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Multifunctional*Plus* Measurement and Control Module

Features

- Comprehensive Signal Conditioning On-Board
- Wide Choice of Input/Output Signal Types
- Powerful Control Capability
- On-board Data Reduction and Engineering Unit Conversion
- Custom On-board DSP Program Development

Overview

The VXI Technology VT1419A Multifunction^{Plus} Measurement and Control module is a C-size, single slot, register-based VXI module. It is ideal for mixed sensor and mixed signal data acquisition and control for design verification of electromechanical components and assemblies.

The flexibility in configuring with multiple Signal Conditioning Plug-ons (SCPs) allows for multiple test setups of mixed signals, both input and output, without adding extra VXI measurement modules. The integrated signal conditioning provides for more accurate and repeatable calibration and eliminates the need for separate signal conditioning carriers. The intelligent measurement and control allows for scaleable configurations, on-board Engineering Unit (EU) conversion, and real-time decision making.

Refer to the VXI Technology Website for instrument driver availability and downloading instructions, as well as for recent product updates, if applicable.

Compact Packaging with Signal Conditioning

The VT1419A provides for configurable signal conditioned I/O with up to eight individual plug-ons for analog, digital, and frequency needs. The SCPs supported by the VT1419A are:

- VT1501A 8-channel Direct Input SCP
- VT1502A 8-channel 7 Hz Low-pass Filter SCP
- VT1503A 8-channel Programmable Filter and Gain SCP
- VT1505A 8-channel Current Source SCP
- VT1506A 8-channel 120 Ω Strain Completion & Excitation SCP
- VT1507A 8-channel 350 Ω Strain Completion & Excitation SCP
- VT1508A 8-channel x16 Gain & 7 Hz Fixed Filter SCP
- VT1509A 8-channel x64 Gain & 7 Hz Fixed Filter SCP
- VT1510A 4-channel Sample & Hold Input SCP
- VT1511A 4-channel Transient Strain SCP
- VT1512A 8-channel 25 Hz Fixed Filter SCP
- VT1513A 8-channel Divide-by-16 Fixed Attenuator & 7 Hz Low-pass Filter SCP
- VT1518A 4-wire Resistance Measurement SCP
- VT1521 4-channel High-Speed Bridge SCP
- VT1531A 8-channel Voltage Output SCP
- VT1532A 8-channel Current Output SCP
- VT1533A 16-bit Digital I/O SCP
- VT1536A 8-bit Isolated Digital I/O SCP
- VT1538A Enhanced Frequency/Totalize/PWM SCP

Wide Choice of Inputs/Outputs

The VT1419A has a variety of signal conditioning plug-ons for making measurements of:

- Temperature, strain
- Voltage, current, resistance
- RPM, frequency, totalize
- Discrete levels, TTL, contact closures

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Multifunctional*Plus* Measurement and Control Module

In addition, the measured input values and the calculated output values can be stored in a 64,000-sample FIFO buffer and efficiently transferred to the controlling computer in blocks of data. A 500-element current value table is provided so user-written programs can post the latest reading or condition to the controlling computer. The result of any program calculation can be an input for use by another program or subsystem, or it can be a direct output of several different types. Among the choices of output are:

- Analog voltage
- Analog current
- Discrete levels (TTL)
- Programmable pulse width modulation (TTL)

As an example of output flexibility, the pulse width modulation output has several modes. In the PWM free-run mode, the frequency or pulse width output is independent of the update rate and can be changed once per loop update cycle. The square wave mode provides a variable frequency, fixed 50% duty cycle output signal. The pulse-per-update mode provides a variable width pulse synchronized to the update cycle.

Powerful Decision Making Capability

The user-written programs are easily developed from a list of algebraic expressions and flow constructs such as IF-THEN-ELSE. Any variable (array or scalar) can be read or written on-the-fly. That is, new values are double-buffered so there is no need to stop scanning the inputs or halt the program execution.

The inputs to user programs can be measured values from multiple channels, operator input values, global variables from other programs, or values from other subsystems. The on-board DSP provides highly deterministic execution, making it easy to accurately predict cycle times. Engineering unit conversions for temperature, strain, resistance, and voltage measurements are made automatically without slowing down the algorithm execution speed.

Custom Program Development

Language: subset of C, including if-then-else, most math and comparison operations.
Variable types: scalar local and global variables, array local and global variables.
Intrinsic functions: interrupt( ), writefifo( ), writecvt( ), writeboth( ), min( ), max( ), abs( ).

Other functions: create your own custom functions to handle transcendental operations.

Other Features

Automated Calibration for Better Measurements

The VT1419A offers superior calibration capabilities that provide more accurate measurements. Periodic calibration of the measurement and control module's measurement inputs is accomplished by connecting an external voltage measurement standard (such as a highly accurate multimeter) to the inputs of the measurement and control module. This external standard first calibrates the on-board calibration source. Then built-in calibration routines use the on-board calibration source and on-board switching to calibrate the entire signal path from the measurement and control module's input, through the signal conditioning plug-ons (SCPs) and FET MUX, to the A/D itself. Subsequent daily or short-term calibrations of this same signal path can be quickly and automatically done using the internal calibration source to eliminate errors introduced by the signal path through the SCPs and FET MUX, or by ambient temperature changes. All input channels can be quickly and productively calibrated to assure continued high-accuracy measurements.

In addition to the calibration of the signal path within the measurement and control module, the VT1419A allows you to perform a "Tare Cal" to reduce the effects of voltage offsets and IR voltage drops in your signal wiring that is external to the measurement and control module. The Tare Cal uses an on-board D/A to eliminate these voltage offsets. By placing a short circuit across the signal or transducer being measured, the residual offset can be automatically measured and eliminated by the D/A. Tare Cal should not be used to eliminate the thermoelectric voltage of thermocouple wire on thermocouple channels.

Signal Conditioning Plug-Ons

A Signal Conditioning Plug-on (SCP) is a small daughter board that mounts on VXI Technology's VXI scanning measurement and control modules. These SCPs provide a number of input and output functions. Several include gain and filtered analog inputs for measuring electrical and sensor-based signals, as well as frequency, total event count, pulse-width modulation, toothed-wheel velocity, and digital state. Output functions include analog voltage and current D/As, 8- or 16-bit digital outputs, pulse output with variable frequency and PWM, and stepper motor control.

Refer to the information on each individual SCP for more details.

Voltage Measurements

Use any of the following SCPs with the VT1419A to make voltage measurements: VT1501A, E1502A, VT1503A, VT1508A, VT1509A, VT1512A, or VT1513A.

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Temperature Measurements

Any of the input SCPs can be used to make temperature measurements with thermocouples, thermistors, or RTDs, but the VT1503A/VT1508A/VT1509A SCPs provide higher accuracy with thermocouples.

Resistance Measurements

Resistance is measured using either the VT1505A 8-channel Current Source SCP and an input SCP or the VT1518A 4-wire Resistance Measurement SCP. Measurements are made by applying a dc current to the unknown and measuring the voltage drop across the unknown.

Static Strain Measurements

The VT1506A and VT1507A SCPs provide a convenient way to measure a few channels of static strain. When using the VT1506A/VT1507A for Bridge completion, a second SCP is required to make the measurement. You can use the following SCPs for this type of static strain measurements:

- VT1503A 8-channel Programmable Filter/Gain SCP
- VT1506A 8-channel 120 Ω Strain Completion & Excitation SCP
- VT1507A 8-channel 350 Ω Strain Completion & Excitation SCP
- VT1508A 8-channel 7 Hz Fixed Filter & x16 Gain SCP
- VT1509A 8-channel 7 Hz Fixed Filter & x64 Gain SCP

For applications requiring large channel counts of strain measurement, the EX1629 provides a more cost effective approach to static (and dynamic) strain measurements.

Transient Measurements

When making higher speed measurements, a vital issue often is the time skew between channels. Ideally, in many applications, the sampled data is needed at essentially the same instant in time. The intrinsic design of the VT1419A provides scanning of 64 channels with maximum skew of 640 µs between the first and last channel, far less than most sampled data systems.

Transient Voltage Measurements

The VT1510A provides basic sample-and-hold capabilities on four channels. Six-pole Bessel filters provide alias and alias-based noise reduction while giving excellent transient response without overshoot or ringing. The VT1510A can be used in strain applications primarily where the bridge is external.

Transient Strain Measurements

The VT1511A, a double-wide SCP, has all the capabilities of the VT1510A but adds on-board bridge excitation and completion functions. The four direct input channels are used for monitoring the bridge excitation. A maximum of two SCPs (8 channels) can be installed on an VT1419A. Note: For field wiring, the use of shielded twisted pair wiring is highly recommended.

Analog Output

Use the VT1531A for voltage outputs and the VT1532A for current outputs. The VT1531A and VT1532A have eight (8) output channels available on each SCP.

Digital I/O

Use the VT1533A Digital I/O SCP to provide two 8-bit input/output words. Use the VT1536A Digital I/O SCP to provide one isolated 8-bit input/output word.

Frequency/Totalize/PWM

The VT1538A Enhanced Frequency/Totalize/PWM SCP provides eight (8) channels which can be individually configured as a frequency or totalizer input, or as a pulse width modulated output.

Product Specifications

Timing Signals

Timing:	Scan-to-scan timing and sample-to-sample timing can be set independently.
Scan triggers:	Can be derived from a software command or a TTL level from other VXI modules, internal timer, or external hardware. Typical latency 17.5 µs.
Synchronization:	Multiple VT1419A modules can be synchronized at the same rate using the TTL trigger output from one VT1419A to trigger the others.
Alternate synchronization:	Multiple VT1419A modules can be synchronized at different integer-related rates using the ALG:SCAN:RATIO command and the TTL trigger output from one VT1419A module to trigger the others.
Scan Triggers Internal:	100 µs to 6.5536 s

Acquisition

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Resolution:	100 µs
Trigger count:	1 to 65535 or infinite
Sample Timer Range:	10 µs to 32768 ms
Resolution:	0.5 µs

Measurement Specifications

The following specifications include the SCP and scanning A/D performance together as a unit. Accuracy is stated for a single sample. Averaging multiple samples will improve accuracy by reducing noise of the signal. The basic VT1419A scanning A/D has a full-scale range of ±16 V and five auto-ranging gains of x1, x4, x16, x64, and x256. An SCP must be used with each eight channel input block to provide input protection and signal conditioning.

Note: For field wiring, the use of shielded twisted pair wiring is highly recommended.

Measurement resolution:	16 bits (including sign)
Maximum reading rate:	Up to 56 kSamples/s dependent upon configuration
Memory:	64 kSamples
Maximum input voltage:	Normal mode plus common mode
Operating:	<±16 V peak
Damage level:	>±42 V peak
Maximum common mode voltage:	
Operating:	< ±16 V peak
Damage level:	>±42 V peak
SCP input impedance:	>100 MΩ differential
Maximum tare cal offset:	65.5 mV range ±75% of full scale, other ranges ±25% of full-scale

Jitter:

Phase jitter scan-to-scan:	80 ps rms
Phase jitter card-to-card:	41 ns peak, 12 ns rms

Measurement Accuracy

Typically ±0.01% of input level; varies with the SCP used. Specifications are 90 days, 23 °C ± 1 °C, with *CAL done after a1hr warm-up and CAL:ZERO done within 5 minutes. Note: Beyond the 5min. limitation and CAL:ZERO not done, apply the following drift error: Drift = 10 V/°C ÷ SCP gain, per °C change from CAL:ZERO temperature.

Accuracy Data

Measurement accuracy is dependent upon the SCP module used. Refer to the accuracy tables and graphs for the individual SCP to determine the overall measurement accuracy.

Many definitions of accuracy are possible. Here, we use single-shot with 3 sigma noise. To calculate accuracy assuming temperature is held constant within ±1 °C of the temperature at calibration, the following formula applies:

$$\text{Single Shot } 3\sigma = \pm(\sqrt{((\text{GainError})^2 + (\text{OffsetError})^2 + (3\sigma \text{ noise})^2})$$

Correcting for Temperature

To calculate accuracy over temperature range outside the ±1° C range, results after *CAL are given by replacing each of the above error terms as follows:

Replace
$(\text{GainError})^2$
with
$(\text{GainError})^2 + (\text{GainTempco})^2$

Replace
$(\text{OffsetError})^2$
with
$(\text{OffsetError})^2 + (\text{OffsetTempco})^2$

Power Available for SCPs

±24 V:	1.0 A
5 V:	3.5 A

General Specifications

VXI device type:	A16, slave only, Register based
Size:	C
Slots:	1
Connectors:	P1/2
VXI buses:	TTL Trigger bus
Drivers:	VXI*plug&play* with Source Code

Instrument Drivers - See the VXI Technology Website www.vxitech.com for driver availability and downloading.

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Ordering Information

VT1419A	Multifuntion Plus measurement and control module
VT1419A-001	Delete 4 Direct Input SCPs
VT1419A-011	Screw Terminal Block
VT1419A-013	Spring-Clamp Terminal Block
VT1419A-A3F	Interface to Rackmount Panel
VT1501A**	8-channel Direct Input SCP
VT1502A**	8-channel 7 Hz Low-pass Filter SCP
VT1503A	8-channel Programmable Filter/Gain SCP
VT1505A	8-channel Current Source SCP
VT1506A	8-channel 120 Ω Strain Completion & Excitation SCP
VT1507A	8-channel 350 Ω Strain Completion & Excitation SCP
VT1508A**	8-channel x16 Gain & 7 Hz Fixed Filter SCP
VT1509A**	8-channel x64 Gain & 7 Hz Fixed Filter SCP
VT1510A	4-channel Sample & Hold Input SCP
VT1511A	4-channel Transient Strain SCP
VT1512A**	8-channel 25 Hz Fixed Filter SCP
VT1513A**	8-channel ÷ 16 Fixed Attenuator & 7 Hz Low-pass Filter SCP
VT1518A	4-wire Resistance Measurement SCP
VT1521	4-channel High Speed Bridge SCP
VT1531A	8-channel Voltage Output SCP
VT1532A	8-channel Current Output SCP
VT1533A	16-bit Digital I/O SCP
VT1536A	8-bit Isolated Digital I/O SCP
VT1538A	Enhanced Frequency/Totalize/PWM SCP

[1] Note: No terminal block is included with the VT1419A. You must specify a terminal block option when ordering.

[2] Note: A total of eight (8) Signal Conditioning Plug-ons (SCPs) can be installed in multiple combinations of input or output configurations on a single VT1419A. The first four positions support only the non-programmable analog input SCPs (marked with asterisks [**] in the Ordering Information table). The VT1419A is shipped preconfigured with the VT1501A direct inputs in the first four SCP positions. Any non-programmable input SCP marked with asterisks (**) may be substituted by ordering Option 001 with the VT1419A, then purchasing the SCP separately.

For More Information

For more information on individual SCPs, refer to the corresponding catalog pages for those products, or contact VXI Technology to request individual data sheets.

ACCESSORIES

73-0025-002 Option 011 Screw Terminal Connector Block

73-0025-003 Option 013 Spring Clamp Terminal Connector Block

73-0025-004 Option A3F Interface to Rackmount Terminal Panel



Acquisition

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