-01	60 Hz
20 ms	2E-02	50 Hz
16.7 ms	1.67E-02	60 Hz
2.0 ms	2E-03	50 Hz
1.67 ms	1.67E-03	60 Hz
500 μs	5E-04	60 Hz / 50 Hz

Setting the aperture time also sets the integration time in power line cycles (PLCs) and the resolution. This command can override the previous values set by CALibration:LFRequency, CURRent:NPLC or CURRent:RESolution. The last command executed has priority. See *RST Values above for default values.

Examples

Command / Query	Response *(Description)*
CURR:APER 1.67E-01	*Sets the aperture time to 167 ms*

Related Commands

CALibration:LFRequency
[SENSe:]CURRent:NPLC
[SENSe:]CURRent:RESolution

[SENSe:]CURRent[:DC]:RANGe

Purpose	Selects the range for dc current measurements	
Type	Setting	
Command Syntax	[SENSe:]CURRent[:DC]:RANGe <expected value>	
Command Parameters	<expected value> = 0.01 | 0.1 | 1 | DEF | MIN | MAX	
***RST Value**	Autoranging	
Query Syntax	[SENSe:]CURRent[:DC]:RANGe? [<MIN | MAX>]	
Query Parameters	<MIN> = Causes the query to report the minimum value (0.01 A) <MAX> = Causes the query to report the maximum value (1.0 A)	
Query Response	0.01 | 0.1 | 1	
Description	This command selects the range for dc current measurements. To select a standard measurement range, specify the *expected value* of the input signal's maximum expected current. The multimeter then selects the correct range. MINimum selects 0.01 A (10 mA) and MAXimum selects 1 A. This command overrides any setting by a previous CONFigure command specifying the same function. With the new range, a new resolution is also selected; however, this resolution is based on the aperture time set by the CONFigure command. Specifying a fixed range also disables the autorange mode.	
Examples	**Command / Query**	**Response *(Description)***
	CURR:RANG MAX CURR:RANG?	 1
Related Commands	CONFigure CURRent:RANGe:AUTOmatic	

[SENSe:]CURRent:NPLC

<table>
<tr><td>Purpose</td><td>Sets the integration time in power line cycles (PLCs)</td></tr>
<tr><td>Type</td><td>Setting</td></tr>
<tr><td>Command Syntax</td><td>[SENSe:]CURRent:NPLC <nplc></td></tr>
<tr><td>Command Parameters</td><td><nplc> = 0.03 | 0.1 | 1 | 10 | 100 | DEF | MIN | MAX</td></tr>
<tr><td>*RST Value</td><td>1</td></tr>
<tr><td>Query Syntax</td><td>[SENSe:]CURRent:NPLC? [<MIN | MAX>]</td></tr>
<tr><td>Query Parameters</td><td><MIN> = Causes the query to report the minimum value (0.00)
<MAX> = Causes the query to report the maximum value (100)</td></tr>
<tr><td>Query Response</td><td>0.03 | 0.1 | 1 | 10 | 100</td></tr>
<tr><td>Description</td><td>This command sets the integration time, for current measurements, in power line cycles (PLCs). Values are rounded up to the nearest number of PLCs as shown in the table below. MINimum sets the value to 0.03 PLC; MAXimum sets the value to 100 PLC. The greater number of PLCs, the greater the normal mode rejection and the lower the reading rate. Use the CALibration:LFRequency command to select the line frequency reference for the multimeter's A/D converter.

<table>
<tr><th>Power Line Cycles (PLCs)</th><th>Frequency</th></tr>
<tr><td>0.03 PLC</td><td>50 Hz | 60 Hz</td></tr>
<tr><td>0.1 PLC</td><td>50 Hz | 60 Hz</td></tr>
<tr><td>1 PLC</td><td>50 Hz | 60 Hz</td></tr>
<tr><td>10 PLC</td><td>50 Hz | 60 Hz</td></tr>
<tr><td>100 PLC</td><td>50 Hz | 60 Hz</td></tr>
</table>

Setting integration time in power line cycles also sets the aperture time and the resolution. This command can override the previous values set by CURRent:NPLC or CURRent:RESolution. The last command executed has priority.</td></tr>
<tr><td>Examples</td><td>
<table>
<tr><th>Command / Query</th><th>Response (Description)</th></tr>
<tr><td>CURR:NPLC 10
CURR:NPLC?</td><td>
10</td></tr>
</table>
</td></tr>
<tr><td>Related Commands</td><td>CALibration:LFRequency
[SENSe:]CURRent:APERture
[SENSe:]CURRent:RESolution</td></tr>
</table>

[SENSe:]CURRent:RANGe:AUTOmatic

Purpose	Enables or disables the autorange function	
Type	Setting	
Command Syntax	[SENSe:]CURRent:RANGe:AUTOmatic <boolean>	
Command Parameters	<boolean> = 0 | 1 | OFF | ON	
***RST Value**	1	
Query Syntax	[SENSe:]CURRent:RANGe:AUTOmatic?	
Query Parameters	N/A	
Query Response	0 | 1	
Description	This command enables or disables the autorange function for measurements. When autoranging is on, the multimeter samples the input before each measurement and selects the appropriate range. Autoranging is automatically disabled if a range is explicitly selected by the CURRent:AC:RANGe or CURRent[:DC]:RANGe command. Four different command branches control this one enable/disable autorange function: RANGe:AUTOmatic [SENSe:]CURRent:RANGe:AUTOmatic [SENSe:]RESistance:RANGe:AUTOmatic [SENSe:]VOLTage:RANGe:AUTOmatic The default setting for this function is ON.	
Examples	**Command / Query**	**Response *(Description)***
	CURR:RANG:AUTO OFF CURR:RANG:AUTO?	 0
Related Commands	RANGe:AUTOmatic [SENSe:]RESistance:RANGe:AUTOmatic [SENSe:]VOLTage:RANGe:AUTOmatic	

[SENSe:]CURRent:RANGe:DELay:AUTOmatic

Purpose	Enables the default delay times
Type	Setting
Command Syntax	[SENSe:]CURRent:RANGe:DELay:AUTOmatic <boolean>
Command Parameters	<boolean> = 0 | 1 | OFF | ON
***RST Value**	1
Query Syntax	[SENSe:]CURRent:RANGe:DELay:AUTOmatic?
Query Parameters	N/A
Query Response	0 | 1
Description	This command enables or disables the default delay times, from this command branch, without having to perform a unit reset. These four commands perform this exact same function: RANGe:DELay:AUTOmatic [SENSe:]CURRent:RANGe:DELay:AUTOmatic [SENSe:]RESistance:RANGe:DELay:AUTOmatic [SENSe:]VOLTage:RANGe:DELay:AUTOmatic Default times are as follows: **Function** — **Range** — **Time** Voltage (dc) — ALL — 5 ms Voltage (ac) — ALL — AC Filter settling time[1] 2- & 4-wire ohms — 20 Ω to 200 kΩ — 5 ms 2 MΩ — 50 ms 20 MΩ — 500 ms Current (dc) — ALL — 5 ms Current (ac) — ALL — AC Filter settling time[1] **Low** — **Mid** — **High** [1]AC Filter settling time — 800 ms — 250 ms — 60 ms

Examples

Command / Query	**Response *(Description)***
CURR:RANG:DEL:AUTO	
CURR:RANG:DEL:AUTO?	1

Related Commands	RANGe:DELay:AUTOmatic [SENSe:]RESistance:RANGe:DELay:AUTOmatic [SENSe:]VOLTage:RANGe:DELay:AUTOmatic

[SENSe:]CURRent:RESolution:AC

Purpose	Selects the resolution for ac measurements	
Type	Setting	
Command Syntax	[SENSe:]CURRent:RESolution:AC <resolution>	
Command Parameters	<resolution> = 0.00000001 (10 nA) 0.0000001 (100 nA) 0.000001 (1 µA) 0.00001 (10 µA) 0.0001 (100 µA) DEF | MIN | MAX	
***RST Value**	Autoranging	
Query Syntax	[SENSe:]CURRent:RESolution:AC? [<MIN | MAX>]	
Query Parameters	<MIN> = Causes the query to report the minimum value (0.00000001) <MAX> = Causes the query to report the maximum value (0.0001)	
Query Response	0.00000001 | 0.0000001 | 0.000001 | 0.00001 | 0.0001	
Description	This command sets the resolution for ac measurements. MINimum sets the value to 10 nA; MAXimum sets the value to 100 µA. Note that exponential form may also be used for the resolution value. Setting resolution also sets the aperture time and the integration time in power line cycles. This command can override the previous values set by CURRent:APERture or CURRent:NPLC. The last command executed has priority.	
Examples	**Command / Query**	**Response *(Description)***
	CURR:RES 0.00001	*(Sets the resolution to 10 µA.)*
Related Commands	[SENSe:]CURRent:APERture [SENSe:]CURRent:NPLC	

[SENSe:]CURRent:RESolution[:DC]

Purpose	Selects the resolution for dc measurements	
Type	Setting	
Command Syntax	[SENSe:]CURRent:RESolution[:DC] <resolution>	
Command Parameters	<resolution> = 0.00000001 (10 nA) 0.0000001 (100 nA) 0.000001 (1 µA) 0.00001 (10 µA) 0.0001 (100 µA) DEF | MIN | MAX	
***RST Value**	Autoranging	
Query Syntax	[SENSe:]CURRent:RESolution[:DC]? [<MIN | MAX>]	
Query Parameters	<MIN> = Causes the query to report the minimum value (0.00000001) <MAX> = Causes the query to report the maximum value (0.0001)	
Query Response	0.00000001 | 0.0000001 | 0.000001 | 0.00001 | 0.0001	
Description	This command sets the resolution for dc measurements. MINimum sets the value to 10 nA; MAXimum sets the value to 100 µA. Note that exponential form may also be used for the resolution value. Setting resolution also sets the aperture time and the integration time in power line cycles. This command can override the previous values set by CURRent:APERture or CURRent:NPLC. The last command executed has priority.	
Examples	**Command / Query**	**Response *(Description)***
	CURR:RES 0.00001	*(Sets the resolution to 10 µA.)*
Related Commands	[SENSe:]CURRent:APERture [SENSe:]CURRent:NPLC	

[SENSe:]FUNCtion

Purpose	Selects the measurement function	
Type	Setting	
Command Syntax	[SENSe:]FUNCtion:<function type>	
Command Parameters	<function type> = FRESistance | RESistance | VOLTage:AC | VOLTage[:DC]	
***RST Value**	VOLTage[:DC]	
Query Syntax	[SENSe:]FUNCtion?	
Query Parameters	N/A	
Query Response	FRES | RES | VOLT:AC | VOLT	
Description	This command selects the measurement function of the multimeter. The default function is dc voltage.	
Examples	**Command / Query**	**Response *(Description)***
	FUNC:RES FUNC?	*(Selects the 2-wire ohms function.)* RES
Related Commands	N/A	

[SENSe:]RESistance:APERture

Purpose	Sets the integration time for resistance measurements
Type	Setting
Command Syntax	[SENSe:]RESistance:APERture <aperture time>
Command Parameters	<aperture time> = 2.0 s | 1.67 s | 200 ms | 167 ms | 20 ms | 16.7 ms | 2.0 ms | 1.67 ms | 500 µs | DEF | MIN | MAX
***RST Value**	1.67E-02 (60 Hz) or 2E-02 (50 Hz)
Query Syntax	[SENSe:]RESistance:APERture? [<MIN | MAX>]
Query Parameters	<MIN> = Causes the query to report the minimum value (500 µs) <MAX> = Causes the query to report the maximum value (2.0 s)
Query Response	2E+00 | 1.67E+00 | 2E-01 | 1.67E-01 | 2E-02 | 1.67E-02 | 2E-03 | 1.67E-03 | 5E-04
Description	This command sets the integration time (in seconds) for resistance measurements. Values are rounded to the nearest aperture time as shown in the table below. Setting to MINimum sets the value to 500 µs; setting to MAXimum sets the value to 2.0 seconds. The greater the aperture time setting, the greater the normal mode rejection and the lower the reading rate.

Aperture Time	Value Entered (or returned)	Frequency
2.0 s	2E+00	50 Hz
1.67 s	1.67E+00	60 Hz
200 ms	2E-01	50 Hz
167 ms	1.67E-01	60 Hz
20 ms	2E-02	50 Hz
16.7 ms	1.67E-02	60 Hz
2.0 ms	2E-03	50 Hz
1.67 ms	1.67E-03	60 Hz
500 µs	5E-04	60 Hz / 50 Hz

Setting the aperture time also sets the integration time in power line cycles (PLCs) and the resolution. This command can override the previous values set by CALibration:LFRequency, RESistance:NPLC or RESistance:RESolution. The last command executed has priority. See *RST Values above for default values.

Examples	**Command / Query**	**Response *(Description)***
	RES:APER 1.67E-01	*(Sets the aperture time to 167 ms.)*
Related Commands	CALibration:LFRequency	

[SENSe:]RESistance:NEGative

Purpose	Enables or disables negative resistance value reporting	
Type	Setting	
Command Syntax	[SENSe:]RESistance:NEGative <boolean>	
Command Parameters	<boolean> = 0 | 1 | OFF | ON	
***RST Value**	0	
Query Syntax	[SENSe:]RESistance:NEGative?	
Query Parameters	N/A	
Query Response	0 | 1	
Description	This command, when active, prevents negative resistance values from being reported by the VM2710A. The reset state is 0, which will report negative values.	
Examples	**Command / Query**	**Response *(Description)***
	RES:NEG 1	*(Enables filtering of negative resistance values; they will not be reported.)*
Related Commands	N/A	

[SENSe:]RESistance:NPLC

Purpose	Sets the integration time in power line cycles (PLCs)
Type	Setting
Command Syntax	[SENSe:]RESistance:NPLC <nplc>
Command Parameters	<nplc> = 0.03 | 0.1 | 1 | 10 | 100 | DEF | MIN | MAX
***RST Value**	1
Query Syntax	[SENSe:]RESistance:NPLC? [<MIN | MAX>]
Query Parameters	<MIN> = Causes the query to report the minimum value (0.03) <MAX> = Causes the query to report the maximum value (100)
Query Response	0.03 | 0.1 | 1 | 10 | 100
Description	This command sets the integration time, for resistance measurements, in power line cycles (PLCs). Values are rounded up to the nearest number of PLCs as shown in the table below. MINimum sets the value to 0.03 PLC; MAXimum sets the value to 100 PLC. The greater number of PLCs, the greater the normal mode rejection and the lower the reading rate. Use the CALibration:LFRequency command to select the line frequency reference for the multimeter's A/D converter.

Power Line Cycles (PLCs)	Frequency
0.03 PLC	50 Hz | 60 Hz
0.1 PLC	50 Hz | 60 Hz
1 PLC	50 Hz | 60 Hz
10 PLC	50 Hz | 60 Hz
100 PLC	50 Hz | 60 Hz

Setting integration time in power line cycles also sets the aperture time and the resolution. This command can override the previous values set by RESistance:NPLC or RESistance:RESolution. The last command executed has priority.

Examples	**Command / Query**	**Response *(Description)***
	RES:NPLC 10	
	RES:NPLC?	10
Related Commands	CALibration:LFRequency [SENSe:]RESistance:APERture [SENSe:]RESistance:RESolution	

[SENSe:]RESistance:RANGe

Purpose	Selects the range for resistance measurements	
Type	Setting	
Command Syntax	[SENSe:]RESistance:RANGe <expected value>	
Command Parameters	<expected value> = 0 Ω through 20 MΩ | DEF | MIN | MAX	
***RST Value**	Autoranging	
Query Syntax	[SENSe:]RESistance:RANGe? [<MIN | MAX>]	
Query Parameters	<MIN> = Causes the query to report the minimum value (0 Ω) <MAX> = Causes the query to report the maximum value (20 MΩ)	
Query Response	0 Ω through 20 MΩ	
Description	This command selects the range for resistance measurements. To select a standard range, select the *expected value* as the input signal's maximum expected resistance. The multimeter then automatically selects the correct range. Also, MINimum (0 Ω) or MAXimum (20 MΩ) may be specified. The Resistance Range command overrides the range setting from a previous CONFigure command specifying the resistance range. With the new range, a new resolution is also selected based on the aperture time set by CONFigure. Specifying a fixed range also overrides and disables the autorange mode.	
Examples	**Command / Query**	**Response *(Description)***
	RES:RANG 25 RES:RANG?	*(Selects the 200 Ω range.)* 200
Related Commands	CONFigure RESistance:RANGe:AUTOmatic	

[SENSe:]RESistance:RANGe:AUTOmatic

Purpose	Enables or disables the autorange function	
Type	Setting	
Command Syntax	[SENSe:]RESistance:RANGe:AUTOmatic <boolean>	
Command Parameters	<boolean> = 0 | 1 | OFF | ON	
***RST Value**	1	
Query Syntax	[SENSe:]RESistance:RANGe:AUTOmatic?	
Query Parameters	N/A	
Query Response	0 | 1	
Description	This command enables or disables the autorange function for resistance measurements. When autoranging is on, the multimeter samples the input before each measurement and selects the appropriate range. Autoranging is automatically disabled if a range is explicitly selected by the RESistance:RANGe command. Four different command branches control this one enable/disable autorange function: RANGe:AUTOmatic [SENSe:]CURRent:RANGe:AUTOmatic [SENSe:]RESistance:RANGe:AUTOmatic [SENSe:]VOLTage:RANGe:AUTOmatic The default setting for this function is ON.	
Examples	**Command / Query**	**Response *(Description)***
	RES:RANG:AUTO OFF RES:RANG:AUTO?	 0
Related Commands	RANGe:AUTOmatic [SENSe:]CURRent:RANGe:AUTOmatic [SENSe:]VOLTage:RANGe:AUTOmatic	

[SENSe:]RESistance:RANGe:DELay:AUTOmatic

Purpose	Enables the default delay times.
Type	Setting
Command Syntax	[SENSe:]RESistance:RANGe:DELay:AUTOmatic <boolean>
Command Parameters	<boolean> = 0 | 1 | OFF | ON
***RST Value**	1
Query Syntax	[SENSe:]RESistance:RANGe:DELay:AUTOmatic?
Query Parameters	N/A
Query Response	0 | 1
Description	This command enables or disables the default delay times, from this command branch, without having to perform a unit reset. These four commands perform this exact same function: RANGe:DELay:AUTOmatic [SENSe:]CURRent:RANGe:DELay:AUTOmatic [SENSe:]RESistance:RANGe:DELay:AUTOmatic [SENSe:]VOLTage:RANGe:DELay:AUTOmatic Default times are as follows: **Function** — **Range** — **Time** Voltage (dc) — ALL — 5 ms Voltage (ac) — ALL — AC Filter settling time[1] 2- & 4-wire ohms — 20 Ω to 200 kΩ — 5 ms 2 MΩ — 50 ms 20 MΩ — 500 ms Current (dc) — ALL — 5 ms Current (ac) — ALL — AC Filter settling time[1] **Low** — **Mid** — **High** [1]AC Filter settling time — 800 ms — 250 ms — 60 ms
Examples	**Command / Query** — **Response *(Description)***
	RES:RANG:DEL:AUTO RES:RANG:DEL:AUTO? — 1
Related Commands	RANGe:DELay:AUTOmatic [SENSe:]CURRent:RANGe:DELay:AUTOmatic [SENSe:]VOLTage:RANGe:DELay:AUTOmatic

[SENSe:]RESistance:RESolution

Purpose	Selects the resolution for the resistance measurements	
Type	Setting	
Command Syntax	[SENSe:]RESistance:RESolution <resolution>	
Command Parameters	<resolution> = 0.0001 | 0.001 | 0.01 | 0.1 | 1 | 10 | 100 | 1000 | DEF | MIN | MAX Refer to the *Resistance Specifications*	
***RST Value**	Autoranging	
Query Syntax	[SENSe:]RESistance:RESolution? [<MIN | MAX>]	
Query Parameters	<MIN> = Causes the query to report the minimum value (0.0001 Ω) <MAX> = Causes the query to report the maximum value (1000 Ω)	
Query Response	0.0001 | 0.001 | 0.01 | 0.1 | 1 | 10 | 100 | 1000	
Description	This command sets the resolution for resistance measurements. MINimum sets the value to 100 μΩ; MAXimum sets the value to 1 kΩ. Setting resolution also sets the aperture time and the integration time in power line cycles. This command can override the previous values set by RESistance:APERture or RESistance:NPLC. The last command executed has priority.	
Examples	**Command / Query**	**Response *(Description)***
	RES:RES 0.001	*(Sets the resolution to 1 mΩ.)*
Related Commands	[SENSe:]RESistance:APERture [SENSe:]RESistance:NPLC	

[SENSe:]VOLTage:AC:RANGe

Purpose	Selects the range for ac voltage measurements	
Type	Setting	
Command Syntax	[SENSe:]VOLTage:AC:RANGe <expected value>	
Command Parameters	<expected value> = 0.0 V through ±300.0 V | DEF | MIN | MAX	
***RST Value**	Autoranging	
Query Syntax	[SENSe:]VOLTage:AC:RANGe? [<MIN | MAX>]	
Query Parameters	<MIN> = Causes the query to report the minimum value (0.0 V) <MAX> = Causes the query to report the maximum value (±300.0 V)	
Query Response	0.0 V through ±300 V	
Description	This command selects the range for ac voltage measurements. To select a standard measurement range, specify the *expected value* of the input signal's maximum expected voltage. The multimeter then selects the correct range. MINimum selects 0.0 V and MAXimum selects ±300.0 V. This command overrides any setting by a previous CONFigure command specifying the same function. With the new range, a new resolution is also selected; however, this resolution is based on the aperture time set by the CONFigure command. Specifying a fixed range also disables the autorange mode.	
Examples	**Command / Query**	**Response *(Description)***
	VOLT:AC:RANG MAX VOLT:AC:RANG?	 300
Related Commands	CONFigure VOLTage:RANGe:AUTOmatic	

[SENSe:]VOLTage:APERture

Purpose	Sets the integration time for voltage measurements
Type	Setting
Command Syntax	[SENSe:]VOLTage:APERture <aperture time>
Command Parameters	<aperture time> = 2.0 s | 1.67 s | 200 ms | 167 ms | 20 ms | 16.7 ms | 2.0 ms | 1.67 ms | 500 µs | DEF | MIN | MAX
***RST Value**	1.67E-02 (60 Hz) or 2E-02 (50 Hz)
Query Syntax	[SENSe:]VOLTage:APERture? [<MIN | MAX>]
Query Parameters	<MIN> = Causes the query to report the minimum value (500 µs) <MAX> = Causes the query to report the maximum value (2.0 s)
Query Response	2E+00 | 1.67E+00 | 2E-01 | 1.67E-01 | 2E-02 | 1.67E-02 | 2E-03 | 1.67E-03 | 5E-04
Description	This command sets the integration time (in seconds) for voltage measurements. Values are rounded to the nearest aperture time as shown in the table below. Setting to MINimum sets the value to 500 µs; setting to MAXimum sets the value to 2.0 seconds. The greater the aperture time setting, the greater the normal mode rejection and the lower the reading rate.

Aperture Time	Value Entered (or returned)	Frequency
2.0 s	2E+00	50 Hz
1.67 s	1.67E+00	60 Hz
200 ms	2E-01	50 Hz
167 ms	1.67E-01	60 Hz
20 ms	2E-02	50 Hz
16.7 ms	1.67E-02	60 Hz
2.0 ms	2E-03	50 Hz
1.67 ms	1.67E-03	60 Hz
500 µs	5E-04	60 Hz / 50 Hz

Setting the aperture time also sets the integration time in power line cycles (PLCs) and the resolution. This command can override the previous values set by CALibration:LFRequency, VOLTage:NPLC or VOLTage:RESolution. The last command executed has priority. See the *RST Values above for the default values.

Examples

Command / Query	Response *(Description)*
VOLT:APER 1.67E-01	*(Sets the aperture time to 167 ms.)*

Related Commands

CALibration:LFRequency
[SENSe:]VOLTage:NPLC
[SENSe:]VOLTage:RESolution

[SENSe:]VOLTage[:DC]:RANGe

Purpose	Selects the range for dc voltage measurements	
Type	Setting	
Command Syntax	[SENSe:]VOLTage[:DC]:RANGe <expected value>	
Command Parameters	<expected value> = 0.0 V through ±300.0 V | DEF | MIN | MAX	
***RST Value**	Autoranging	
Query Syntax	[SENSe:]VOLTage[:DC]:RANGe? [<MIN | MAX>]	
Query Parameters	<MIN> = Causes the query to report the minimum value (0.0 V) <MAX> = Causes the query to report the maximum value (±300.0 V)	
Query Response	0.0 V through ±300.0 V	
Description	This command selects the range for dc voltage measurements. To select a standard measurement range, specify the *expected value* of the input signal's maximum expected voltage. The multimeter then selects the correct range. MINimum selects 0.0 V and MAXimum selects ±300.0 V. This command overrides any setting by a previous CONFigure command specifying the same function. With the new range, a new resolution is also selected; however, this resolution is based on the aperture time set by the CONFigure command. Specifying a fixed range also disables the autorange mode.	
Examples	**Command / Query**	**Response *(Description)***
	VOLT:RANG MAX VOLT:RANG?	 300
Related Commands	CONFigure VOLTage:RANGe:AUTOmatic	

[SENSe:]VOLTage:NPLC

Purpose	Sets the integration time in power line cycles (PLCs)
Type	Setting
Command Syntax	[SENSe:]VOLTage:NPLC <nplc>
Command Parameters	<nplc> = 0.03 | 0.1 | 1 | 10 | 100 | DEF | MIN | MAX
***RST Value**	1
Query Syntax	[SENSe:]VOLTage:NPLC? [<MIN | MAX>]
Query Parameters	<MIN> = Causes the query to report the minimum value (0.03) <MAX> = Causes the query to report the maximum value (100)
Query Response	0.03 | 0.1 | 1 | 10 | 100
Description	This command sets the integration time, for voltage measurements, in power line cycles (PLCs). Values are rounded up to the nearest number of PLCs as shown in the table below. MINimum sets the value to 0.03 PLC; MAXimum sets the value to 100 PLC. The greater number of PLCs, the greater the normal mode rejection and the lower the reading rate. Use the CALibration:LFRequency command to select the line frequency reference for the multimeter's A/D converter.

Power Line Cycles (PLCs)	Frequency
0.03 PLC	50 Hz | 60 Hz
0.1 PLC	50 Hz | 60 Hz
1 PLC	50 Hz | 60 Hz
10 PLC	50 Hz | 60 Hz
100 PLC	50 Hz | 60 Hz

Setting integration time in power line cycles also sets the aperture time and the resolution. This command can override the previous values set by VOLTage:NPLC or VOLTage:RESolution. The last command executed has priority.

Examples	**Command / Query**	**Response *(Description)***
	VOLT:NPLC 10 VOLT:NPLC?	 10
Related Commands	CALibration:LFRequency [SENSe:]VOLTage:APERture [SENSe:]VOLTage:RESolution	

[SENSe:]VOLTage:RANGe:AUTOmatic

Purpose	Enables or disables the autorange function	
Type	Setting	
Command Syntax	[SENSe:]VOLTage:RANGe:AUTOmatic <boolean>	
Command Parameters	<boolean> = 0 | 1 | OFF | ON	
***RST Value**	1	
Query Syntax	[SENSe:]VOLTage:RANGe:AUTOmatic?	
Query Parameters	N/A	
Query Response	0 | 1	
Description	This command enables or disables the autorange function. When autoranging is on, the multimeter samples the input before each measurement and selects the appropriate range. Autoranging is automatically disabled if a range is explicitly selected by the VOLTage:AC:RANGe or VOLTage[:DC]:RANGe command. Four different command branches control this one enable/disable autorange function: RANGe:AUTOmatic [SENSe:]CURRent:RANGe:AUTOmatic [SENSe:]RESistance:RANGe:AUTOmatic [SENSe:]VOLTage:RANGe:AUTOmatic The default setting for this function is ON.	
Examples	**Command / Query**	**Response *(Description)***
	VOLT:RANG:AUTO OFF VOLT:RANG:AUTO?	 0
Related Commands	RANGe:AUTOmatic [SENSe:]CURRent:RANGe:AUTOmatic [SENSe:]RESistance:RANGe:AUTOmatic	

[SENSe:]VOLTage:RANGe:DELay:AUTOmatic

Purpose	Enables the default delay times
Type	Setting
Command Syntax	[SENSe:]VOLTage:RANGe:DELay:AUTOmatic <boolean>
Command Parameters	<boolean> = 0 | 1 | OFF | ON
***RST Value**	1
Query Syntax	[SENSe:]VOLTage:RANGe:DELay:AUTOmatic?
Query Parameters	N/A
Query Response	0 | 1
Description	This command enables or disables the default delay times, from this command branch, without having to perform a unit reset. These four commands perform this exact same function: RANGe:DELay:AUTOmatic [SENSe:]CURRent:RANGe:DELay:AUTOmatic [SENSe:]RESistance:RANGe:DELay:AUTOmatic [SENSe:]VOLTage:RANGe:DELay:AUTOmatic Default times are as follows:

Function	**Range**	**Time**
Voltage (dc)	ALL	5 ms
Voltage (ac)	ALL	AC Filter settling time[1]
2- & 4-wire ohms	20 Ω to 200 kΩ	5 ms
	2 MΩ	50 ms
	20 MΩ	500 ms
Current (dc)	ALL	5 ms
Current (ac)	ALL	AC Filter settling time[1]

	Low	**Mid**	**High**
[1]AC Filter settling time	800 ms	250 ms	60 ms

Examples	**Command / Query**	**Response *(Description)***
	VOLT:RANG:DEL:AUTO VOLT:RANG:DEL:AUTO?	 1
Related Commands	RANGe:DELay:AUTOmatic [SENSe:]CURRent:RANGe:DELay:AUTOmatic [SENSe:]RESistance:RANGe:DELay:AUTOmatic	

[SENSe:]VOLTage:RESolution:AC

Purpose	Selects the resolution for ac voltage measurements	
Type	Setting	
Command Syntax	[SENSe:]VOLTage:RESolution:AC <resolution>	
Command Parameters	<resolution> = 0.0000001 (100 nV) 0.000001 (1 μV) 0.00001 (10 μV) 0.0001 (100 μV) 0.001 (1 mV) 0.01 (10 mV) DEF | MIN | MAX	
***RST Value**	Autoranging	
Query Syntax	[SENSe:]VOLTage:RESolution:AC? <MIN | MAX>	
Query Parameters	<MIN> = Causes the query to report the minimum value (0.0000001) <MAX> = Causes the query to report the maximum value (0.01)	
Query Response	0.0000001 | 0.000001 | 0.00001 | 0.0001 | 0.001 | 0.01	
Description	This command sets the resolution for voltage measurements. MINimum sets the value to 100 nV; MAXimum sets the value to 10 mV. Note that exponential form may also be used for the resolution value. Setting resolution also sets the aperture time and the integration time in power line cycles. This command can override the previous values set by VOLTage:APERture or VOLTage:NPLC. The last command executed has priority.	
Examples	**Command / Query**	**Response *(Description)***
	VOLT:RES 0.001	*(Sets the resolution to 1 mV.)*
Related Commands	[SENSe:]VOLTage:APERture [SENSe:]VOLtage:NPLC	

[SENSe:]VOLTage:RESolution[:DC]

Purpose	Selects the resolution for dc voltage measurements
Type	Setting
Command Syntax	[SENSe:]VOLTage:RESolution[:DC] <resolution>
Command Parameters	<resolution> = 0.0000001 (100 nV) 0.000001 (1 μV) 0.00001 (10 μV) 0.0001 (100 μV) 0.001 (1 mV) 0.01 (10 mV) DEF | MIN | MAX
***RST Value**	Autoranging
Query Syntax	[SENSe:]VOLTage:RESolution[:DC]? <MIN | MAX>
Query Parameters	<MIN> = Causes the query to report the minimum value (0.0000001) <MAX> = Causes the query to report the maximum value (0.01)
Query Response	0.0000001 | 0.000001 | 0.00001 | 0.0001 | 0.001 | 0.01
Description	This command sets the resolution for voltage measurements. MINimum sets the value to 100 nV; MAXimum sets the value to 10 mV. Note that exponential form may also be used for the resolution value. Setting resolution also sets the aperture time and the integration time in power line cycles. This command can override the previous values set by VOLTage:APERture or VOLTage:NPLC. The last command executed has priority.
Examples	**Command / Query** — **Response *(Description)***
	VOLT:RES 0.001 — *(Sets the resolution to 1 mV.)*
Related Commands	[SENSe:]VOLTage:APERture [SENSe:]VOLtage:NPLC

TEST?

Purpose	Performs self-test and reports results	
Type	Event	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	TEST?	
Query Parameters	N/A	
Query Response	number	
Description	The TEST command performs an internal unit self-test. Disconnect all input signals before running the self-test or there may be errors. A zero is returned when the test has completed with no errors.	
Examples	**Command / Query**	**Response *(Description)***
	TEST?	*(Performs an internal self-test and reports the results.)*
Related Commands	*TST	

TRACe:FEED

Purpose	Sets data retrieval method	
Type	Setting	
Command Syntax	TRACe:FEED <type>	
Command Parameters	<type> = OFF | REGister	
***RST Value**	OFF	
Query Syntax	TRACe:FEED?	
Query Parameters	N/A	
Query Response	OFF | REG	
Description	Data (measurements) are retrieved from the VM2710A using two different methods. For most systems, the easiest method to use is word serial data transfers. This is the same technique used to program the module and query the module's settings. When fast response time is important, measurements can be retrieved using register access. The two methods are exclusive; only one can be used at a time. Setting TRACe:FEED to OFF is the way to use word serial data transfers; this is the unit default. Setting TRACe:FEED to REGister is the way to use register access. Note that in register access mode the MATH and CALCulate functions are not available with the exception of CALCulate:[FUNCtion:]LIMit. See Section 3 for more information on register access.	
Examples	**Command / Query**	**Response *(Description)***
	TRAC:FEED REG	*(Sets the unit for register interface.)*
Related Commands	N/A	

TRIGger:BUFFered

Purpose	Enables or disables the multimeter's trigger buffer	
Type	Setting	
Command Syntax	TRIGger:BUFFered <boolean>	
Command Parameters	<boolean> = 0 | 1 | OFF | ON	
***RST Value**	0	
Query Syntax	TRIGger:BUFFered?	
Query Parameters	N/A	
Query Response	0 | 1	
Description	This command enables the trigger buffer and corrects for a "trigger too fast" type of error. This mode is only used with the front-panel external trigger. With the Trigger Buffer on, if a trigger occurs during a reading the trigger is stored and no error is generated. After the reading is complete, the stored trigger satisfies the EXT event if the multimeter is programmed as such. However, a second trigger occurring during a reading will still generate a "trigger too fast" error.	
Examples	**Command / Query**	**Response *(Description)***
	TRIG:BUFF ON TRIG:BUFF?	 1
Related Commands	N/A	

TRIGger:COUNt

Purpose	Sets the number of triggers	
Type	Setting	
Command Syntax	TRIGger:COUNt <number>	
Command Parameters	<number> = 0 through 16,777,215 | MIN | MAX|CONTinuous	
***RST Value**	1	
Query Syntax	TRIGger:COUNt? [<MIN | MAX>]	
Query Parameters	<MIN> = Causes the query to report the minimum value (1) <MAX> = Causes the query to report the maximum value (16,777,215)	
Query Response	0 through 16,777,215	
Description	This command sets the number of triggers issued. When setting the trigger count, the memory (64 k or 256 k readings) must be taken into consideration, for the trigger count multiplied by the sample count (SAMPle:COUNt) must be less than or equal to the memory capability. When set to 0 (countinuous) the voltmeter returns to the waiting for trigger state after each trigger. This is particularly useful when using the register interface and an extrenal trigger. Once INITiate is used to start operation, ABORt or *RST command must be used to remove the voltmeter form the countinuous opeation. The CONFigure and MEASure commands set the trigger count to 1.	
Examples	**Command / Query**	**Response *(Description)***
	TRIG:COUN 10 TRIG:COUN?	 10
Related Commands	SAMPle:COUNt	

TRIGger:DELay

Purpose	Sets the delay period between the trigger and the measurement	
Type	Setting	
Command Syntax	TRIGger:DELay <period>	
Command Parameters	<period> = 1 µs through 2100 s | MIN | MAX	
***RST Value**	TRIGger:DELay:AUTOmatic	
Query Syntax	TRIGger:DELay? [<MIN | MAX>]	
Query Parameters	<MIN> = Causes the query to report the minimum value (1 µs) <MAX> = Causes the query to report the maximum value (2100 s)	
Query Response	1 µs through 2100 s	
Description	This command sets the delay period between receipt of the trigger and the start of the measurement. If a trigger period is specified by this command then the TRIGger:DELay:AUTOmatic function is automatically turned off. The delay period value set by this command remains set until a new value is entered or the multimeter is reset. The period values are accurate down to 150 µs. If a value below 150 µs is specified, the actual delay is approximately 67 µs for MINimum aperture time and 82 µs for all other aperture times. A delay between measurements in a burst can be set using the SAMPle:TIMer command.	
Examples	**Command / Query**	**Response *(Description)***
	TRIG:DEL 2 TRIG:DEL?	 2
Related Commands	TRIGger:DELay:AUTOmatic	

TRIGger:DELay:AUTOmatic

Purpose	Enables or disables the automatic trigger delay function
Type	Setting
Command Syntax	TRIGger:DELay:AUTOmatic <boolean>
Command Parameters	<boolean> = 0 | 1 | OFF | ON
***RST Value**	1
Query Syntax	TRIGger:DELay:AUTOmatic?
Query Parameters	N/A
Query Response	0 | 1
Description	This command enables or disables the automatic trigger delay. If a trigger delay is not specified by the TRIGger:DELay command, then this function automatically determines a delay time based on the present measurement function, range, resolution and ac bandwidth setting. The delay time is automatically updated whenever the function or range is changed. Delay times are as follows: DC Trigger Delay 100 µs AC Trigger Delay w/ Low Filter 500 ms AC Trigger Delay w/ Mid Filter 250 ms AC Trigger Delay w/ High Filter 60 ms Resistance Trigger Delay 20 Ω to 200 kΩ 5 ms Resistance Trigger Delay 2 MΩ 50 ms Resistance Trigger Delay 20 MΩ 500 ms The TRIGger:DELay:AUTOmatic function is on by default.

Examples	**Command / Query**	**Response *(Description)***
	TRIG:DEL:AUTO 1	
	TRIG:DEL:AUTO?	1

Related Commands	TRIGger:DELay

TRIGger[:IMMediate]

Purpose	Causes the multimeter to trigger immediately when in the wait-for-trigger state	
Type	Event	
Command Syntax	TRIGger[:IMMediate]	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	N/A	
Query Parameters	N/A	
Query Response	N/A	
Description	This command causes a trigger to occur immediately if the multimeter is in the wait-for-trigger state. The TRIGger:SOURce must be set to BUS or HOLD. When TRIGger:IMMediate command is executed, the readings are stored in multimeter memory. Use the **FETCh?** command to place the readings in the output buffer. The TRIGger:SOURce BUS or HOLD settings remain in effect after the TRIGger:IMMediate is executed. The levels of trigger commands containing the **IMMediate** parameter are different. The TRIGger:SOURce:IMMediate bypasses the trigger system so that the VM2710A is triggered immediately only if it is in the wait-for-trigger state. The TRIGger:IMMediate command causes a single trigger cycle to happen after the trigger system has been disabled.	
Examples	**Command / Query**	**Response *(Description)***
	TRIG	*(Causes a trigger to occur.)*
Related Commands	FETCh? INITiate TRIGger:SOURce	

TRIGger:SLOPe

Purpose	Selects the rising or falling edge of a trigger signal	
Type	Setting	
Command Syntax	TRIGger:SLOPe <POS | NEG>	
Command Parameters	<POS | NEG> = the positive or negative edge	
***RST Value**	NEG	
Query Syntax	TRIGger:SLOPe?	
Query Parameters	N/A	
Query Response	POS | NEG	
Description	This command determines whether the rising or falling edge of the front panel signal will trigger the multimeter.	
Examples	**Command / Query**	**Response *(Description)***
	TRIG:SLOP POS	*(Sets the multimeter to trigger on the rising edge of the front panel signal.)*
	TRIG:SLOP?	POS
Related Commands	N/A	

TRIGger:SOURce

Purpose	Sets the trigger source
Type	Setting
Command Syntax	TRIGger:SOURce <source>
Command Parameters	<source> = BUS | EXT | HOLD | IMM | TTLT0 – TTLT7
***RST Value**	IMM
Query Syntax	TRIGger:SOURce?
Query Parameters	N/A
Query Response	BUS | EXT | HOLD | IMM | TTLT0 – TTLT7
Description	The TRIGger:SOURce command selects the source of the trigger. The trigger source can only be changed when the VM2710A is in idle state. **BUS** Group Execute Trigger (GET) bus command or the *TRG common command When **BUS** is selected, ABORt returns the VM2710A to the idle state. The READ? command cannot be used with this trigger setting. **EXTernal** The VM2710A's front panel connector. If **EXTernal** is selected, then the trigger comes from the front-panel connector input. **HOLD** Suspend triggering; only the TRIGger:IMMediate command will generate a trigger. When **HOLD** is selected, ABORt returns the VM2710A to idle state. The READ? command cannot be used with this trigger setting. **IMMediate** The trigger system is always true. A trigger will happen immediately if the VM2710A is in wait-for-trigger state. This is the default setting. **TTLTrg <*n*>** The VXIbus TTL trigger lines on the backplane. Note that the CONFigure and MEASure command subsystems automatically reset the trigger source to TRIGger:SOURce:IMMediate.
Examples	**Command / Query** / **Response *(Description)***
	`TRIG:SOUR TTLT3` / *(Sets the trigger source to the backplane trigger line #3.)*
Related Commands	INITiate TRIGger[:IMMediate] TRIGger:SLOPe

REQUIRED SCPI COMMANDS

STATus:OPERation:CONDition?

Purpose	Queries the Operation Status Register's condition register	
Type	Required SCPI command	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	STATus:OPERation:CONDition?	
Query Parameters	N/A	
Query Response	0 | 32	
Description	Reports the bits set in the Operation Status Register's condition register. Returns a decimal number of 0 (no bits set) or 32 (bit 5 set).	
Examples	**Command / Query**	**Response *(Description)***
	STAT:OPER:COND?	0
Related Commands	STATus:OPERation:ENABle STATus:OPERation[:EVENt]	

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 STAT:OPER:ENAB?	*(Enables bit 0 and bit 5)* 33
Related Commands	STATus:OPERation:CONDition? STATus:OPERation[:EVENt]	

STATus:OPERation[:EVENt]?

Purpose	Queries the Operation Status Register's event register	
Type	Required SCPI command	
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 Operation Status Register's event 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

Purpose	Presets the Status Registers	
Type	Required SCPI command	
Command Syntax	STATus:PRESet	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	N/A	
Query Parameters	N/A	
Query Response	N/A	
Description	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.	
Examples	**Command / Query**	**Response *(Description)***
	STAT:PRES	
Related Commands	N/A	

STATus:QUEStionable:CONDition?

Purpose	Queries the Questionable Status Condition Register	
Type	Required SCPI command	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	STATus:QUEStionable:CONDition?	
Query Parameters	N/A	
Query Response	0	
Description	The Questionable Status Condition Register query is provided for SCPI compliance only. The VM2710A does not alter any bits in this register and a query always reports a 0.	
Examples	**Command / Query**	**Response *(Description)***
	STAT:QUES:COND?	0
Related Commands	N/A	

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]?

Purpose	Queries the Questionable Status Event Register	
Type	Required SCPI command	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	STATus:QUEStionable [:EVENt]?	
Query Parameters	N/A	
Query Response	Decimal number	
Description	The query reports the bits set in the Questionable Data/Signal register's event register. This command reads the event register and then clears all bits in the event register and enters the value into the computer.	
Examples	**Command / Query**	**Response *(Description)***
	STAT:QUES?	0
Related Commands	N/A	

SYSTem:ERRor?

Purpose	Queries the Error Queue	
Type	Required SCPI command	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	Clears queue	
Query Syntax	SYSTem:ERRor?	
Query Parameters	N/A	
Query Response	ASCII string	
Description	The System Error query is used to retrieve error messages from the error queue. The error queue will maintain two error messages. If additional errors occur, the queue will overflow and the subsequent error messages will be lost. In the case of an overflow, an overflow message will replace the second error message. See the SCPI standard Volume 2: Command Reference for details on errors and reporting them.A list of error codes is provided in the SYST:ERR? Error Codes table below.	
Examples	**Command / Query**	**Response *(Description)***
	SYST:ERR?	-350, “Queue overflow”
Related Commands	N/A	

SYST:ERR? ERROR CODES

Err Code	Description
-109	Missing Parameter value
-160	Block data error; Character after # wasn't a digit
-160	Block data error; Block length was non-numeric
-160	Block data error; Character after # wasn't a digit
-160	Block data error; Block length was non-numeric
-161	Invalid block data; Expected more data than what was supplied
-161	Invalid block data; Expected more data than what was supplied
-200	Execution error; Can’t test while running
-200	Execution error; In guard microprocessor revision is too low
-200	Execution error: Trigger request while triggered
-200	Execution error: Trigger request while triggered
-200	Execution error: Mail queue overflow
-203	Command protected; Can’t change security code with secure state on
-203	Command protected; Can’t query security code with secure state on
-203	Command protected; Can’t store CAL data with secure state on
-203	Command protected; Can’t default CAL data with secure state on
-203	Command protected; Can’t get CAL data with secure state on
-203	Command protected; Can’t store serial number with secure state on
-210	Trigger error: Trigger too fast
-211	Trigger ignored
-213	Init ignored; Measurement already in progress
-221	Settings conflict; Can’t change trigger delay while running
-221	Settings conflict; Can’t change aperture time while running
-221	Settings conflict; Can’t change auto ranging while running
-221	Settings conflict; Can’t change trigger delay while running
-221	Settings conflict; Can’t change bandwidth while running
-221	Settings conflict; Can’t perform check while running
-221	Settings conflict; Can’t change input source while running
-221	Settings conflict; Can’t change math setting while running
-221	Settings conflict; Can’t perform selftest while running
-221	Settings conflict; DOWNLOAD can only be used by the top module
-221	Settings conflict; Can’t change trigger source while running
-221	Settings conflict; Can’t change sample count while running
-221	Settings conflict; Can’t change sample timer while running
-221	Settings conflict; Can’t change trigger settings while running
-221	Settings conflict; Can’t change trigger polarity while running
-221	Settings conflict; Can’t measure when feed is set to REGister
-221	Settings conflict; Can’t fetch when feed is set to REGister
-221	Settings conflict; Can’t fetch when NO READ is active
-221	Settings conflict; Can’t read data when feed is set to REGister
-221	Settings conflict; Can’t read data when NO READ is active
-221	Settings conflict; Can’t operate in auto range
-221	Settings conflict; Can’t have more than 1 reading per trigger
-221	Settings conflict; Can’t change trace feed type while running
-221	Settings conflict; Can’t change trigger slope while running
-221	Settings conflict; Can’t change function settings while running
-221	Settings conflict; Can’t change line frequency while running
-221	Settings conflict; Can’t perform zero while running
-221	Settings conflict; Zero only performed in 50 Hz and 60 Hz
-221	Settings conflict; Can’t change sample source while running
-221	Settings conflict; Can’t change buffered trigger while running
-221	Settings conflict; Can’t change trigger count while running
-222	Data out of range; Valid zeros are 0 to 7
-222	Data out of range; Valid latest zeros are 0 to 7
-223	Too much data; Security buffer full
-223	Too much data; Format buffer full
-223	Too much data; Output string would be too big

Err Code	Description
-224	Illegal parameter value
-310	System error; Unrecognized aperture request
-310	System error; Illegal zero index
-310	System error; Unrecognized aperture request
-310	System error; Unrecognized internal dc range
-310	System error; Unrecognized internal dci range
-310	System error; Unrecognized internal dc range
-310	System error; Unrecognized internal aci range
-310	System error; Unrecognized AC filter
-310	System error; Unrecognized internal type
-310	System error; Unrecognized input source
-310	System error; Unrecognized function
-310	System error; Unrecognized calculate function
-310	System error; Unrecognized overflow type
-310	System error; Nonvol has wrong data, using defaults
-310	System error; Unrecognized internal trigger source
-310	System error; Unrecognized internal trigger sourc
-310	System error; Unrecognized internal sample count
-310	System error; Unrecognized sample source
-310	System error; Unrecognized sample period
-310	System error; Unrecognized function
-310	System error; Unrecognized calculate type
-310	System error; Unrecognized function
-310	System error; Unrecognized internal line frequency
-310	System error; Unrecognized sample source
-310	System error; Unrecognized resistance range
-310	System error; Unrecognized internal resistance resolution
-310	System error; Unrecognized intrenal trigger count
-310	System error; Unrecognized internal trigger delay

SYSTem:VERSion?

Purpose	Queries the SCPI version number the VM2710A complies with	
Type	Required SCPI command	
Command Syntax	N/A	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	SYSTem:VERSion?	
Query Parameters	N/A	
Query Response	Numeric ASCII value	
Description	The System Version query reports version of the SCPI standard with which the VM2710A complies.	
Examples	**Command / Query**	**Response *(Description)***
	SYST:VERS?	1994.0
Related Commands	N/A	

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