VM3618

ISOLATED DIGITAL-TO-ANALOG CONVERTER

USER'S MANUAL

82-0028-000
Release December 1, 2003

VXI Technology, Inc.

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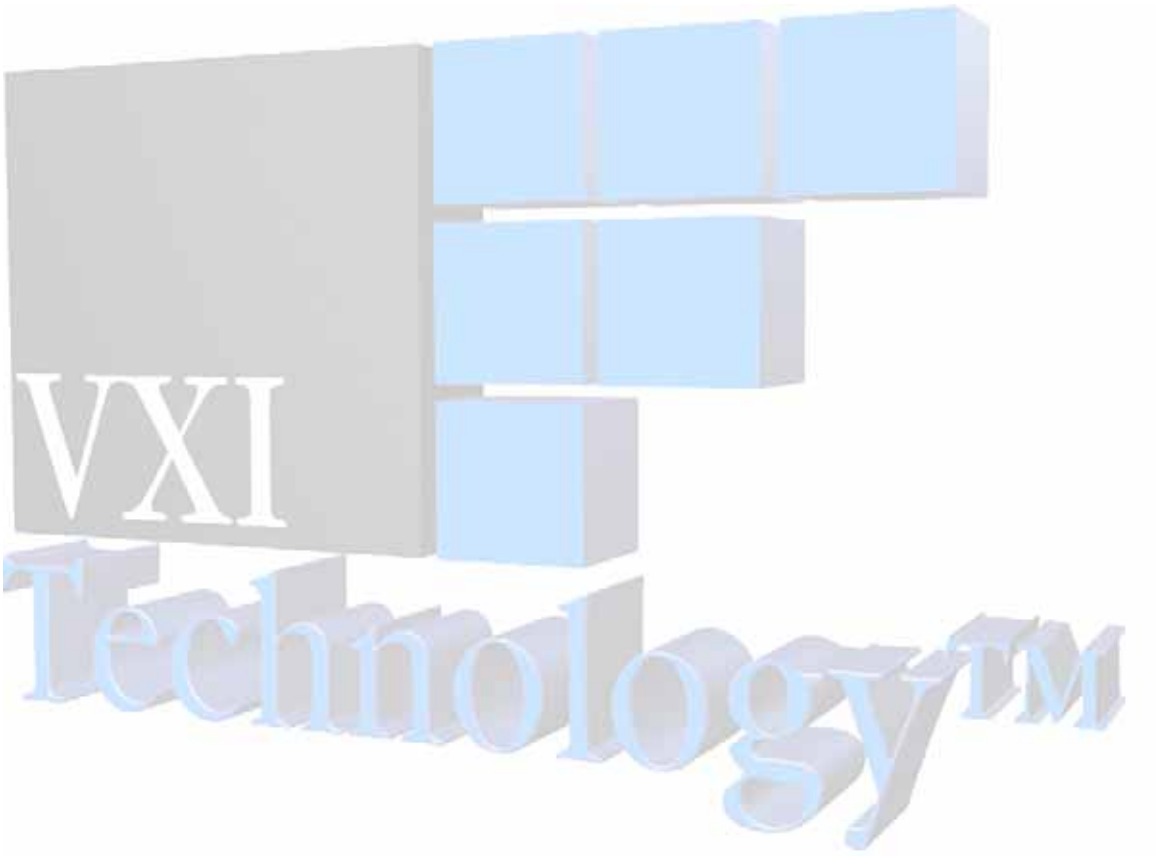
VXI
Technology™

TABLE OF CONTENTS

CERTIFICATION

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

WARRANTY

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

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

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

LIMITATION OF WARRANTY

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

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

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

DECLARATION OF CONFORMITY

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

MANUFACTURER'S NAME	VXI Technology, Inc.
MANUFACTURER'S ADDRESS	2031 Main Street Irvine, California 92614-6509
PRODUCT NAME	Isolated Digital-to-Analog Converter
MODEL NUMBER(S)	VM3618
PRODUCT OPTIONS	All
PRODUCT CONFIGURATIONS	All

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

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

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

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

December 2003

CE

Jerry Patton, QA Manager

GENERAL SAFETY INSTRUCTIONS

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

Service should only be performed by qualified personnel.

TERMS AND SYMBOLS

These terms may appear in this manual:

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

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

These symbols may appear on the product:

ATTENTION - Important safety instructions

Frame or chassis ground

WARNINGS

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

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

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

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

WARNINGS (CONT.)

Avoid Electric Shock

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

Ground the Product

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

Operating Conditions

To avoid injury, electric shock or fire hazard:

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

Improper Use

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

SUPPORT RESOURCES

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

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World Headquarters

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

SECTION 1

INTRODUCTION

INTRODUCTION

The VM3618 provides eight independent digital-to-analog converter (DAC) channels with 16 bits of resolution and isolated outputs. This module is part of the VMIP™ family of instruments and can be combined with up to two other modules to form a high-density VXIbus instrument that fully uses the capabilities of the VMIP. The instrument uses the message-based word serial interface for programming and data movement, as well as supporting direct register access for high-speed data throughput. The VM3618 command set conforms to the SCPI standard for consistency and ease of programming.

The VM3618 is a member of the VXI Technology VMIP (*VXI Modular Instrumentation Platform*) family and is available as an 8-, 16- or 24-channel, single-wide VXIbus instrument. In addition to the three standard configurations, the VM3618 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 VM3618 with two other instrument functions in a single-wide C-size VXIbus module. Figure 1-2 shows the 24-channel version of the VM3618. The 16-channel version would not have J200 and its associated LEDs and nomenclature while the 8-channel version would also eliminate J202.

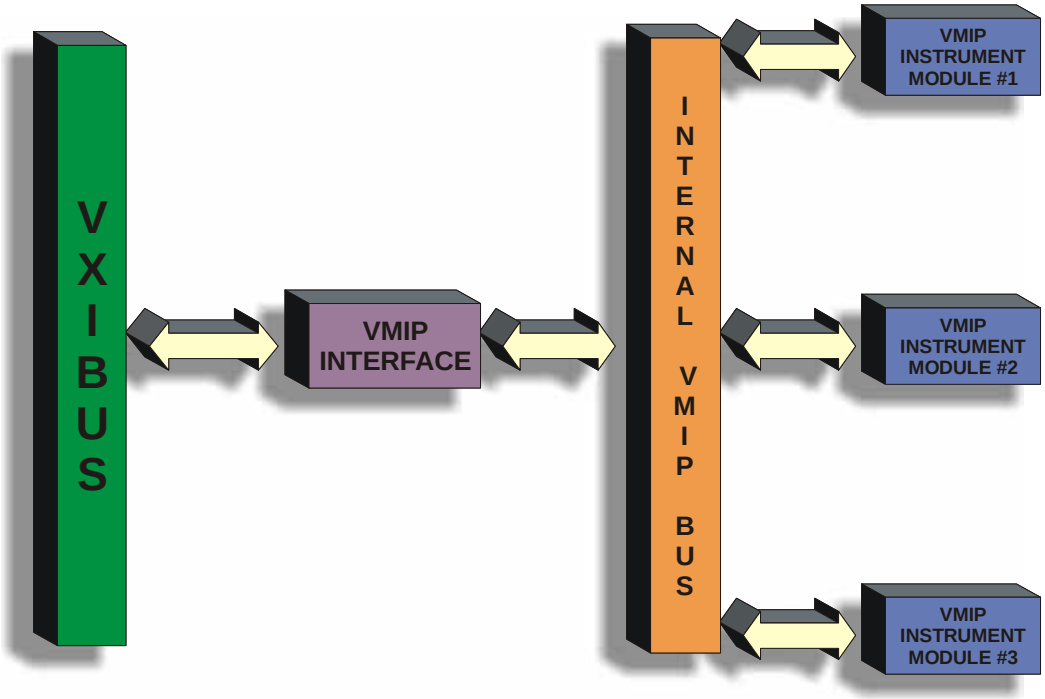
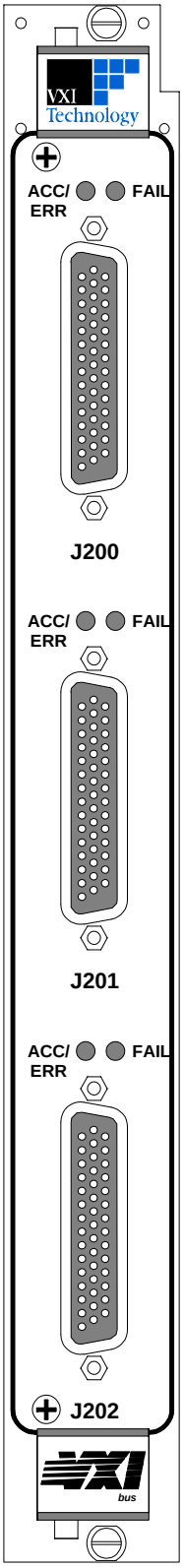


FIGURE 1-1: VMIP™ PLATFORM



Regardless whether the VM3618 is configured with other VM3618 modules, or with other VMIP modules, each group of eight channels is treated as an independent instrument in the VXIbus chassis and each group has its own FAIL and ACCESS light.

DESCRIPTION

The VM3618 instrumentation module provides eight independent isolated channels of a digital to analog converter (DAC) each with 16 bits of resolution. Each channel consists of a DAC combined with an output amplifier that allows for output voltage ranges that can be ±16 VDC, 0 to +32 VDC.

This module is part of the VMIP family of instruments and can be combined with up to two other modules to form a high-density VXIbus instrument that fully uses the capabilities of the VMIP.

In order to support accelerated testing, the module supports up to 512 predefined setups. Each setup is numbered and defines the voltage of each DAC on the board. All the voltages can then be set with a single command.

To further speed up testing, the DAC module supports up to 16 different scan lists, each 512 entries long. The scan list is a predefined sequence of setups that is loaded into the DACs. The scan list, when enabled, can be incremented through any of the trigger sources outlined in the following section. Both the setups and scan lists are loaded into RAM before their use.

All the DACs update synchronously and may be triggered to update via one of three sources:

1. Trigger source from the front panel input. This input is TTL compatible and is edge sensitive. The unit may be programmed to trigger on either the rising or the falling edge of this signal.

2. Trigger source from the VXI TTL trigger bus. Any one of the eight TTL trigger bus lines may be programmed to trigger the update on either the rising or the falling edge of this signal.

3. Trigger upon receipt of a word serial command. When this mode is selected, the DACs will convert when the instrument receives a word serial command.

The VM3618 may be programmed to output a trigger on the VXI TTL trigger bus when the DACs are updated. The user may specify any one of the eight available trigger lines, or may disable the function if not needed.

The calibration constants used by the VM3618 are stored in non-volatile memory. 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 queried at any time via a word serial query and altered via a word serial command. By querying the calibration constants, the user may pre-calibrate the data sent to the unit if the direct register-based access method is being used to program the instrument.

FIGURE 1-2: FRONT PANEL LAYOUT

VM3618 SPECIFICATIONS

GENERAL SPECIFICATIONS	
NUMBER OF CHANNELS	
VM3618-1	8
VM3618-2	16
VM3618-3	24
VOLTAGE MODES	
Output Range	± 10.0 V, ±16.0 V, 0.0 - 20.0 V, 0.0 - 32.0 V
Output Current	20 mA max. per channel normal operation
	50 mA max. per channel short circuit
Short Circuit	Continuous duration
Slew Rate	3 V/μs (20 mA load)
Resolution	16 bits, 15 bits monotonic
Differential Ripple & Noise	< 2 mV_{RMS} (20 Hz - 300 kHz, 10 kΩ load)
CURRENT MODES	
Output Range	±20 mA
Output Voltage	12.0 V max. compliance at ±20 mA output
	16.0 V max. compliance at ±5 mA < 18.0 V open circuit
Resolution	15 bits, 14 bits monotonic
Differential Ripple & Noise	< 2 μA rms (20 Hz – 300 kHz, 250 Ω load)
SETTLING TIME	
	20 μs to 0.1% of specified value
GAIN ERROR	
	±0.015% + 0.003%/ºC of setting
OFFSET ERROR	
	±2 LSB + 0.04 LSB/ºC
CONVERSION RATE	
	> 100,000 changes per second-dir. register access mode
	> 20,000 changes per second-pseudo register access
	> 300 changes per second-word-serial access mode
ISOLATION	
	100 V_{RMS}, 150 VDC/AC pk (channel-to-channel or chassis)
POWER REQUIREMENTS	
VM3618-1	+5.0 V @ 1.40 A, -5.2 V @ 0.10 A, +24.0 V @ 0.70 A
VM3618-2	+5.0 V @ 2.05 A, -5.2 V @ 0.20 A, +24.0 V @ 1.40 A
VM3618-3	+5.0 V @ 2.70 A, -5.2 V @ 0.30 A, +24.0 V @ 2.10 A
MANUFACTURER'S ID	
	3915
MODULE MODEL CODE	
	271

Note: The manufacturer does not recommend combining ***VM3618*** modules with ***VM2XXX*** series modules within the same VMIP base unit.

SECTION 2

PREPARATION FOR USE

INSTALLATION

When the VM3618 is unpacked from its shipping carton, the contents should include the following items:

(1) VM3618 VXIbus module
(1) VM3618 Digital to Analog Converter Module User's Manual (this manual)

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

Once the VM3618 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 VM3618. Once the chassis is determined adequate, configure the logical address of the VM3618 and the chassis backplane jumpers before installing the VM3618.

CALCULATING SYSTEM POWER AND COOLING REQUIREMENTS

The power and cooling requirements of the VM4018 are given in the Specifications section of Chapter 1 in this manual. 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.

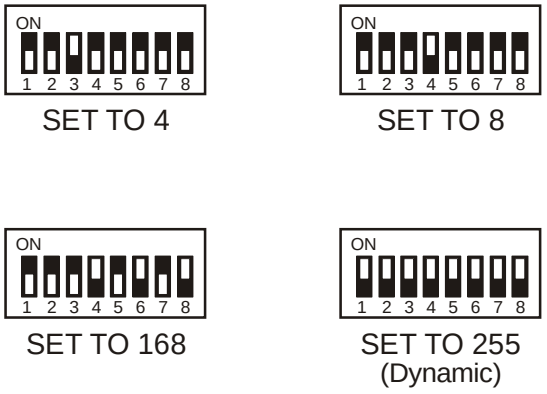
It should be noted that if the chassis cannot provide adequate power to the module, the instrument might not perform to specification or possibly not operate at all. In addition, if adequate cooling is not provided, the reliability of the instrument will be jeopardized and permanent damage may occur.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

SETTING THE CHASSIS BACKPLANE JUMPERS

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

SETTING THE LOGICAL ADDRESS

The logical address of the VM4018 is set by a single 8-position DIP switch located near the module's backplane connectors (this is the only switch on the module). The switch is labeled with positions 1 through 8 and with an ON position. A switch pushed toward the ON legend will signify a logic 1; switches pushed away from the ON legend will signify a logic 0. The switch located at position 1 is the least significant bit while the switch located at position 8 is the most significant bit. See Figure 2-1 for examples of setting the logical address switch.



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

FIGURE 2-1: LOGICAL ADDRESS SWITCH SETTING EXAMPLES

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

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

FRONT PANEL INTERFACE WIRING

Front-panel connector, J201, contains all the instrument signals for the 8-channel version of the VM3618 instrument (VM3618-1). The 16-channel version (VM3618-2) has J201 and J202 provided, while the 24-channel version (VM3618-3) has J200, J201 and J202. The wiring for each of these connectors is identical. Since each group of eight channels is treated as a separate instrument, the module will have three Channel 1s, three Channel 2s, three Channel 3s, etc., if three VM3618s are installed.

TABLE 2-1: PIN ASSIGNMENTS FOR MODELS VM3618 ADC

SIGNAL	PIN	SIGNAL	PIN	SIGNAL	PIN	SIGNAL	PIN
OUTPUT1	1	NC	12	GND6	23	RETURN3	34
OUTPUT2	2	NC	13	NC	24	RETURN4	35
NC	3	TRIGIN	14	GND7	25	NC	36
OUTPUT3	4	GND	15	GND8	26	RETURN5	37
OUTPUT4	5	GND1	16	NC	27	RETURN6	38
NC	6	GND2	17	NC	28	NC	39
OUTPUT5	7	NC	18	NC	29	RETURN7	40
OUTPUT6	8	GND3	19	GND	30	RETURN8	41
NC	9	GND4	20	RETURN1	31	NC	42
OUTPUT7	10	NC	21	RETURN2	32	NC	43
OUTPUT8	11	GND5	22	NC	33	GND	44

The connector for the VM3618 DAC board is a 44-pin female high-density D-Sub type. Connections listed are for the model VM3618 8-channel DAC board. A solder pot type mating connector is provided with each unit. Contact the factory for more connector information. The pin locations for J200, J201 and J202 are shown in Figure 2-2:

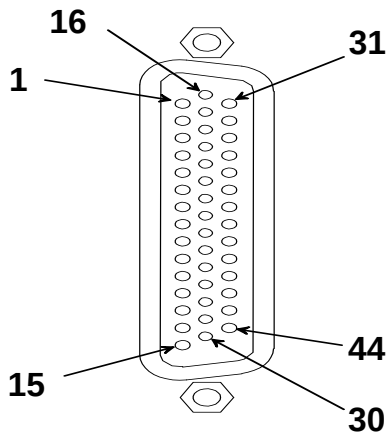


FIGURE 2-2: J200, J201 AND J202 PIN LOCATIONS

Four voltage range settings are available on the VM3618: two bipolar (±10 V, ±16 V) and two unipolar (0 – 20, 0 – 32). The output pin is referenced to different reference pins depending on the range selected. The 20 mA current range operates per the bipolar configuration.

When a unipolar range is used, the OUTPUT*x* pin must be referenced to the RETURN*x* pin, and in a bipolar range, the output pin must be referenced to the GND*x* pin, where '*x*' refers to the channel number.

As an example, to get a range out of channel 1, OUTPUT1 (pin 1) must be referenced to RETURN1 (pin 31). Likewise, to get a range of ±10 V on channel 1, OUTPUT1 (pin 1) must be referenced to GND (pin 16).

These are floating outputs. GND pins (e.g. pins 15, 30 and 44) are tied to chassis ground and can be used as shields.

MATING CONNECTORS

The mating connector for the VM3618 is available from the following company:

Assmann Electronic, Inc.	P/N AHDS44LL-T	Mating Connector

SECTION 3

PROGRAMMING

INTRODUCTION

The VM3618 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 uses 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, end each branch with a semicolon. For example, **VOLTage:LEVel** and **CURRent:LEVel** are both branches off the **SOURce:** trunk and can be combined as follows:

```
SOURce:VOLTage:LEVel <value>,<channel_list>;CURRent:LEVel <value>,<channel_list>
```

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

```
SOURce:VOLTage:LEVel <value>,<channel_list>
SOURce:CURRent:LEVel <value>,<channel_list>
```

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:

```
SOURce:VOLTage:LEVel <value>,<channel_list>
source:voltage:level <value>,<channel_list>
SOURCE:VOLTAGE:LEVEL <value>,<channel_list>
SOUR:VOLTage:LEVel <value>,<channel_list>
SOUR:VOLT:LEVel <value>,<channel_list>
SOUR:VOLT:LEV <value>,<channel_list>
sour:volt:lev <value>,<channel_list>
```

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

soure:volt:lev <value>,<channel_list> *incorrect syntax - extra "c"*

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

NOTATION

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

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

SCPI COMMAND EXAMPLES

CALIBRATION COUNT

The Calibration Count query returns the number of times the VM3618 module has been calibrated.

CALibration:COUNt? — ***There are no parameters for this command***

EXAMPLES

CAL:COUN? 20	*Returns the number of times the VM3618 has been calibrated.*
CAL1:GAIN 0.9000	*Programming Channel 1's gain constant.*
CAL1:ZERO 220	*Programming Channel 1's offset constant.*
CAL:STORE	*Storing the calibration constants into the non-volatile memory.*
CAL:COUN? 21	*Returns the number of times the VM3618 has been calibrated.*

CALIBRATION GAIN

The Calibration Gain command is used to set the calibration constant for the gain of the selected channel; its effect is immediate.

CALibration<channel>:GAIN <value>	***Where <channel> is the channel to be calibrated.*** ***Where <value> is the selected channel's gain to be programmed.***

EXAMPLES

CAL1:GAIN 1.000000	*Programming Channel 1's gain constant as 1.000000.*
CAL1:GAIN? 1.000000	*Returns the current calibration constant from the non-volatile memory.*

CALIBRATION SECURE CODE

The Calibration Secure code command is used to set the calibration security code that protects the non-volatile memory for unauthorized access. This code must be specified in order to disable the calibration security.

CALibration:SECure:CODE <code>	**W*here <code> is the calibration security code to be set. This parameter must be specified in definite or indefinite length arbitrary block format.***

EXAMPLES

CAL:SEC:CODE #15OLIVE	*Programs the calibration security code as OLIVE.*
CAL:SEC:STAT OFF,#15OLIVE	*Disable the calibration security.*
CAL:SEC:CODE? #15OLIVE	*Returns the current calibration security code. The query can be performed only when the calibration security has been currently disabled.*

CALIBRATION SECURE STATE

The Calibration Secure State command is used to enable or disable the calibration security state.

CALibration:SECure:STATe <mode>[,<code>]

Where <mode> specifies whether the security is to be enabled or disabled.

Where <code> is the calibration security code.

EXAMPLES

CAL:SEC:STATE ON	*Enables the calibration security. The security code is not required in order to enable the security state.*
CAL:SEC:STAT? 1	*Returns the current calibration security state.*
CAL:SEC:STATE OFF,#15OLIVE	*Disables the calibration security. The security code is required in order to disable the calibration security. If the password is incorrect, an error is returned.*
CAL:SEC:STAT? 0	*Returns the current calibration security state.*

CALIBRATION STORE

The Calibration Store command stores the current calibration constants into the non-volatile memory.

CALibration:STORe	***There are no parameters for this command***

EXAMPLES

CAL:STOR	*Stores the current calibration constants into the non-volatile memory. It must be ensured that the calibration security has been disabled before this command can be executed.*
CAL:SEC:STAT OFF,#15OLIVE	*Disabling the calibration security.*
CAL2:GAIN 0.785500	*Programming Channel 2's gain constant.*
CAL1:ZERO 220	*Programming Channel 1's offset constant.*
CAL:STOR	*Storing the new calibration constants into the non-volatile memory.*
CAL:SEC:STAT ON	*Enabling the calibration security.*

CALIBRATION ZERO

The Calibration Zero command is used to set the calibration constant for the selected channel's offset and its effect is immediate.

CALibration<channel>:ZERO <value>	***Where <channel> specifies the channel whose calibration constant is to be programmed.***
	Where <value> is the offset constant that is to be programmed for the specified channel.

EXAMPLES

CAL1:ZERO 240	*Programming Channel 1's offset constant.*
CAL:SEC:STAT OFF,#15OLIVE	*Disabling the calibration security.*
CAL1:ZERO -200	*Programming Channel 1's offset constant.*
CAL:STORE	*Storing the new constant value into the non-volatile memory.*
CAL:SEC:STAT ON	*Enabling the calibration security.*
CAL1:ZERO? -200	*Returns the current calibration constant for Channel 1's offset from the non-volatile memory.*

RANGE

The Range command is used to specify the operating range under which the specified channel should operate.

RANGe <range>,<channel_list>	***Where <range> specifies the range under which the specified channel(s) should operate.***
	Where <channel_list> specifies which channels operating range is to be configured. For more details on the syntax of the channel list, see Section 4.

EXAMPLES

RANG 16V,(@2:6)	*Configures the operating range for Channels 2 through 6 to ±16 volts.*
RANG 20mA,(@1)	*Configures the operating range for Channel 1 as ±20 mA.*
RANG? 1 20MA	*Returns the current operating range for Channel 1.*
RANG 32V,(@2)	*Configuring the operating range for Channel 2 as 0 to 32 volts.*
RANG? 2 32V	*Returns the current operating range for Channel 2.*

ROUTE CLOSE

The Route Close command is used to connect one or more channel outputs to their front panel connectors.

ROUTe:CLOSe <channel_list>	***Where <channel_list> specifies the channels whose outputs are to be connected to their respective front panel connectors. For more details on the syntax of the channel list, see Section 4.***

EXAMPLES

ROUT:CLOS (@1:8)	*Connects the outputs of Channels 1 through 8 to their front panel connectors.*
ROUT:CLOS? 1 1	*Returns whether the output of Channel 1 is connected to its front panel connector or not.*
ROUT:OPEN (@2:8)	*Disconnecting the outputs of Channels 2 through 8 from their front panel connectors.*
ROUT:CLOS? 2 0	*Returns whether the output of Channel 2 is connected to its front panel connector or not.*

ROUTE OPEN

The Route Open command is used to disconnect one or more channel outputs from their front panel connectors.

ROUTe:OPEN <channel_list>

Where <channel_list> specifies the channels whose outputs are to be disconnected from their respective front panel connectors. For more details on the syntax of the channel list, see Section 4.

EXAMPLES

ROUT:OPEN (@1:8)

Disconnects the outputs of Channels 1 through 8 from their front panel connectors.

ROUT:OPEN? 2
1

Returns whether the output of Channel 2 is disconnected from its front panel connector or not.

ROUT:CLOS (@1:4)

Connects the outputs of Channels 1 through 4 to their front panel connectors.

ROUT:OPEN? 1
0

Returns whether the output of Channel 1 is disconnected from its front panel connector or not.

SCAN

The Scan command enables or disables the operation of the scan list for the specified channels.

SCAN <mode>,<channel_list>	***Where <mode> specifies the scan list operation mode to be configured for the specified channels.***
	Where <channel_list> specifies the which channels scan list mode is to be configured. For more details on the syntax of the channel list, see Section 4.

EXAMPLES

SCAN ON,(@2:8)	*Configures the Scan Mode for Channels 2 through 8 as ON.*
SCAN LOOP,(@1)	*Configures the Scan Mode for Channel 1 as LOOP.*
SCAN? 1 LOOP	*Returns the current scan mode operation for Channel 1.*

Note: For the scan mode to be configured for the DACs, it must be ensured that a trigger source of EXTernal or TTLT<n> is selected.

SCAN LIMIT

The Scan Limit command sets the point in the scan list array of the specified channel where the interrupt routine loading the DAC either stops loading or loops back to zero.

SCAN:LIMit <channel>,<count>

Where <channel> specifies the channel whose scan limit is to be configured.

Where <count> is a value in the range 1-512, which specifies the point in the scan list array where the interrupt routine loading the DAC should either stop loading or loop back to zero.

EXAMPLES

SCAN:LIM 1,20	*Configures the scan limit for Channel 1 as 20.*
SCAN LOOP,(@1)	*Configuring the scan mode for Channel 1 as LOOP.*
SCAN:LIM 1,30	*Configuring the scan limit for Channel 1 as 30. The interrupt routine loading the DAC 1 will load values from index 1 to 30 from the scan list after which it will loop back to zero and continue.*
SCAN:LIM? 1 30	*Returns the scan limit corresponding to Channel 1.*

SCAN TABLE

The Scan Table command sets up the scan list for the specified channel. It allows entries of a list of voltage/current values to be placed in the specified channel' scan list.

SCAN:TABLe <channel>,<value_list>

Where <channel> specifies the channel whose scan list is to be configured.

Where <value_list> specifies the voltage/current values that are to be loaded into the scan list of the specified channel. The number of values in this list range from 1 to 512.

EXAMPLES

SCAN:TABL 1,2,3,4,5

Loading 4 values into the scan list for Channel 1.

SCAN? 1,3,2
2.999878,4.000244,5.000000

Returns 3 values from the scan list of Channel 1 starting at index 2.

SCAN TABLE LOCATION

The Scan Table Location command is used to load a voltage/current value at a specified location in the scan list of the specified channel.

SCAN:TABLe <channel>:LOCation <number>,<value>

Where <channel> specifies the channel whose scan list at the specified index is to be configured.

Where <number> specifies a value in the range 1 - 512 where the voltage/current is to be loaded into the scan list.

Where <value> specifies the voltage/ current value that is to be loaded into the scan list of the specified channel at the specified index.

EXAMPLES

SCAN:TABL1:LOC 10,4	*Configures the value in the scan list of Channel 1 at the index 10 as 4.*
SCAN:TABL1:LOC? 10 4.000244	*Returns the value from the scan list of Channel 1 at index 10.*
SCAN:TABL 1,1,2,3,4,5	*Configures the scan list for Channel 1.*
SCAN:TABL1:LOC 6,4	*Configures the value in the scan list for Channel 1 at index 6 as 4.*
SCAN:TABL1:LOC? 6 4.000244	*Returns the value from the scan list of Channel 1 at index 6.*
SCAN:TABL1:LOC? 3 2.999878	*Returns the value from the scan list of Channel 1 at index 3.*

SOURCE CURRENT LEVEL

The Source Current Level command sets the output current level of the specified channels. This command can be used for only those channels that are operating on the current range. If this command is used on channels operating on the voltage range, an error is generated.

SOURce:CURRent:LEVel <value>,<channel_list>

Where <value> specifies a value in the range -20 to 19.998779, which specifies the output current level that is to be set for the specified channels.

Where <channel_list> specifies the channels for which the output current level is to be configured. It must be ensured that the channels specified in this list are operating on the current range otherwise an error will be generated. For more details on the syntax of the channel list, see Section 4.

EXAMPLES

SOUR:CURR:LEV -20,(@1:4)	*Configures the output current level for Channels 1 through 4 to -20 mA..*
RANG 20mA,(@1:2)	*Configures the operating range for Channels 1 and 2 to ±20 mA.*
SOUR:CURR:LEV 10.1,(@1)	*Configures the output current level for Channel 1 to 10.1 mA.*
SOUR:CURR:LEV? 2 -20	*Returns the output current level for Channel 2 as -20 mA.*

SOURCE DATA

The Source Data command is used to set the output voltage/current level for the specified channels using the 16-bit value that is the equivalent representation of the voltage/current to be configured.

SOURce:DATA <value>,<channel_list>

Where <value> specifies the voltage/current value level as a 16-bit value to be set up for the specified channels.

Where <channel_list> specifies the channels for which the output voltage/current level must be configured. For more details on the syntax of the channel list, see Section 4.

EXAMPLES

SOUR:DATA 32767,(@1)	*Sets the output level for Channel 1.*
RANG 16V,(@2)	*Configures the operating range for Channel 2 as ±16 V.*
SOUR:DATA -32768,(@2)	*Configures the voltage level for Channel 2 as –32768, which corresponds to -16 V on the ±16 V range.*
SOUR:DATA? 2 -32768	*Returns the voltage level for Channel 2.*

SOURCE SETUP

The Source Setup command loads each specified DAC with the value from the specified location in its respective scan list.

SOURce:SETup <index>,<channel_list>	***Where <index> is a value in the range 1 to 512, which specifies the location in the specified channel's scan list from where the value is to be loaded to the DAC.***

EXAMPLES

SOUR:SET 1,(@1:8)	*Loads all the 8 DACs with the value from the respective scan lists at index 1.*
SCAN:TABL 1 1,2,3,4,5	*Loads the scan list of Channel 1 with the specified values.*
SOUR:SET 3,(@1)	*Loads the DAC 1 with the value from the scan list of Channel 1 at index 3. In other words, the DAC voltage of Channel 1 is 2.999878 volts.*

SOURCE VOLTAGE LEVEL

The Source Voltage Level command sets the output voltage level of the specified channels. This command can be used for only those channels that are operating on the voltage range. If this command is used on channels operating on the current range, an error is generated.

SOURce:VOLTage:LEVel <value>,<channel_list>

Where <value> specifies the output voltage level that is to be set for the specified channels. The range for this parameter depends on the range in which the specified channels are operating.

Where <channel_list>specifies the channels for which the output voltage level is to be configured. It must be ensured that the channels specified in this list are operating on the voltage range otherwise an error will be generated. For more details on the syntax of the channel list, see Section 4.

EXAMPLES

SOUR:VOLT:LEV 20,(@1:4)	*Configures the output voltage level for Channels 1 through 4 to 20 V.*
RANG 32V,(@1:2)	*Configures the operating range for Channels 1 and 2 to 0 to 32 V.*
SOUR:VOLT:LEV 10.1,(@1)	*Configures the output voltage level for Channel 1 to 10.1 V.*
SOUR:VOLT:LEV? 2 20	*Returns the output voltage level for Channel 2 as 20 V.*

TRIGGER SEQUENCE IMMEDIATE

The Trigger Sequence Immediate command causes a trigger event to occur.

TRIGger[:SEQuence]:IMMediate	***There are no parameters for this command.***

EXAMPLES

TRIG	*Causes a trigger event to occur.*
TRIG:SEQ	*Causes a trigger event to occur.*
TRIG:IMM	*Causes a trigger event to occur.*
TRIG:SEQ:IMM	*Causes a trigger event to occur.*

TRIGGER SEQUENCE SLOPE

The Trigger Sequence Slope command configures which edge of the active triggering signal is the active edge. This command applies only to the EXTernal or TTLT<n> trigger sources.

TRIGger[:SEQuence]:SLOPe <slope>	***Where <slope> specifies the active edge of the triggering signal.***

EXAMPLES

TRIG:SLOP POS	*Configures the positive edge as the active edge of the triggering signal.*
TRIG:SLOP NEG	*Configures the negative edge as the active edge of the triggering signal.*
TRIG:SLOP? NEG	*Returns the negative edge as the active edge of the triggering signal.*

TRIGGER SEQUENCE SOURCE

The Trigger Sequence Source configures the trigger event that will update the DACs on the VM3618 module. It must be noted that when using the SCAN mode of operation, a trigger source of either EXTernal or TTLT<n> must be selected

TRIGger[:SEQuence]:SOURce <source>	***Where <source> specifies the triggering signal.***

EXAMPLES

TRIG:SOUR EXT	*Configures the front panel trigger input as the active triggering signal.*
TRIG:SOUR INT3	*Configures Channel 3 as the active triggering signal. All the other channels will wait for Channel 3 to update.*
TRIG:SOUR? INT3	*Returns Channel 3 as the active triggering signal.*
TRIG:SOUR TTLT2	*Configures TTLT2 as the active triggering signal.*
SCAN ON,(@1:4)	*Configures the scan mode for Channels 1 through 4 as ON.*
TRIG:SOUR? TTLT2	*Returns TTLT2 as the triggering signal.*

APPLICATION EXAMPLES

The following example shows how the SCPI commands can be used to set up the trigger parameters of the instrument and to configure the output level of the channels.

TRIG:SOUR EXT	*Configuring the triggering source of the module as EXT, i.e., the front panel input.*
TRIG:SLOP NEG	*Configuring the negative edge of the input trigger to be the triggering edge.*
RANG 20V,(@1)	*Configuring Channel 1 to operate on the 20 V range.*
RANG 20mA,(@2)	*Configuring Channel 2 to operate on the ±20 mA range.*
ROUT:CLOS (@1,2)	*Connecting the outputs of Channels 1 and 2 to their front panel connectors.*
SOUR:VOLT:LEV 10.1,(@1)	*Setting Channel 1's voltage level to 10.1 V.*
SOUR:CURR:LEV 2.1,(@2)	*Setting Channel 2's current level to 2.1 mA.*

REGISTER ACCESS EXAMPLES

This instrument can be programmed through the registers as well as through word serial commands. The programming registers are in the A16 address space. All registers are write-only registers in the real register mode and read/write in the pseudo register mode. Register offsets from the base address are shown in the following table. The base of the registers is set by the logical address of the instrument:

```
BASE_ADDRESS = 49152 + logical_address * 64
```

For example, a logical address of 8 means the base address is 49152 + 8*64 = 49664 (C200 in hex).

To set a value for Channel 1, store the 16-bit binary value at offset 20 hex. A value of 123 (007B hex) will cause Channel 1 to go to that value on the corresponding DAC.

The actual value set depends on the selected range for that channel. The full 16-bit value can be used to program the voltage ranges. The -20 mA to 20 mA range uses only 15 bits. Here are some examples:

Hex Value	10 V	16 V	20 V	32 V	20 mA
FFFF	9.999695	15.999512	19.999695	31.999512	N/A
FFFE	9.999390	15.999023	19.999390	31.999023	N/A
:					
C001	5.000305	8.000488	15.000305	24.000488	N/A
C000	5.000000	8.000000	15.000000	24.000000	N/A
BFFF	4.999695	7.999512	14.999695	23.999512	19.998779
BFFE	4.999390	7.999023	14.999390	23.999023	19.997559
:					
8001	0.000305	0.000488	10.000305	16.000488	0.001221
8000	0.000000	0.000000	10.000000	16.000000	0.000000
7FFF	-0.000305	-0.000488	9.999695	15.999512	-0.001221
:					
4001	-4.999695	-7.999512	5.000305	8.000488	-19.998779
4000	-5.000000	-8.000000	5.000000	8.000000	-20.000000
3FFF	-5.000305	-8.000488	4.999695	7.999512	N/A
3FFE	-5.000610	-8.000977	4.999390	7.999023	N/A
:					
0001	-9.999695	-15.999512	0.000305	0.000488	N/A
0000	-10.000000	-16.000000	0.000000	0.000000	N/A

There are two types of register access: direct register access and pseudo register access. Direct register access is the fastest type with an access time approximately 0.5 μs (actual speed depends on the controller used). While direct register access is fast, there is no calibration correction done by the module. In the direct register access mode the user is responsible for doing calibration corrections before storing in the register. Direct register access also has no read back. Values read from the registers are undefined.

The second type of register access is called pseudo register access. Pseudo register access is slower than direct register access with an access time approximately 40 μs. While pseudo register access is slower than direct register access, the module performs the offset and scale associated with the calibration constants. Pseudo register access also allows register read back. The value read back from a register is the value stored in the DAC after the offset and scale operation.

Note: The register access method is selected by the **INHOUSE:PSEUDO** command and takes effect the next time the module is powered up. (See the Table 3-1for the register layout.)

The Model VM3618 D/A Module supports access to the eight channels via the Device Dependent Registers of the VXIbus interface. The specific registers are located in A16 Memory at offsets 0x20=Port1, 0x22=Port2, 0x24=Port3, 0x26=Port4, 0x28=Port5, 0x2A=Port6, 0x2C=Port 7 and 0x2E=Port8. The following diagram shows A16 Memory and the Model VM3618 Data Port Map.

TABLE 3-1: A16 MEMORY

Offset	Description
3E	
3C	
3A	
38	
36	
34	
32	
30	
2E	Channel 8
2C	Channel 7
2A	Channel 6
28	Channel 5
26	Channel 4
24	Channel 3
22	Channel 2
20	Channel 1
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

VXI*PLUG&PLAY* EXAMPLES

```
/*****************************************************************
Function:               vtvm3618_calibrateInstrument

Formal Parameters       ViSession instrHndl,
                        - A valid session handle to the instrument.

                        ViInt16  calibration Channel,
                        - This parameter is used to select the channel for which the calibration
                        constants are to be set.

                        Valid Range:
                                        -----------
                        vtvm3618_CALIBRATION_CHANNEL_MIN        (1)  to
                        vtvm3618_CALIBRATION_CHANNEL_MAX        (8)

                        ViReal32        gainVal,
                        - This parameter specifies the calibration gain for the selected channel.

                        Valid Range:
                                        -----------
                        vtvm3618_CALIB_GAIN_MIN (0.000000)
                        vtvm3618_CALIB_GAIN_MAX (1.000000)

                        ViInt16  offsetVal,
                        - This parameter specifies the calibration offset for the selected
                        channel.

                         Valid Range:
                                        -----------
                         vtvm3618_CALIBRATION_DATA_MIN  (-32768) to
                         vtvm3618_CALIBRATION_DATA_MAX (32767).

                        ViChar   password[],
                        - This parameter specifies the calibration security access code.

                        Valid Range:
                                        -----------
An ASCII string whose length is in the range:
                         vtvm3618_PASSWORD_LEN_MIN (1) to
                         vtvm3618_PASSWORD_LEN_MAX (12).

        ViBooleanstoreDontstore,
                        - This parameter specifies whether the calibration constants are to be
                        stored in the Non-Volatile memory or not.

                        Valid Range:                    Interpretation:
                         ------------                   ---------------
                        vtvm3618_STORE                  Store Calibration Data
                        vtvm3618_DONT_STORE             Don't Store Calibration Data
```

```
        ViPInt32count,
                                        - This parameter returns the calibration count i.e., the
                                        number of times the module has been calibrated.

Return Values:  Returns VI_SUCCESS if successful.
                                        else returns error value.

Description     This function is an application function, which shows how the user can use core
                driver functions to calibrate the channels. This function sets the calibration
                gain and calibration offset for the specified channel. If Store/Don't Store switch
                is set to Store, it stores these changes to the Non-Vol memory. It also returns
                the number of times Non-Vol memory has been updated.
*****************************************************************************/
ViStatus _VI_FUNC vtvm3618_calibrateInstrument( ViSession instrHndl,
ViInt16  channelNumber,
ViReal32        gainVal,
ViInt16  offsetVal,
ViChar   password[],
ViBoolean       storeDontstore,
ViPInt32        count)
{
/* Variable used to store the return status of the function */
ViStatus status     = VI_NULL;

        status = vtvm3618_calibrateOffsetGain(instrHndl,
        password,
        channelNumber,  gainVal, offsetVal);
        if (status < VI_SUCCESS)
        return vtvm3618_ERROR_CALIBRATE_OFFSET_GAIN;

        status = vtvm3618_invalidIntegerRange(      storeDontstore,

        vtvm3618_DONT_STORE,

        vtvm3618_STORE,

        VI_ERROR_PARAMETER6);
        if (status < VI_SUCCESS)
                return status;

        if (storeDontstore == vtvm3618_STORE)
{
        status = vtvm3618_storeCalibrationData(instrHndl,
        password,count);
        if (status < VI_SUCCESS)
        return vtvm3618_ERROR_STORING_CAL_DATA;
}
        return VI_SUCCESS;
}
```

/***

Function: vtvm3618_setupAndWriteToDAC

Formal Parameters ViSession instrHndl,
- A valid session handle to the instrument.

ViInt16 triggerSource,
- This parameter is used to select the Trigger Source.

Valid Range:	Interpretation:
vtvm3618_TRIG_SRC_AUTO	Auto
vtvm3618_TRIG_SRC_EXT	External
vtvm3618_TRIG_SRC_TTLTRG0	TTL Trigger 0
vtvm3618_TRIG_SRC_TTLTRG1	TTL Trigger 1
vtvm3618_TRIG_SRC_TTLTRG2	TTL Trigger 2
vtvm3618_TRIG_SRC_TTLTRG3	TTL Trigger 3
vtvm3618_TRIG_SRC_TTLTRG4	TTL Trigger 4
vtvm3618_TRIG_SRC_TTLTRG5	TTL Trigger 5
vtvm3618_TRIG_SRC_TTLTRG6	TTL Trigger 6
vtvm3618_TRIG_SRC_TTLTRG7	TTL Trigger 7
vtvm3618_TRIG_SRC_INT_CH1	Internal Channel 1
vtvm3618_TRIG_SRC_INT_CH2	Internal Channel 2
vtvm3618_TRIG_SRC_INT_CH3	Internal Channel 3
vtvm3618_TRIG_SRC_INT_CH4	Internal Channel 4
vtvm3618_TRIG_SRC_INT_CH5	Internal Channel 5
vtvm3618_TRIG_SRC_INT_CH6	Internal Channel 6
vtvm3618_TRIG_SRC_INT_CH7	Internal Channel 7
vtvm3618_TRIG_SRC_INT_CH8	Internal Channel 8
vtvm3618_TRIG_SRC_IMMImmediate	

ViBoolean slope,
- This parameter is used to configure the active edge of the triggering signal. This parameter is considered only for the EXTernal trigger source and the TTLT trigger sources. i.e., when the trigger source is one of the following vtvm3618_TRIG_SRC_EXT
vtvm3618_TRIG_SRC_TTLTRG0
vtvm3618_TRIG_SRC_TTLTRG1
vtvm3618_TRIG_SRC_TTLTRG2
vtvm3618_TRIG_SRC_TTLTRG3
vtvm3618_TRIG_SRC_TTLTRG4
vtvm3618_TRIG_SRC_TTLTRG5
vtvm3618_TRIG_SRC_TTLTRG6
vtvm3618_TRIG_SRC_TTLTRG7

Valid Values:	Interpretation:
vtvm3618_SLOPE_POSITIVE	Positive edge
vtvm3618_SLOPE_NEGATIVE	Negative edge

ViReal32 outputLevel,
- This parameter sets the output level for the specified channel(s).

```
                Valid Range:
                                ----------
                                For the 10 Volt Range:
                                vtvm3618_VOLT_LEVEL_10V_MIN
                                vtvm3618_VOLT_LEVEL_10V_MAX

                                For the 16 Volt Range:
                                vtvm3618_VOLT_LEVEL_16V_MIN
                                vtvm3618_VOLT_LEVEL_16V_MAX

                                For the 20 Volt Range:
                                vtvm3618_VOLT_LEVEL_20V_MIN
                                vtvm3618_VOLT_LEVEL_20V_MAX

                                For the 20mA Range:
                                vtvm3618_VOLT_LEVEL_20mA_MIN
                                vtvm3618_VOLT_LEVEL_20mA_MAX

                                For the 32 Volt Range:
                                vtvm3618_VOLT_LEVEL_32V_MIN
                                vtvm3618_VOLT_LEVEL_32V_MAX

                ViInt16  channelList[],
                                - This parameter specifies the channels for which
                                the specified output level is to be configured.

                Valid Range for each element:
                                ----------------------------
                                vtvm3618_CHANNEL_LIST_MIN (1) to
                                vtvm3618_CHANNEL_LIST_MAX (8)

                ViInt16  numOfChannels,
                                - This parameter specifies the number of valid
                                elements in the input 'channelList[]' array.

                Valid Range:
                                 ------------
                                 vtvm3618_CHANNEL_LIST_MIN (1) to
                                vtvm3618_CHANNEL_LIST_MAX (8)

Return Values:  Returns VI_SUCCESS if successful.
                                else returns error value.

Description     This is an application function that shows how to group core driver functions
                 to setup trigger parameters and output level for the specified channels.
*************************************************************************/
ViStatus _VI_FUNC vtvm3618_setupAndWriteToDAC(ViSession      instrHndl,
                ViInt16  triggerSource,
                ViBoolean slope,
                ViReal32  outputLevel,
                ViInt16  channelList[],
                ViInt16  numOfChannels)
{
```

```
ViStatus status     = VI_NULL;

        /*
         * Configuring the trigger parameters
         */
        status = vtvm3618_configTriggerParams (instrHndl, triggerSource,slope);
        if (status < VI_SUCCESS)
                return vtvm3618_ERROR_SETTING_TRIGGER_PARAMS;

        /*
         * Configuring the output voltage/current levels for the specified
         * channels
         */
        status = vtvm3618_setupOutputLevel(instrHndl, outputLevel,
        channelList,numOfChannels);
        if (status < VI_SUCCESS)
        return vtvm3618_ERROR_SETTING_OUTPUT_LEVEL;

        return VI_SUCCESS;
}

/*****************************************************************************
```

Function: vtvm3618_setupScanListParams

Formal Parameters

ViSession instrHndl,
- A valid session handle to the instrument.

ViInt16 channel,
- This parameter specifies the channel for which the scan list operation mode is to be set.

Valid Range:
---
vtvm3618_CHANNEL_LIST_MIN (1) to
vtvm3618_CHANNEL_LIST_MAX (8)

ViInt16 mode,
- This parameter specifies the mode of operation to be set for the scan list operation for the specified channel.

Valid Range:	Interpretation:
vtvm3618_SCAN_MODE_OFF	Scan Mode Off.
vtvm3618_SCAN_MODE_ON	Scan Mode On.
vtvm3618_SCAN_MODE_LOOP	Scan Mode Loop.

ViInt16 count,
- This parameter specifies the position in the scan list array where the interrupt routine loading the DACs should either stop or loop back to zero. In other words, it specifies the scan limit.

Valid Range:

---

vtvm3618_COUNT_MIN (1) to
vtvm3618_COUNT_MAX (512).

ViReal32 outputLevelList[],
- This parameter specifies the output level values to be set in the scan list array of the specified channel.

Each element of the array should be of the range specified below:

For the 10 Volt Range:
vtvm3618_VOLT_LEVEL_10V_MIN
vtvm3618_VOLT_LEVEL_10V_MAX

For the 16 Volt Range:
vtvm3618_VOLT_LEVEL_16V_MIN
vtvm3618_VOLT_LEVEL_16V_MAX

For the 20 Volt Range:
vtvm3618_VOLT_LEVEL_20V_MIN
vtvm3618_VOLT_LEVEL_20V_MAX

For the 20mA Range:
vtvm3618_VOLT_LEVEL_20mA_MIN
vtvm3618_VOLT_LEVEL_20mA_MAX

For the 32 Volt Range:
vtvm3618_VOLT_LEVEL_32V_MIN
vtvm3618_VOLT_LEVEL_32V_MAX

ViInt16 numElems
- This parameter specifies the number of valid elements in the 'outputLevelList[]' array.

Valid Range:

---

vtvm3618_VOLTAGE_LIST_MIN (1) to
vtvm3618_VOLTAGE_LIST_MAX (512).

Return Values: Returns VI_SUCCESS if successful. Else returns error value.

Description This function is an application fuction that shows how the user can use core functions to load the specified channel's scan list with the voltage/current values. These values can then be loaded to the DAC using the interrupt routine.

```
*****************************************************************************/
ViStatus _VI_FUNC vtvm3618_setupScanListParams(         ViSession instrHndl,
        ViInt16  channel,
        ViInt16  mode,
        ViInt16  count,

        ViReal32         outputLevelList[],
        ViInt16  numElems)
{

        ViStatus status     = VI_NULL;
        ViInt16  channelList[1];


        channelList[0] = channel;

        /*
         * Resetting the module to its default state
         */
        status = vtvm3618_reset(instrHndl);
        if (status < VI_SUCCESS)
                return status;
        /*
         * Configuring the TTLT Line 0 as the trigger source for the
         * Scan Mode
         */
        status = vtvm3618_configTriggerParams (    instrHndl,

        vtvm3618_TRIG_SRC_TTLTRG0,

        vtvm3618_SLOPE_POSITIVE);
        if (status < VI_SUCCESS)
                return vtvm3618_ERROR_SETTING_TRIGGER_PARAMS;
        /*
         * Configuring the Scan Mode of the specified channel
         */
        status = vtvm3618_setupScanMode(instrHndl,
        mode,    channelList, 1);

        if (status < VI_SUCCESS)
                return vtvm3618_ERROR_SETTING_SCAN_MODE;

        /*
         * Configuring the Scan List for the specified channel
         */
        status = vtvm3618_setupScanList(instrHndl,
        channel, outputLevelList,  numElems);
        if (status < VI_SUCCESS)
                return vtvm3618_ERROR_SETTING_SCAN_LIST;
```

```
        /*
         * Configuring the Scan Limit Index in the scan array where the
         * interrupt routine loading the DAC will either stop or loop
         * back to zero depending on the scan mode
         */
        status = vtvm3618_setupScanLimit(instrHndl,
        channel,  count);
        if (status < VI_SUCCESS)
                return vtvm3618_ERROR_SETTING_SCAN_LIMIT;

        return VI_SUCCESS;
}
```

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 VM3618 divided into three sections: IEEE 488.2 commands, the instrument specific SCPI commands and the required SCPI commands. With each command is a brief description of its function, whether the command's value is affected by the *RST command and its default value.

The remainder of this section is devoted to describing each command, one per page, in detail. The description is presented in a regular and orthogonal way assisting the user in the use of each command. Every command entry describes the exact command and query syntax, the use and range of parameters and a complete description of the command's purpose.

ALPHABETICAL COMMAND LISTING

The following tables provide an alphabetical listing of each command supported by the VM3618 along with a brief description. 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 default column gives the value of each command's setting when the unit is powered up or when a *RST command is executed.

THE <CHANNEL_LIST> PARAMETER

A channel list is a SCPI convention for specifying one or more channels. A channel list begins with a left parenthesis and an @ sign. Channels are then listed as individual comma-separated channels or as a range of channels separated by a colon. Finally, a trailing right parenthesis ends the channel list.

EXAMPLES:

(@1)	Channel 1
(@1,4)	Channels 1 and 4
(@ 1,2,3,4)	Channels 1, 2, 3 and 4
(@ 1:8)	Channels 1, 2, 3, 4, 5, 6, 7 and 8

TABLE 4-1: IEEE 488.2 COMMON COMMANDS

Command	Description	*RST	Reset Value
*CLS	Clear the Status Register	X	
*ESE	Set the Event Status Enable Register		N/A
*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	X	0
*RST	Reset 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		N/A

TABLE 4-2: INSTRUMENT SPECIFIC SCPI COMMANDS

Command	Description	*RST	Reset Value
CALibration:COUNt?	Query the number of times the VM3618 has been calibrated.		N/A
CALibration:GAIN	Set the calibration constant for the gain of the selected channel.	X	Values from non-volatile memory
CALibration:SECure:CODE	Set the code required to disable calibration security.		N/A
CALibration:SECure:STATe	Enable or disable calibration security.	X	1 (security enabled)
CALibration:STORe	Save the current calibration constants into non-volatile memory.		N/A
CALibration:ZERO	Set the calibration constant for the offset of the selected channel.	X	Values from non-volatile memory
MEMory:SETup	Enter a voltage list for manual loading.	X	0
OUTPut:TRIGger:SLOPe	Sets the polarity of the output trigger pulse	X	NEG
OUTPut:TRIGger:TTLTrig	Selects which VXIbus TTL trigger line will output a trigger pulse	X	0
OUTPut:TTLTrig[:STATe]	Enables or disables an output trigger pulse to the TTL trigger lines	X	0
RANGe	Set a range of operation	X	±16 volts
ROUTe:CLOSe	Connect one or more channels with their output pins.	X	All channels open
ROUTe:OPEN	Disconnect one or more channels from their output pins.	X	All channels open
SCAN	Enable or disable the operation of the scan list function.	X	Off
SCAN:LIMit	Set the scan loop-back limit.	X	512
SCAN:TABLe	Enter a voltage list on a per channel basis.	X	0
SCAN:TABLe:LOCation	Enter a voltage in a specific location in a list.		N/A
SOURce:CURRent:LEVel	Set the output current level of the channels selected by the channel list.	X	0 mA
SOURce:DATA	Set the output level of the channels selected by the channel list using the binary data programmed into the 16-bit DAC.	X	0
SOURce:VOLTage:LEVel	Set the output voltage of the channels selected by the channel list.	X	0 volts
SOURce:SETup	Set the output level of all channels using the binary data from a selected location in the scan list.		N/A
TRIGger[:SEQuence][:IMMediate]	Causes a trigger event to occur.		N/A
TRIGger[:SEQuence]:SLOPe	Selects which edge of a triggering signal is the active edge.	X	POSitive edge
TRIGger[:SEQuence]:SOURce	Selects the trigger event that updates the DACs on the VM3618.	X	AUTO mode

TABLE 4-3: SCPI REQUIRED COMMANDS

Command	Description	*RST	Reset Value
STATus:OPERation:CONDition?	Query the Operation Status Condition Register	X	
STATus:OPERation:ENABle	Sets the Operation Status Enable Register	X	
STATus:OPERation[:EVENt]?	Query the Operation Status Event Register	X	
STATus:PRESet	Presets the Status Register	X	
STATus:QUEStionable:CONDition?	Query the Questionable Status Condition Register	X	
STATus:QUEStionable:ENABle	Sets the Questionable Status Enable Register	X	
STATus:QUEStionable[:EVENt]?	Query the Questionable Status Event Register	X	
SYSTem:ERRor?	Query the Error Queue	X	Clears queue
SYSTem:VERSion?	Query which version of the SCPI standard the module complies with		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 under each command page:

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	Clear the Status Register	
Type	IEEE488.2 Common Command	
Command Syntax	*CLS	
Command Parameters	None	
***RST Value**	*RST performs all the functions of *CLS	
Query Syntax	None - Command Only	
Query Parameters	N/A	
Query Response	N/A	
Description	This command clears all event registers, clears the OPC flag and clears all queues (except the output queue).	
Examples	**Command / Query**	**Response *(Description)***
	*CLS	
Related Commands	None	

*ESE

Purpose	Set the Event Status Enable Register
Type	IEEE488.2 Common Command
Command Syntax	*ESE <mask>
Command Parameters	<mask> = numeric ASCII value in the range of 0 to 255
***RST Value**	N/A
Query Syntax	*ESE?
Query Parameters	None
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/IEEE488.2-1987 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 (not used in the VM3618) Bit 2 - Query Error Bit 3 - Device Dependent Error (not used in the VM3618) Bit 4 - Execution Error Bit 5 - Command Error Bit 6 - User Request (not used in the VM3618) 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	Query the Standard Event Status Register
Type	IEEE488.2 Common Command
Command Syntax	None - Query Only
Command Parameters	N/A
***RST Value**	N/A
Query Syntax	ESR?
Query Parameters	None
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 (not used in the VM3618, always 0) Bit 2 - Query Error Bit 3 - Device Dependent Error (not used in the VM3618, always 0) Bit 4 - Execution Error Bit 5 - Command Error Bit 6 - User Request (not used in the VM3618, always 0) Bit 7 - Power On The Operation Complete bit is set by the VM3618 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 ranging from -200 to -299 are execution errors. The Command Error bit is set when a command error is detected. Errors ranging 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**: *ESR? **Response *(Description)***: 4
Related Commands	*ESE

*IDN?

Purpose	Query the module for its identification string	
Type	IEEE488.2 Common Command	
Command Syntax	None - Query Only	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	*IDN?	
Query Parameters	None	
Query Response	ASCII character string	
Description	The Identification query returns the identification string of the VM3618 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?	VXI Technology, Inc.,VM3816,0,1.00 *(The revision listed here is for reference only; the response will always be the current revision of the instrument.)*
Related Commands	None	

*OPC

Purpose	Set the OPC bit in the Event Status Register
Type	IEEE488.2 Common Command
Command Syntax	*OPC
Command Parameters	None
***RST Value**	*RST removes any pending *OPC request
Query Syntax	*OPC?
Query Parameters	None
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. Specifically, the operations of connecting or disconnecting channels (ROUTe:CLOSe or ROUTe:OPEN), and changing ranges require relay operations. When a relay changes, the operation is not complete until the relay has had time to settle.

Examples

Command / Query	**Response *(Description)***
*OPC	
*OPC?	1

Related Commands	*WAI

*RST

Purpose	Reset the module to a known state	
Type	IEEE488.2 Common Command	
Command Syntax	*RST	
Command Parameters	None	
***RST Value**	N/A	
Query Syntax	None - Command Only	
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 tables at the beginning of this section for the default parameter values set by this command.	
Examples	**Command / Query**	**Response *(Description)***
	*RST	
Related Commands	None	

*SRE

Purpose	Set the Service Request Enable Register
Type	IEEE 488.2 Common Command
Command Syntax	*SRE <mask>
Command Parameters	<mask> = Numeric ASCII value in the range of 0 to 255
***RST Value**	N/A
Query Syntax	*SRE?
Query Parameters	None
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 back plane interrupts. If a bit is set in the mask that newly enables a bit set in the status byte and interrupts are enabled, the module will generate a REQUEST TRUE event via an interrupt. See the *STB? Command for the layout of bits. **Note**: Bit 6 is always internally cleared to zero as required by IEEE 488.2 section 11.3.2.3.

Examples	**Command / Query**	**Response *(Description)***
	*SRE 4	
	*SRE?	4
Related Commands	None	

*STB?

Purpose	Query the Status Byte Register
Type	IEEE488.2 Common Command
Command Syntax	None - Query Only
Command Parameters	N/A
***RST Value**	N/A
Query Syntax	*STB?
Query Parameters	None
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 Byte 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 Bit (ESB) Bit 6 - Master Summary Status Bit 7 - Operation Status Summary

Examples	**Command / Query**	**Response *(Description)***
	*STB?	16

Related Commands	None

*TRG

Purpose	Causes a trigger event to occur	
Type	IEEE488.2 Common Command	
Command Syntax	*TRG	
Command Parameters	None	
***RST Value**	N/A	
Query Syntax	None - Command Only	
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	TRIGger:SEQuence:IMMediate	

*TST?

Purpose	Starts and reports a self-test procedure
Type	IEEE488.2 Common Command
Command Syntax	None - Query Only
Command Parameters	N/A
***RST Value**	N/A
Query Syntax	*TST?
Query Parameters	None
Query Response	Numeric ASCII value from 0 to 255
Description	The Self-Test query causes the VM3618 to run its self-test procedures and report on the results. The following tests are performed: 1. Non-volatile memory test 2. Timer test 3. Data path test 4. Trigger test The *TST? query returns a numeric ASCII value which has the following meaning: Bit 0 - Non-volatile memory failed Bit 1 - Timer failed Bit 2 - Data path failed Bit 3 - Trigger failed Bit 4 - Unused Bit 5 - Unused Bit 6 - Unused Bit 7 - Unused A bit value of 1 in any location indicates a failure while a bit value of 0 indicates the test passed. An overall value of 0 indicates all tests passed.

Examples	**Command / Query**	**Response *(Description)***
	*TST?	0

Related Commands	None

*WAI

Purpose	Halts execution and queries	
Type	IEEE488.2 Common Command	
Command Syntax	*WAI	
Command Parameters	None	
***RST Value**	N/A	
Query Syntax	None - Command Only	
Query Parameters	N/A	
Query Response	N/A	
Description	The Wait to Continue command halts the execution of additional 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. Specifically, the operations of connecting or disconnecting channels (ROUTe:CLOSe or ROUTe:OPEN), and changing ranges require relay operations. When a relay changes, the operation is not complete until the relay has had time to settle.	
Examples	**Command / Query**	**Response *(Description)***
	*WAI	
Related Commands	*OPC	

INSTRUMENT SPECIFIC SCPI COMMANDS

CALibration:COUNt?

Purpose	Query the number of times the VM3618 has been calibrated
Type	Instrument specific SCPI
Command Syntax	None - Query Only
Command Parameters	N/A
***RST Value**	N/A
Query Syntax	CALibration:COUNt?
Query Parameters	None
Query Response	Numeric ASCII value
Description	The instrument will increment the count every time the non-volatile memory holding the calibration constants is updated. If the calibration security is disabled (CALibration:SECure:STATe OFF active) and CALibration:STORe:AUTO ON is active, the count will increment with each execution of the CALibration:GAIN or CALibration:ZERO command. If the CALibration:STORe:AUTO OFF is active, the count will only be incremented by invoking the CALibration:STORe command. The maximum value for the count is 16,777,215 after which it will wrap to 0. **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:COUN?	3

Related Commands	CALibration:STORe

CALibration:GAIN

Purpose	Set the calibration constant for the selected channel's gain
Type	Instrument specific SCPI
Command Syntax	CALibration<channel>:GAIN <value>
Command Parameters	<channel> = 1 - 8 referring to a specific channel <value> = 0 to 1.0
***RST Value**	Set to values stored in non-volatile memory
Query Syntax	CALibration<channel>:GAIN?
Query Parameters	<channel> = 1 - 8 referring to a specific channel
Query Response	A numeric ASCII floating point number from 0.000000 to 1.000000
Description	If the CALibration:STORe:AUTO ON is active, the command will save the new constant to the non-volatile memory each time the command is sent; its effect is immediate. If the CALibration:STORe:AUTO OFF is active, a CALibration:STORe command must be executed in order to save the new constant in non-volatile memory. The Calibration Gain command will only function when calibration security is disabled; otherwise, an error is generated. Note that the query returns the value from the non-volatile memory rather than the currently used value and may be different from the constant currently being used.  **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)***
	CAL2:GAIN -120 CAL2:GAIN?	 -120
Related Commands	CALibration<channel>:ZERO <value> CALibration:DATA <block_data>	

CALibration:SECure:CODE

Purpose	Sets the code required to disable calibration security
Type	Instrument specific SCPI
Command Syntax	CALibration:SECure:CODE<code>
Command Parameters	<code> = 1 to 12 ASCII character string
***RST Value**	N/A
Query Syntax	CALibration:SECure:CODE?
Query Parameters	N/A
Query Response	IEEE-488.2 definite length arbitrary block
Description	The Calibration Secure Code command sets the code, or password required for access to the calibration commands. Calibration security must be disabled in order to change the code string. Before shipping the instrument, the factory sets the code to 'VM3618'. The Query Only works if calibration security is disabled. The code string must be1 to 12 ASCII characters in length, entered 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:CODE #16VM3618 CAL:SEC:CODE?	#16VM3618 *(Returns the currently set security code assuming calibration has been disabled)*

Related Commands	CALibration:SECureSTATe <mode>[,<code>]

CALibration:SECure:STATe

Purpose	Enable or disable calibration security
Type	Instrument specific SCPI
Command Syntax	CALibration:SECureSTATe<mode>[,<code>]
Command Parameters	<mode> = 0 | 1 | ON | OFF <code> = 1 to 12 ASCII character string
***RST Value**	1
Query Syntax	CALibration:SECure:STATe?
Query Parameters	None
Query Response	1 | 0
Description	The calibration constants may not be changed or saved while the CALibration:SECure:STATe is ON. The query returns the current mode. 0 or OFF means values may be stored in non-volatile memory. 1 or ON means values may NOT be stored in non-volatile memory. The code parameter must be present to disable the security (mode of 0) or it generates error -109, "Missing parameter". The value must match the currently programmed security code or it generates error -224, "Illegal parameter value". To enable security, the code parameter is not required, but if it is provided, it will be checked. If the code is given but does not match the current security code, error -224, "Illegal parameter value" will be generated.  **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:STAT 0,#16VM3618 CAL:SEC:STAT?	 0
Related Commands	CALibration:SECure:CODE<code>	

CALibration:STORe

Purpose	Save the current calibration constants into non-volatile memory
Type	Instrument specific SCPI
Command Syntax	CALibration:STORe
Command Parameters	None
***RST Value**	N/A
Query Syntax	None - Command Only
Query Parameters	N/A
Query Response	N/A
Description	The CALibration:SECure:STATe must be OFF before using this 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:STORE	

Related Commands	CALibration<channel>:GAIN<value> CALibration<channel>:ZERO<value> CALibration:DATA <block_data>

CALibration:ZERO

Purpose	Set the calibration constant for the selected channel's offset
Type	Event
Command Syntax	CALibration<channel>:ZERO<value>
Command Parameters	<channel> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 <value> = -32768 to 32767
***RST Value**	Set to values stored in non-volatile memory
Query Syntax	CALibration<channel>:ZERO?
Query Parameters	<channel> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8
Query Response	Returns the currently used calibration value for the specified channel
Description	If CALibration:STORe:AUTO ON is active, the command will save the new constant to the non-volatile memory each time the command is sent. If CALibration:STORe:AUTO OFF is active, a CALibration:STORe command must be executed in order to save the new constant. The CALibration:ZERO command will only function when calibration security is disabled, otherwise an error is generated.  **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)***
	CAL1:ZERO 115	
	CAL1:ZERO?	115

Related Commands	CALibration<channel>:GAIN<value> CALibration:DATA <block_data>

INHOUSE:PSEUDO

Purpose	Controls the use of the register interface
Type	Setting
Command Syntax	INHOUSE:PSEUDO <boolean>
Command Parameters	<boolean> = 0 | 1 | OFF | ON
***RST Value**	N/A
Query Syntax	INHOUSE:PSEUDO?
Query Parameters	N/A
Query Response	ASCII numeric 0 or 1
Description	In House Pseudo, set true says to use the pseudo register interface. Pseudo set false says to use the hardware register interface. The value set takes effect next time the unit powers up - it does not take effect immediately. While pseudo register access is slower than direct register access (about 40 µs compared to 0.5 µs), the module performs the offset and scale associated with the calibration constants. Pseudo register access also allows register read back. The value read back from a register is the value stored in the DAC after the offset and scale operation.

Examples	**Command / Query**	**Response *(Description)***
	INHOUSE:PSEUDO 1	
	INHOUSE:PSEUDO?	1

Related Commands	None

MEMory:SETup

Purpose	Enter a voltage list for manual loading
Type	Instrument specific SCPI
Command Syntax	MEMory:SETup <index>,<voltage_list>
Command Parameters	<index> = 1 to 512 (specifies the array element) <voltage_list> = a list of 8 voltages
***RST Value**	0
Query Syntax	MEMory:SETup? <index>
Query Parameters	<index> = 1 to 512 (specifies the array element)
Query Response	Voltage list separated by commas
Description	The Memory Setup command enters voltage levels into an array. Each VM3618 channel has an associated 512-element "memory" array. The same elements in all eight arrays are loaded at the same time from the supplied 8-element voltage list. The query form of this command returns the voltages at position <index> for all DACs in their respective 512-element array. The format is a set of voltages delimited by commas. The reset value is zero - all elements in the memory array are set to 0 volts.

Examples	**Command / Query**	**Response *(Description)***
	MEM:SET 1,2,3,4,5,2,3,4,5	
	MEM:SET? 1	2.000122,2.999878,4.000244,5.000000, 2.000122,2.999878,4.000244,5.000000

Related Commands	SOURce:VOLTage:SETup <index>

OUTPut:TRIGger:SLOPe

Purpose	Sets the polarity of the output trigger pulse
Type	Setting
Command Syntax	OUTPut:TRIGger:SLOPe <slope>
Command Parameters	<slope> = POSitive | NEGative
***RST Value**	NEG
Query Syntax	OUTPut:TRIGger:SLOPe?
Query Parameters	None
Query Response	<slope> = POS or NEG
Description	The Output Trigger Slope command sets the polarity of the output trigger pulse. For example, if the SLOPe is set for POSitive, the device will generate a positive going pulse whenever a trigger event occurs. The line is held statically low when there is no trigger event. The negative pulse is the default condition.

Examples	**Command / Query**	**Response *(Description)***
	OUTP:TRIG:SLOP POS	*(Selects a positive polarity for the output trigger pulse.)*
	OUTP:TRIG:SLOP?	POS
	OUTP:TRIG:SLOP NEG	*(Selects a negative polarity for the output trigger pulse.)*
	OUTP:TRIG:SLOP?	NEG

Related Commands	OUTPut:TRIGger:TTLTrig OUTPut:TTLTrig:STATe

OUTPut:TRIGger:TTLTrig

Purpose	Selects which VXIbus TTL trigger line will output a trigger pulse
Type	Setting
Command Syntax	OUTPut:TRIGger:TTLTrig<n>
Command Parameters	<n> = 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7
***RST Value**	TTLT0
Query Syntax	OUTPut:TRIGger:TTLTrig?
Query Parameters	None
Query Response	<n> = 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7
Description	The Output Trigger command selects which VXIbus TTL trigger line will output a trigger pulse when the output is enabled.

Examples	**Command / Query**	**Response *(Description)***
	OUTP:TRIG:TTLT 1	*(Selects TTL trigger 1 as output.)*
	OUTP:TRIG:TTLT?	1

Related Commands	OUTPut:TTLTrig:STATe OUTPut:TRIGger:SLOPe

OUTPut:TTLTrig[:STATe]

Purpose	Enables or disables an output trigger pulse to the TTL trigger lines	
Type	Setting	
Command Syntax	OUTPut:TTLTrig[:STATe] <state>	
Command Parameters	<state> = ON | OFF | 1 | 0	
***RST Value**	0 or OFF	
Query Syntax	OUTPut:TTLTrig[:STATe]?	
Query Parameters	None	
Query Response	<state> = 0 | 1	
Description	The Output TTL Trigger State command enables or disables an output trigger pulse onto the VXIbus backplane TTL trigger lines. ON would enable the driving while an OFF would disable it.	
Examples	**Command / Query**	**Response *(Description)***
	OUTP:TTLT ON	*(Enables the TTL trigger bus outputs.)*
	OUTP:TTLT?	ON
Related Commands	OUTPut:TRIGger:TTLTrig OUTPut:TRIGger:SLOPe	

RANGe

Purpose	Set a range of operation
Type	Instrument specific SCPI
Command Syntax	RANGe <range>,<channel_list>
Command Parameters	<range> = 10V | 16V | 20V | 32V | 20mA <channel_list> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8
Reset Value	*RST sets all channels to the 16V range
Query Syntax	RANGe?<channel>
Query Parameters	<channel> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8
Query Response	10V | 16V | 20V | 32V | 20mA
Description	Four voltage range settings are available on the VM3618: two bipolar (±10 V, ±16 V) and two unipolar (0 – 20, 0 – 32). The output pin is referenced to different reference pins depending on the range selected. The 20 mA current range operates per the bipolar configuration. When a unipolar range is used, the OUTPUT*x* pin must be referenced to the RETURN*x* pin, and in a bipolar range, the output pin must be referenced to the GND*x* pin, where '*x*' refers to the channel number. As an example, to get a range out of channel 1, OUTPUT1 (pin 1) must be referenced to RETURN1 (pin 31). Likewise, to get a range of ±10 V on channel 1, OUTPUT1 (pin 1) must be referenced to GND (pin 16). These are floating outputs. GND pins (e.g. pins 15, 30 and 44) are tied to chassis ground and can be used as shields.

Examples	**Command / Query**	**Response *(Description)***
	RANG 32V,(@2)	*(Sets Channel 2 to operate on the 0 to 32 volt range.)*
	RANG? 2	32V (I*ndicates that Channel 2 is set to the 0 to 32 volt range.)*
Related Commands	None	

ROUTe:CLOSe

Purpose	Connect one or more channels with their output pins	
Type	Instrument specific SCPI	
Command Syntax	ROUTe:CLOSe <channel_list>	
Command Parameters	<channel_list> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8	
Reset Value	*RST sets all channels open	
Query Syntax	ROUTe:CLOSe ?<channel>	
Query Parameters	<channel> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8	
Query Response	1 | 0 (1 = close, 0 = open)	
Description	The Route Close command connects the indicated channel(s) to the corresponding front panel connector.	
Examples	**Command / Query**	**Response *(Description)***
	ROUT:CLOS (@2)	*(Connects Channel 2 to its front panel connector.)*
	ROUT:CLOS? 2	1 *(Indicates that the channel is connected to its front panel connector)*
Related Commands	ROUTe:OPEN	

ROUTe:OPEN

Purpose	Disconnect one or more channels from their output pins	
Type	Instrument specific SCPI	
Command Syntax	ROUTe:OPEN <channel_list>	
Command Parameters	<channel> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8	
Reset Value	*RST sets all channels open	
Query Syntax	ROUTe:OPEN? <channel>	
Query Parameters	<channel> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8	
Query Response	1 | 0 (1 = open, 0 = close)	
Description	The Route Open command disconnects the indicated channel(s) from their front panel connectors.	
Examples	**Command / Query**	**Response *(Description)***
	ROUT:OPEN (@2)	*(Disconnects Channel 2 from its front panel connector.)*
	ROUT:OPEN? 2	1 *(indicates that Channel 2 is disconnected from its front panel connector.)*
Related Commands	ROUTe:CLOSe	

SCAN

Purpose	Enable or disable the operation of the scan list function
Type	Instrument specific SCPI
Command Syntax	SCAN <mode>,<channel_list>
Command Parameters	<mode> = 0 | 1 | ON | OFF | LOOP <channel_list> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8
***RST Value**	<mode> = OFF
Query Syntax	SCAN? <channel>
Query Parameters	<channel> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8
Query Response	0 | 1 | LOOP
Description	The Scan command enables or disables the scan list function for a specified channel. For each channel that is enabled, the interrupt routine will load a voltage from its respective scan list arrays at the current array position to the DAC and auto increment the scan list array pointer. If the array pointer equals the limit, then the scan function for that channel will stop, unless the mode of that channel is set to LOOP. LOOP mode means the scan function will reset the array pointer to 0 and continue. **Note**: Legal transitions of SCAN are: OFF to ON ON to OFF OFF to LOOP LOOP to OFF Illegal transitions of SCAN are: ON to LOOP LOOP to ON

Examples	**Command / Query**	**Response *(Description)***
	SCAN ON,(@1:4)	
	SCAN? 2	1

Related Commands	SCAN:LIMit <channel>,<count> SCAN:TABle <channel>:LOCation <number>,<voltage>

SCAN:LIMit

Purpose	Set the scan loop-back limit
Type	Instrument specific SCPI
Command Syntax	SCAN:LIMit <channel>,<count>
Command Parameters	<channel> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 <count> = 1 - 512
***RST Value**	512
Query Syntax	SCAN:LIMit? <channel>
Query Parameters	<channel> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8
Query Response	1 - 512
Description	The Scan Limit command specifies a position in the 512-element scan list array where the interrupt routine loading the DACs should either stop, or loop back to zero.

Examples	**Command / Query**	**Response *(Description)***
	SCAN:LIMIT 2,256	
	SCAN:LIMIT? 2	256

Related Commands	SCAN:MODE <mode>,<channel_list> SCAN:TABle <channel>:LOCation <number>,<voltage>

SCAN:TABLe

Purpose	Enter a voltage list on a per channel basis
Type	Instrument specific SCPI
Command Syntax	SCAN:TABLe <channel>, <value_list>
Command Parameters	<channel> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 <value_list> = 1 - 512 (separated by commas)
***RST Value**	0
Query Syntax	SCAN:TABLe? <channel> [count [,start]]
Query Parameters	<channel> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 <count> = 1 - 512 <start> = 1 - 512
Query Response	A list of values delimited by commas according to the <count> and <start> parameters. If count and start are not specified the entire 512 element scan list will be returned
Description	The Scan Table command loads values into the scan list of a specified channel. These values are then loaded to the DAC from the interrupt routine. This operation is dependent upon the scan mode and the scan limit. Each channel has its own independent mode, limit, scan list array and pointer in the array (some channels could loop back while others continue in the array). <value_list> is a list of values to be loaded into the channel scan list. These are values delimited by commas. The number of values in the list ranges from 1 to 512. <count> is the number of values to be returned. If not specified the entire 512 element scan list will be returned. <start> specifies a point in the 512 element array to begin the returning of values. The reset value is zero; all elements in the array are set to 0 volts on the ±16 volt range.

Examples	**Command / Query**	**Response *(Description)***
	SCAN:TABL1 2,3,4,5 SCAN:TABL? 1 3,2	2.999878,4.000244,5.000000

Related Commands	SCAN:MODE <mode>,<channel_list> SCAN:LIMit <channel> <count>

SCAN:TABLe:LOCation

Purpose	Enter a voltage in a specific location in a list
Type	Instrument specific SCPI
Command Syntax	SCAN:TABLe <channel>:LOCation <number>,<value>
Command Parameters	<channel> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 <number> = A specific location in the scan list array <value> = A single value
***RST Value**	N/A
Query Syntax	SCAN:TABLe<channel>:LOCation? <number>
Query Parameters	<channel> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 <number> = A specific location in the scan list array
Query Response	A single value
Description	The Scan Table Location command allows the value at a specific location in the scan list to be modified or queried.

Examples	**Command / Query**	**Response *(Description)***
	SCAN:TABL1:LOC 2 4	
	SCAN:TABL1:LOC? 2	4.000244

Related Commands	SCAN:MODE <mode>, <channel_list> SCAN:TABLe <channel>, <value_list>

SOURce:CURRent:LEVel

Purpose	Set the output current level of the channels selected by the channel list
Type	Instrument specific SCPI
Command Syntax	[SOURce:]CURRent[:LEVel] <value>,<channel_list>
Command Parameters	<value> = -20.0 to 19.998779 <channel_list> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8
***RST Value**	0 mA
Query Syntax	[SOURce:]CURRent[:LEVel]? <channel>
Query Parameters	<channel> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8
Query Response	-20.0 to 19.998779
Description	The Source Current Level command sets the output current level for a specified channel. The <value> parameter is converted to a 16-bit binary representation used to program the 16-bit DAC.

Examples	**Command / Query**	**Response *(Description)***
	CURR 10,(@1,2,3)	*(Loads Channels 1, 2 and 3.)*
	CURR? 3	10.000000
Related Commands	None	

SOURce:DATA

Purpose	Set the output level of the channels selected by the channel list using the binary data programmed into the 16-bit DAC
Type	Instrument specific SCPI
Command Syntax	[SOURce:] DATA<value>,<channel_list>
Command Parameters	<value> = -32,768V to +32,767V | -16384 to +16383 in 20 mA current range <channel_list> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8
***RST Value**	0
Query Syntax	[SOURce:]DATA?<channel>
Query Parameters	<channel> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8
Query Response	-32,768 V to +32,767 V | -16384 to +16383 in 20 mA current range
Description	The Source Data command programs the 16-bit DAC with the binary value specified. For example, a binary value of -32768 would translate into a voltage level of -16 volts on the ±16-volt range. The range for the value parameter is from -32,768 to +32,767 for all voltage ranges and from -16384 to +16383 for the 20 mA current range. A *RST sets all channels to 0 volts on the ±16 volt range.

Examples	**Command / Query**	**Response *(Description)***
	DATA 8191,(@1,2,3)	*(Loads Channels 1, 2 and 3.)*
	DATA? 3	8191
	DATA 16384,(@7:10)	*(Loads Channels 7, 8, 9 and 10.)*

Related Commands	SOURce:VOLTage:LEVel SOURce:CURRent:LEVel

SOURce:VOLTage:LEVel

Purpose	Set the output voltage level of the channels selected by the channel list
Type	Instrument specific SCPI
Command Syntax	[SOURce:]VOLTage[:LEVel]<value>,<channel_list>
Command Parameters	<value> = The range for the value parameter depends on the range selected <channel_list> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8
***RST Value**	0
Query Syntax	[SOURce:]VOLTage[:LEVel]?<channel>
Query Parameters	<channel_list> = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8
Query Response	The range for the value parameter depends on the range selected
Description	The Source Voltage Level command sets the voltage level for the instrument. Note that the correct range must first be selected. The voltage input parameter is converted to a 16-bit binary representation used to program the 16-bit DACs. A *RST sets all channels to 0 volts on the ± 16 volt range.

Examples	**Command / Query**	**Response *(Description)***
	VOLT:LEV –10,(@1,2,3)	*(Loads Channels 1,2 and 3.)*
	VOLT:LEV? 3	-10.000000
Related Commands	RANGe	

SOURce:SETup

Purpose	Set the output level of all channels using the binary data from a selected location in the scan list	
Type	Instrument specific SCPI	
Command Syntax	SOURce: SETup <index>	
Command Parameters	<index> = 1 to 512	
***RST Value**	N/A	
Query Syntax	None - Command Only	
Query Parameters	None	
Query Response	None	
Description	The Source Setup command loads the DAC from the memory list rather than from an embedded value in an instrument SCPI command, such as SOURce:VOLTage:DATA or from the scan list, which loads from the interrupt routine.	
Examples	**Command / Query**	**Response *(Description)***
	MEM:SET 1,2,3,4,5 SOUR:SET 1	
Related Commands	MEMory:SETup <index>,<value_list>	

TRIGger[:SEQuence][:IMMediate]

Purpose	Causes a trigger event to occur	
Type	Instrument specific SCPI	
Command Syntax	TRIGger[:SEQuence][:IMMediate]	
Command Parameters	None	
Reset Value	N/A	
Query Syntax	None	
Query Parameters	N/A	
Query Response	N/A	
Description	The Trigger Sequence Immediate command causes a trigger event to occur.	
Examples	**Command / Query**	**Response *(Description)***
	TRIG TRIG:SEQ TRIG:IMM TRIG:SEQ:IMM	
Related Commands	*TRG	

TRIGger[:SEQuence]:SLOPe

Purpose	Selects which edge of a triggering signal is the active edge	
Type	Instrument specific SCPI	
Command Syntax	TRIGger[:SEQuence]:SLOPe <slope>	
Command Parameters	<slope> = POSitive | NEGative	
***RST Value**	POS	
Query Syntax	TRIGger:SLOPe?	
Query Parameters	None	
Query Response	POS | NEG	
Description	The Trigger Sequence Slope Command Only applies to the External and TTL trigger sources. It selects which edge of a triggering signal is the active edge.	
Examples	**Command / Query**	**Response *(Description)***
	TRIG:SLOP POS TRIG:SLOP?	 POS
Related Commands	TRIGger[:SEQuence]:SOURce	

TRIGger[:SEQuence]:SOURce

Purpose	Selects the trigger event which updates the DACs on the VM3618
Type	Instrument specific SCPI
Command Syntax	TRIGger[:SEQuence]:SOURce <source>
Command Parameters	<source> = IMMediate | AUTO | EXTernal | INTernal<n> | TTLTrig<n>
***RST Value**	AUTO
Query Syntax	TRIGger[:SEQuence]:SOURce?
Query Parameters	None.
Query Response	IMM | AUTO | EXT | INT 1-8 | TTLT 0-7
Description	The Trigger Sequence Source command sets the trigger source for the instrument. Each DAC is double buffered. Therefore, writing to the DAC (source:voltage:data or source:voltage:level) will require a second event to cause the output voltage to be updated. This command selects the source of the update event. When using SCAN, an EXTernal trigger source or one of the TTLTriggers is required. This command is used to select that source. The following describes each source parameter: IMMediate - All outputs update when this command is processed. This is useful for updating the output voltage for all channels simultaneously. AUTO - A DAC output is immediately updated when the channel is programmed. The second event is not required to update the output voltage. EXTernal - Selects the front panel trigger input and all channels are updated (all other channels wait for the selected channel to update). INTernal <n> - All outputs are updated when the selected channel (<n>) is updated (all other channels wait for the selected channel to update). TTLTrig<n> - All outputs update when the selected TTL trigger line goes active. The valid range for <n> is from 0 to 7.

Examples	**Command / Query**	**Response *(Description)***
	TRIG:SOUR TTLT3 TRIG:SOUR?	 TTLT3
Related Commands	TRIGger:SLOPe <slope>	

INSTRUMENT SPECIFIC COMMANDS

STATus:OPERation:CONDition?

Purpose	Query the Operation Status Condition Register
Type	Required SCPI command
Command Syntax	None - Query Only
Command Parameters	N/A
***RST Value**	N/A
Query Syntax	STATus:OPERation:CONDition?
Query Parameters	None
Query Response	0
Description	The Operation Status Condition Register query is provided for SCPI compliance only. The VM3618 does not alter the state of any of the bits in this register and always reports a 0.

Examples

Command / Query	**Response *(Description)***
STAT:OPER:COND?	0

Related Commands None

STATus:OPERation:ENABle

Purpose	Sets the Operation Status Enable Register
Type	Required SCPI command
Command Syntax	STATus:OPERation:ENABle <NRF>
Command Parameters	<NRF> = numeric ASCII value from 0 to 32767
***RST Value**	N/A
Query Syntax	STATus:OPERation:ENABle?
Query Parameters	None
Query Response	Numeric ASCII value from 0 to 32767
Description	The Operation Status Enable Register is included for SCPI. The register layout is as follows: Bit 0 - Calibrating (not used on the VM3618) Bit 1 - Setting (not used on the VM3618) Bit 2 - Ranging (not used on the VM3618) Bit 3 - Sweeping (not used on the VM3618) Bit 4 - Measuring (not used on the VM3618) Bit 5 - Waiting for trigger (not used on the VM3618) Bit 6 - Waiting for arm (not used on the VM3618) Bit 7 - Correcting (not used on the VM3618)

Examples	**Command / Query**	**Response *(Description)***
	STAT:OPER:ENAB 0	
	STAT:OPER:ENAB?	0

Related Commands	None

STATus:OPERation[:EVENt]?

Purpose	Query the Operation Status Event Register	
Type	Required SCPI command	
Command Syntax	None - Query Only	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	STATus:OPERation[:EVENt]?	
Query Parameters	None	
Query Response	0	
Description	The Status Operation Event Register query is included for SCPI compliance. The register layout is as follows: Bit 0 - Calibrating (not used on the VM3618) Bit 1 - Settling (not used on the VM3618) Bit 2 - Ranging (not used on the VM3618) Bit 3 - Sweeping (not used on the VM3618) Bit 4 - Measuring (not used on the VM3618) Bit 5 - Waiting for trigger (not used on the VM3618) Bit 6 - Waiting for arm (not used on the VM3618) Bit 7 - Correcting (not used on the VM3618)	
Examples	**Command / Query**	**Response *(Description)***
	STAT:OPER?	0
Related Commands	None	

STATus:PRESet

Purpose	Presets the Status Registers	
Type	Required SCPI command	
Command Syntax	STATus:PRESet	
Command Parameters	None	
***RST Value**	N/A	
Query Syntax	None - Command Only	
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	None	

STATus:QUEStionable:CONDition?

Purpose	Query the Questionable Status Condition Register	
Type	Required SCPI command	
Command Syntax	None - Query Only	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	STATus:QUEStionable:CONDition?	
Query Parameters	None	
Query Response	0	
Description	The Questionable Status Condition Register query is provided for SCPI compliance only. The VM3618 does not alter any of the bits in this register and a query always reports a 0.	
Examples	**Command / Query**	**Response *(Description)***
	STAT:QUES:COND?	0
Related Commands	None	

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**	N/A	
Query Syntax	STATus:QUEStionable:ENABle?	
Query Parameters	None	
Query Response	Numeric ASCII value from 0 to 32767	
Description	The Status Questionable Enable command sets the bits in the Questionable Status Enable Register. This command is provided only to comply with the SCPI standard. The Status Questionable Enable query reports the contents of the Questionable Status Enable Register. The VM3618 does not alter the bit settings of this register and will report the last programmed value.	
Examples	**Command / Query**	**Response *(Description)***
	STAT:QUES:ENAB 64 STAT:QUES:ENAB?	 64
Related Commands	None	

STATus:QUEStionable[:EVENt]?

Purpose	Query the Questionable Status Event Register	
Type	Required SCPI command	
Command Syntax	None - Query Only	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	STATus:QUEStionable [:EVENt]?	
Query Parameters	None	
Query Response	0	
Description	The Questionable Status Event Register is provided for SCPI compliance only. The VM3618 does not alter the bits in this register and queries always report a 0	
Examples	**Command / Query**	**Response *(Description)***
	STAT:QUES?	0
Related Commands	None	

SYSTem:ERRor?

Purpose	Query the Error Queue	
Type	Required SCPI command	
Command Syntax	None - Query Only	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	SYSTem:ERRor?	
Query Parameters	None	
Query Response	ASCII string	
Description	The System Error query is used to retrieve error messages from the error queue. The error queue will maintain up to two error messages. If additional errors occur, the queue will overflow and the second and 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.	
Examples	**Command / Query**	**Response *(Description)***
	SYST:ERR?	-350,"No error"
Related Commands	None	

SYSTem:VERSion?

Purpose	Query which version of the SCPI standard the module complies with	
Type	Required SCPI command	
Command Syntax	None - Query Only	
Command Parameters	N/A	
***RST Value**	N/A	
Query Syntax	SYSTem:VERSion?	
Query Parameters	None	
Query Response	Numeric ASCII value	
Description	The System Version query reports version of the SCPI standard with which the VM3618 complies.	
Examples	**Command / Query**	**Response *(Description)***
	SYST:VERS?	1996.0
Related Commands	None	

SECTION 5

THEORY OF OPERATION

INTRODUCTION

The VM3618 instrumentation module provides eight independent digital-to-analog converter (DAC) channels with 16 bits of resolution. Each channel consists of an independent DAC combined with its own instrumentation amplifier (see Figure 5-1 below).

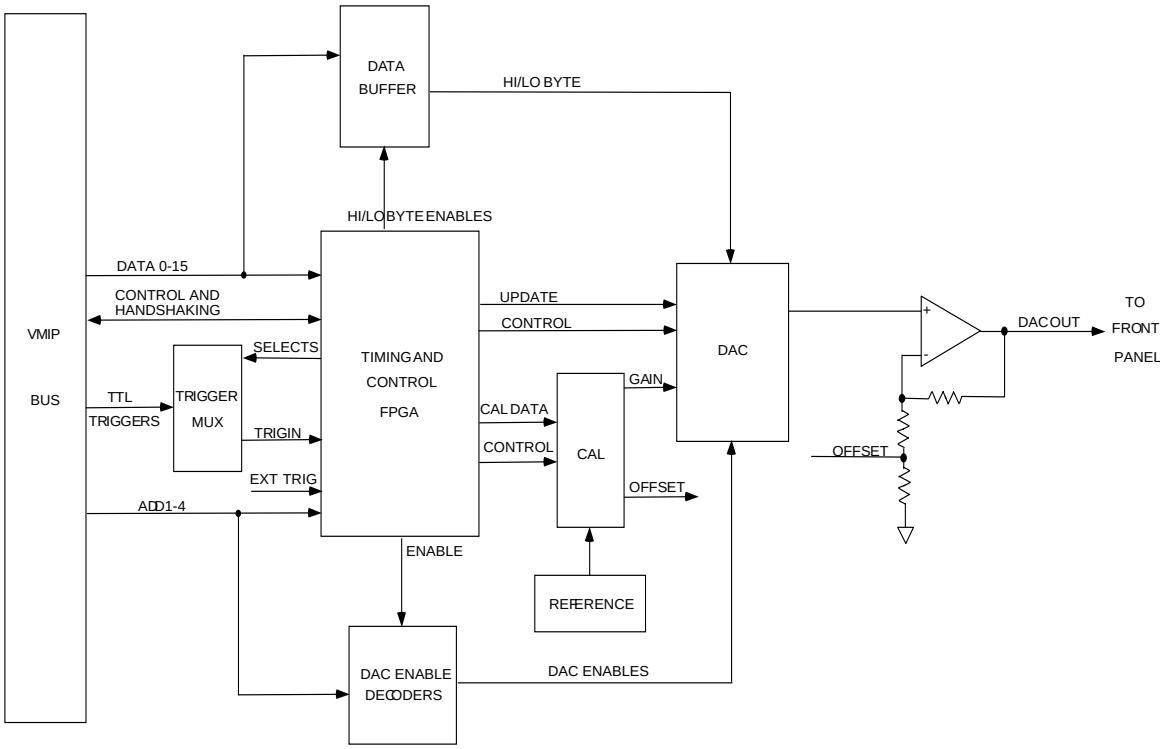


FIGURE 5-1: VM3618 FUNCTIONAL BLOCK DIAGRAM

Each channel has a separate 512 value scan list that is user definable. This list may be started from and stopped at any one of the 512 locations. For further capabilities, the VM3618 scan lists can be looped to output repetitive values.

The output data is converted when a trigger event occurs from one of the three following methods:

1. Trigger source from the front panel input: This input is TTL compatible and is edge sensitive. The unit may be programmed to trigger on either the rising or the falling edge of this signal.

2. Trigger source from the VXI TTL trigger bus: Any one of the eight TTL trigger bus lines may be selected as the trigger source. The unit may be programmed to trigger on either the rising or the falling edge of this signal.

3. Trigger upon receipt of a word serial command: When this mode is selected, the DACs will transmit when a word serial command is received by the instrument.

The trigger event causes all enabled channels to convert simultaneously.

The calibration constants used to correct the data values are stored in non-volatile memory. The constants are determined when the instrument is calibrated and can be changed as necessary (such as during routine calibration cycles or when the user selects a new gain setting and wishes to set the gain accurately). The constants may also be queried at any time via a word serial query and altered via a word serial command. All calibration is done using calibration DACs to adjust the gain and offset of each channel. This eliminates the need for removing covers from the unit and allows for automated calibration.

INTERFACE AND CONTROL FPGA

The interface FPGA controls all functions needed to interface with the VMIP host. The interface FPGA receives addresses and data from the VMIP bus for enabling and loading the DACs (see Figure 5-2). The interface and control FPGA enables the DAC enable decoders to decode address bits 1 - 4. The outputs of the DAC enable decoders (DACENABLE) are routed to the specified DACs. The interface and control FPGA provides the HI byte (HBENA) and LO byte (LBENA) enable signals that are used in loading the DACs. Data bits 0 - 15 are placed on the data bus by the VMIP host. The interface and control FPGA will then output a LBENA signal to the data buffer mux and to all DACs. This causes the data buffer mux to output data bits 0 - 7 (DB0-7) to all DACs and the enabled DACs to latch in the data. The interface and control FPGA will then output a HBENA signal to the data buffer mux and to all DACs. This causes the data buffer mux to output data bits 8 - 15 (DB0-7) to all DACs and the enabled DACs to latch in the data.

The interface FPGA also contains the trigger logic that monitors the VXI backplane TTL trigger, the external trigger and internal trigger lines. The interface and control FPGA will select which of the 8 VXI TTL trigger lines are to be used. The FPGA will output to the trigger mux three select lines that are decoded by the trigger mux. An external trigger line from the front panel is routed directly to the FPGA and does not go through the trigger multiplexer. The interface FPGA will determine which edge of the desired trigger is to be used based on the users programming.

The interface and control FPGA will initiate an UPDATE signal to the DAC when the specified trigger has been received thus latching the data into the DACs internal register and causing the DACs to convert. The outputs of the DACs are routed through their respective amplifiers, as all DACs have independent amplifiers, and on to the front panel. All DAC outputs use a predefined offset for nulling conversion errors.

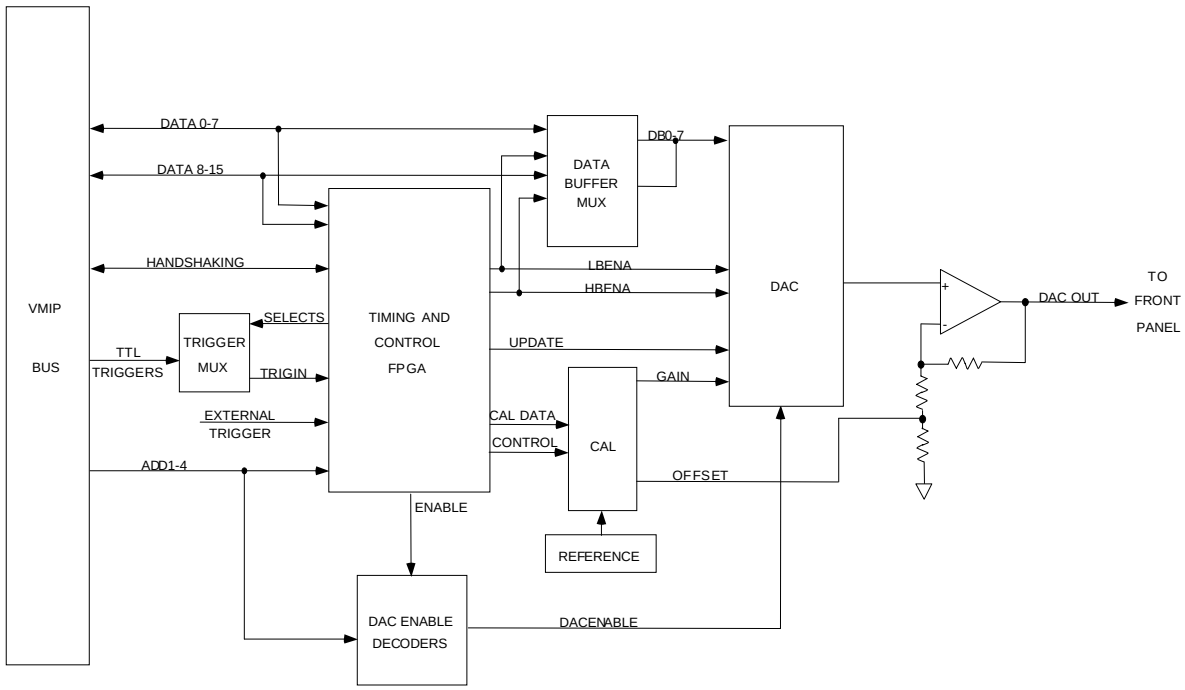


FIGURE 5-2: INTERFACE AND CONTROL FPGA FUNCTIONAL DIAGRAM

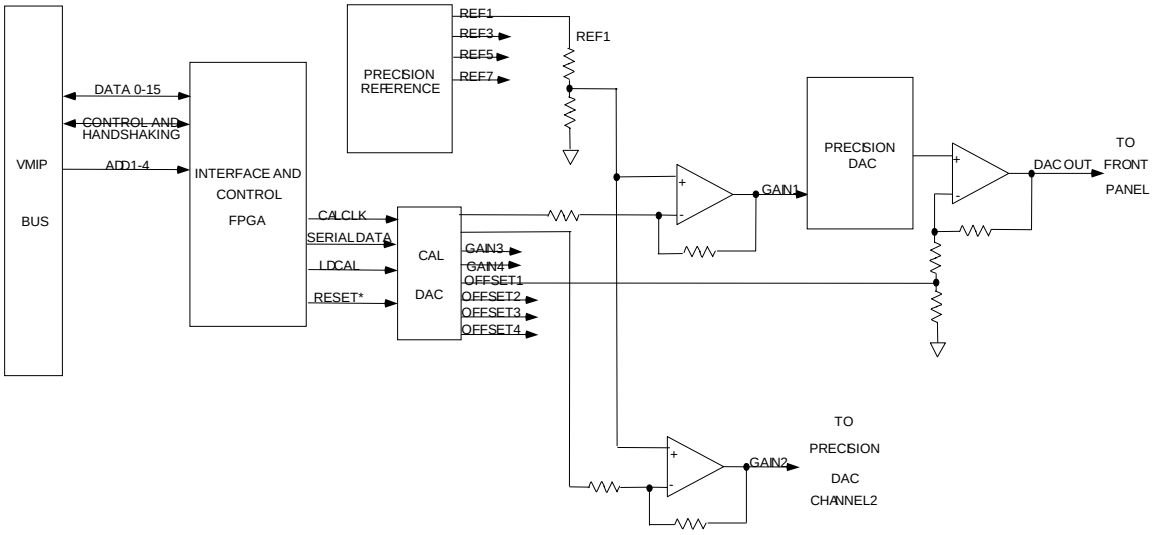


FIGURE 5-3: REFERENCE AND CALIBRATION FUNCTIONAL DIAGRAM

REFERENCE AND CALIBRATION

The calibration circuitry contains a precision voltage reference, calibration DACs, and an instrumentation amplifier. The calibration DACs are group to four channels with each channel having its own unique instrumentation amplifier. Channels 0 - 3 share one calibration DAC, Channels 4 - 7 share another and so on. All channels share the precision voltage reference.

The calibration logic resides in the interface and control FPGA. This logic will receive the parallel calibration data from the VMIP bus, convert the parallel data to serial, generate the appropriate clock and load control signals to the calibration DACs (see Figure 5-3). The calibration DACs output signal GAIN#, where # is a specific channel, is routed to the precision DAC as the reference for the conversion cycles. The calibration DACs output signal OFFSET#, is routed to the precision DAC instrumentation amplifier for feedback correction of errors in the amplifier.

INDEX

V

W