

# EX1402



## FEATURES

- > 16-channel Isolated voltage Measurements
- > 24-bit SAR ADC per Channel
- > 128k samples/second/channel Sample Rate
- > 500V channel-ground isolation
- > 1000V channel-channel isolation
- > Input voltage ranges peak:  $\pm 420\text{V}/\pm 10\text{V}/\pm 1\text{V}$
- > Data logger acquisition mode
- > 3-Pin screw terminal Input Connector
- > LXI Ethernet Interface
- > IEEE-1588 Synchronization
- > Power over Ethernet (PoE+) or 12– 50 V DC input
- > Simultaneous Data Streaming
- > 8-bit bank isolated digital I/O
- > Full-featured Embedded Web Interface
- > Compact 1U Half-rack Form Factor

## 16-CHANNEL ISOLATED HIGH VOLTAGE MEASUREMENT INSTRUMENT

## APPLICATIONS

*BATTERY AND FUEL CELL TEST*

*DATA ACQUISITION*

*GAS TURBINE TEST*

*HALT/HASS*

*HEALTH MONITORING*

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# EX1402 16-CHANNEL ISOLATED HIGH VOLTAGE MEASUREMENT INSTRUMENT



## EX1402 Precision, Isolated High Voltage Measurements

The AMETEK VTI Instruments EX1402 adds isolation and high-speed measurement capability to the popular EX1400 Series of instruments, an advanced, full-featured data acquisition family designed to acquire precision data from voltage sensors. The EX1402 delivers accurate and highly repeatable voltage measurements by implementing fully integrated signal conditioning, 24-bit ADC's, on a per-channel basis. With industry-leading sample rates of 128 kSa/s/channel, the EX1402 is well-suited for a wide range of applications that require maximum accuracy, flexible sampling rates, and protection against damaging voltage levels. Enhanced power options, including AC, DC, and PoE+, adapt to virtually any application requirement while the stand-alone data logging and parallel data streaming capabilities break new ground for performance and flexibility.

## Scalable for High-Speed Synchronized Data Acquisition

In addition to the core set of features, the EX1402 integrates Extended Functions as defined in the LXI specifications to provide box-to-box synchronization to precisely correlate acquired data as well as timestamping of data and LAN Event Messaging that facilitate intermodule communication and flexible triggering options over Ethernet, thereby eliminating overhead normally attributed to application software running on the host controller. The EX1402 supports easy integration and synchronization of multiple devices through the IEEE-1588 v2 Precision Time Protocol standard for synchronization, providing an architecture that can be scaled from 10s to 1000s of channels.

Multiple boxes can be easily distributed extremely close to the measurement points of interest reducing the run length of analog cable and minimizing errors induced by noisy environments. Additionally, Power Over Ethernet (PoE+) enables a single cable to be used for both power and data capture. All measurement data is returned with IEEE-1588 timestamp values with typical accuracies of <200nS ensuring that data is tightly correlated across the test article.



### LXI – The Industry Standard for Ethernet Instrumentation

Created in 2004 and adopted by the test and measurement industry in 2005, LXI (LAN Extensions for Instrumentation) defines a core set of capabilities that ensure compliant devices interact consistently in an instrumentation network. As an LXI-certified device, the EX1402 provides the convenience of LAN communications and control with features such as an embedded web page for monitor and control and a consistent means of identification on the network. Connect the device directly to your network using industry-standard cables with the assurance that it will be a trusted and proven ‘network citizen.’

### Isolated Measurements

Challenging measurement environments such as areas with a high level of electrical noise or where transient power surges can occur require unique protection capabilities in order to safeguard against common-mode noise or ground loop problems. The EX1402 provides exceptional input protection and isolation across a wide range of operating conditions, protecting the instrument from harmful voltages while ensuring measurement integrity. The Ethernet communications interface and input power are isolated from the analog front end inputs.

### Self-Test

Manufacturing and test environments of today are dynamic, dictating minimal downtime of test systems in order to meet increasing product throughput demands. Ensuring that acquired data is reliable and instrument calibration can be turned around quickly are keys to the success of any production team. VTI embeds intelligence into the EX1402 to facilitate maximum system ‘uptime’ and increase manufacturing efficiency. Built-in self-test can be invoked under software control prior to each critical test. A simple pass-fail result will be returned after completing system health diagnostics, including temperature and voltage level measurements of the on-board processor and can be used to prevent a test from running in the event of a failure.

# EX1402 16-CHANNEL ISOLATED HIGH VOLTAGE MEASUREMENT INSTRUMENT

## 1. Performance Specifications

All specifications are typical (stated at the 95% confidence interval at 23°C ±5°C) unless otherwise stated.

GENERAL SPECIFICATIONS	
Number of Channels	16 Isolated and fully differential inputs
Input Power Requirements	Input Voltage: 12V to 50V DC, must be isolated to 1500Vrms Power (AUX): 12.5 W typical, 15 W max 1PoE+ Power: 12.5 W typical, 15 W max
Channel Input Type	Voltage
Voltage Input Range	±420 V, ±10.0 V, ±1.0 V (Peak)
Input Overvoltage Protection	Up to ±450V peak between the two terminals of analog channel
Input Impedance	2 MΩ differential 1MΩ Single Ended
Input Coupling	DC only
Input Connector	3-pin Screw Terminal from TE connectivity.
Accuracy - Typical	± (% of reading + offset) 1V Range: ± [(0.03%+9PPM/°C)Rdng + 0.002%Rng + 2μV/°C] 10V Range: ± [(0.03%+10PPM/°C)Rdng + 0.002% Rng+ 5μV/°C] 420V Range: ± [(0.05%+25PPM/°C)Rdng + 0.002% Rng+ 66μV/°C]
Power Input Protection	±50V and reverse polarity
Fan Control Logic	Variable speed FAN controls for improved measurement accuracy/stability

Specifications subject to change without notice.

## GENERAL SPECIFICATIONS

Isolation – Analog Inputs	Insulation, Compliant to EN 61010-1:2010/A1:2019 and IEC 61010-2-030:2021, Pollution degree II, Material IIIa, Altitude < 3000m, Over-voltage Category I, applicable for secondary circuits derived from the Mains Input Channel to Ground: $\pm 500$ V Peak continuous working voltage Input Channel to Channel: $\pm 1000$ V Peak continuous working voltage between channels
Common Mode Rejection Ratio (CMRR)	-100dB typical at 1kHz Signal
Channel To Channel Crosstalk	-115 dB Typical at 1kHz Signal
Total Harmonic Distortion (THD)	-85 dB Typical at 1kHz Signal
Supported Sampling Rate	Support Sample Rates: Programmable up to 128k SPS with filtered Decimation from 128k, 102.4k, 100k, 78.125k, 65.536k, 39.0625k SPS Accuracy: $\pm 100$ PPM
Programmable Digital Filters	None (No Filter): Raw data High Performance (FIR): 1 to 16 number of /2 stages (Selectable & Customizable) Low Latency (CIC): /4 to /8192 (Selectable) Medium Latency (CIC+CFIR): Low latency CIC filter, followed by /4 FIR Filter (Customizable) Post Filter Blind Divider: 1 - 65536 (selectable)
Passband Ripple	$< \pm 0.005$ dB over the passband of $0.45 * \text{Sample Rate}$

Specifications subject to change without notice.

## CLOCK AND TRIGGER SPECIFICATIONS

Electrical Specifications	Maximum Input Voltage: -0.5V to 5.5V, ESD protected Input Impedance: 50 Ohm series terminated with a 10k Ohm pulldown resistor Minimum Input Pulse Width: 1 $\mu$ s Minimum Output Pulse Width: 10 MHz $V_{IL} < 0.8V$ $V_{IH} > 3.5V$ $V_{OL} < 0.65V @ 32 \text{ mA}$ $V_{OH} > 3V @ 32\text{mA}$ $I_{MAX} < 50\text{mA max}$
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Specifications subject to change without notice.

# EX1402 16-CHANNEL ISOLATED HIGH VOLTAGE MEASUREMENT INSTRUMENT

## DIO SPECIFICATIONS

Number of DIO Channels	8 Isolated Digital input and Output channels
Electrical Specifications	Maximum Input Voltage: -0.5V to 5.5V, ESD protected Input Impedance: Signal is pulled low by a 10k Ohm resistor Minimum Input Pulse Width: 100 $\mu$ s Minimum Output Pulse Width: 100 $\mu$ s, updated synchronously with the ADC sampling, prior to decimation $V_{IL}^*$ : < 0.8V $V_{IH}^*$ : > 2.0V $V_{OL}^*$ : < 0.55V @ 10 mA $V_{OH}^*$ : > 2.0 V @ 10 mA $I_{MAX}^*$ : 10mA max per channel, 20mA max per bank
Connector	9 pin standard D-Sub Female socket

Specifications subject to change without notice.

## USB 2.0: A USB 2.0 HOST CONTROLLER INTERFACE IS IMPLEMENTED

Speeds	USB full speed (480Mbps)
Connector	USB Type A

## NETWORK / DATA PORT

Connection	10/100 Base-T (auto MDI-X)
Connector	RJ-45

**ENVIRONMENTAL SPECIFICATIONS FOR EX1402**

<b>Operating Location</b>	This module should be operated indoors in a controlled environment, protected from exposure to the elements (i.e. direct sunlight, precipitation, wind, etc.)
<b>Input Connectors</b>	Voltage: 3POS TERM BLOCK HDR 3POS Clock & Trigger: SMB
<b>Dimensions</b>	1.68" H x 8.69" W x 10.00" D (all dimensions are in inches)
<b>Reliability</b>	MTBF: > 225,000 hours Methodology: Telcordia (Bellcore) SR-332, Issue 3 Environment = GB, Quality Level = II, 25C ambient environment, 90% UCL
<b>Weight</b>	4.7 lbs (2.1 kg)
<b>Temperature</b>	Operating: 0 °C to +50 °C Storage: -40 °C to +80 °C
<b>Humidity Operating</b>	5% – 95% (non-condensing)
<b>Altitude</b>	Up to 3000 Meters
<b>Shock and Vibration</b>	Conforms to MIL-PRF-28800 Class 3
<b>CE Compliance</b>	EMC EN 61326 Class A, Criteria A
<b>Creepage and Clearance Calculations</b>	Pollution degree 2, Material IIIa (PCB), and an altitude up to 3000

Specifications subject to change without notice.

**ORDERING INFORMATION**

<b>70-0691-000R</b>	EX1402, 16-Channel Isolated High Voltage Measurement Instrument
<b>56-0739-120R</b>	EX14XX AC/DC Power Supply, 120W, PSE Certified
<b>56-0739-000R</b>	EX14XX AC/DC Power Supply 60W
<b>70-0626-900R</b>	EX14XX-RK001, Rack Mount Kit
<b>41-0620-015R</b>	EX14XX Rack Mount Filler Panel



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