

DATA SHEET



# RX0124

24 CHANNEL HIGH PERFORMANCE  
BRIDGE MEASUREMENTS

## APPLICATIONS

Gas Turbine measurements  
Strain Gage Health Monitoring in Harsh Environments

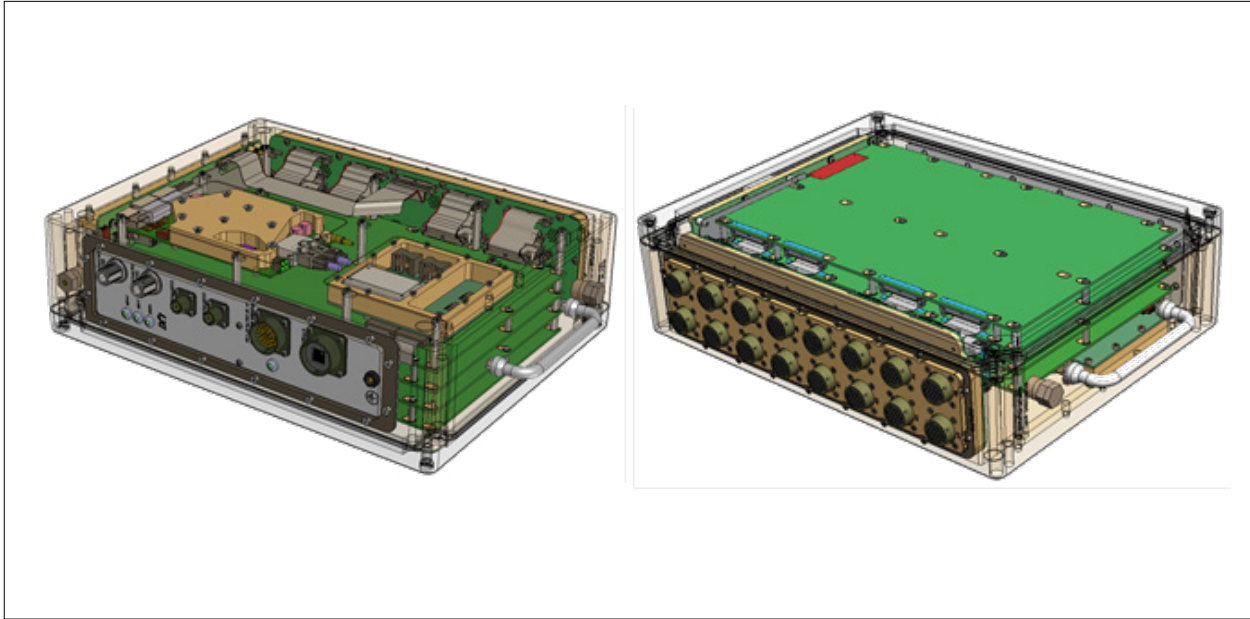
## OVERVIEW

24 Channel Bridge/Strain gage measurements  
Designed to support both Dynamic and Static bridge measurements  
128 Ksa/Sec with 24 bit ADC per channel for high resolution data and wide dynamic range  
Precise synchronization of measurements in a distributed environment through IEEE-1588  
Rugged design; -20°C to +60°C operating range  
IP66 rated  
GigE Ethernet connectivity via LXI industry standard

## SOFTWARE DRIVERS

IVI-COM, IVI-C, Linux drivers

Specifications contained within this document are subject to change without notice



RX0124 - INTERNAL VIEW

## OVERVIEW

The RX0124 is part of VTI's RX0XXX family of rugged instruments with built in sensor signal conditioning. The RX0124 is designed to address all strain/bridge measurement requirements for use in a harsh test cell environment. All connections and operations are designed for rugged operation by using Mil-Grade connections for all inputs. The RX0124 is capable of:

- 24 simultaneous sampling ADC's and Bridge signal conditioning Bridge Completion Selections of 120 $\Omega$ , 350 $\Omega$ , and 1000 $\Omega$
- Ethernet interface for simplified scalability and IEEE 1588 provides time stamping and instrument to instrument synchronization
- 24-bit A/D converters per channel with selectable sample rate of up to 128Ksa/s.

The unit has an IP66 rating, protecting against dust, spills, humidity, and water jets from every direction. All connections are designed for rugged operation through the incorporation of Mil-Grade connections for all inputs. The unit also has an extended operating temperature range of -20°C to +60°C and a compact, light-weight design. Using thermal conduction cooling techniques, the RX0124 is able to dissipate heat without the use of a fan.

## SELF-TEST DIAGNOSTICS

The RX0124 has a built in health monitoring capability. This allows for close monitoring of functions, including:

- Signal Conditioning & ADC - Voltage Excitation, Current Excitation, and Bridge Completion
- Input Voltage Ranges
- Volatile and Non-Volatile Memory of the System
- Internal TEDS memory
- Closed loop end-to-end self-calibration to help ensure maximum accuracy over time and temperature
- Loop/Lead wire resistance
- Open and short circuit self-test diagnosis
- Gage integrity verification

## BUILT-IN SIGNAL PROCESSING

The RX0124 leverages its internal FPGA for all necessary signal processing and digitally filters all signals to output alias free data for maximum data reliability.

ADC data can be corrected in real time and scaled to Engineering Units. Digital Filtering and Averaging are examples of digital signal processing that can be applied real time to the ADC data.

## TEMPERATURE MONITORING

The RX0124 can monitor its own internal temperature and airflow and provide over-temperature warning and temperature readings over Ethernet interfaces.

## SCALABLE FOR HIGH-SPEED SYNCHRONIZED DATA ACQUISITION

The VTI RX0xxx family of instruments supports easy integration and synchronization of multiple devices through the IEEE-1588 synchronization standard. Multiple instruments can be easily distributed extremely close to the measurement points of interest reducing the run length of analog cable, minimizing errors induced by noisy environments. All measurement data is returned with IEEE-1588 timestamp values with typical accuracies of <100 ns ensuring that acquired data is tightly correlated across the test article.

When multiple instruments are connected on a local network, the instruments with the most accurate clock source will automatically become the master, and other instruments will derive the clock from the master - simplifying data synchronization across multiple units.

## ONE INSTRUMENT WITH SOFTWARE CONFIGURED PERSONALITIES

The RX0124 gives users the ability to address a wide range of strain gage measurement capabilities with a single instrument. The RX0124 can be configured to provide highly accurate static strain measurements using constant voltage bridge excitation at a wide range of sample rates.

For 2 wire dynamic strain gage measurements, the instrument can be configured to provide constant current excitation with AC coupling to capture data at rates of up to 128Ksa/sec to properly capture dynamic strain responses. This gives the RX0124 the ability to work in a wide range of applications simplifying setup and reducing multiple measurement configurations. All of this is configured and controlled via the LXI/Ethernet interface.

# RX0124

## SPECIFICATIONS

	Specification
Sensor Type	Static Strain (1/4 , 1/2 , Full Resistive Bridge), Dynamic Strain (1/4 Bridge), Continuity Wire
No. of Channels	24 Simultaneous ADC's
Input Type (Diff or Single-Ended)	Both Diff. & Single-Ended
Input Ground Isolation	No Ground Isolation
Input Coupling	DC & AC, -3dB: 3Hz High-Pass Filter $\pm 10\%$
Common Mode Rejection (CMR)	-120dB Typical, <100 Hz -100dB Typical, 100 Hz - 1 kHz -90dB Typical, 1 kHz - 10 kHz
Channel-to-Channel Crosstalk	-120dB Typical, <1 kHz Overdriving 1 channel does not affect performance of other channels
Input Impedance	1.0M $\Omega$ each input to ground, 2.0M $\Omega$ differential.
Input EMI Filter	Interconnect board has 1nF feed through capacitors to chassis ground and high speed TVS clamp diodes for ESD protection.
Input Range	$\pm 0.4V_{pk}$
Offset/Zero	(2-Wire constant current mode, AC coupled): $\pm 200\mu V$ Max.; $\pm 50\mu V$ Typical; $\pm 20 \mu V/^{\circ}C$ Typical  (Static strain mode, DC coupled): $\pm 15\mu V$ Max.; $\pm 8\mu V$ Typical; $\pm 1 \mu V/^{\circ}C$ Typical
Noise	DC Coupling: 35 $\mu VRMS$ Typical AC Coupling: 50 $\mu VRMS$ Typical SNR >110dB
Bridge Balance	Software nulling
Bridge Configuration	Full, 1/4, 1/2: programmable
1/4 Bridge Completion	Software Selectable: OFF, 120 $\Omega$ , 350 $\Omega$ , 1k $\Omega$ Accuracy: $\pm 0.1\% + 0.002\Omega$ Stability: $\pm 10$ ppm/ $^{\circ}C \pm 5m\Omega/^{\circ}C$ Drift: < $\pm 350$ ppm/year

Parameter	Specification
Channel to Channel Isolation	<-90dB effect on other channels for Load changes, Opens and Shorts
Voltage & Current Excitation Protection	Will survive indefinite short circuit to ground. Crosstalk: A Short does not affect Exc. Accuracy in other channels
Voltage Excitation	Levels: +2.5V & +5V Accuracy: $\pm 0.1\%$ Current Limit: 40mA Max. Stability: 25 ppm/ $^{\circ}\text{C}$ , < 0.1% Noise: 25nV/ $\sqrt{\text{Hz}}$ (50 $\mu\text{VRMS}$ ) Output Impedance: <0.1 $\Omega$ Remote/Local Sense: Internal, only to Interconnect
Voltage Excitation Load Regulation	<-90dB effect on other channels for Load changes and opens and shorts
Voltage Excitation Monitoring	Voltage Excitation monitoring and can be enabled or disabled for self-test and ratio-metric computation Accuracy: $\pm 0.1\%$ , 0 $^{\circ}\text{C}$ to +60 $^{\circ}\text{C}$
Current Excitation	Levels: Selectable 0, 101 $\mu\text{A} \pm 1\%$ , 1.01mA $\pm 0.2\%$ , 5.036mA $\pm 0.2\%$ Stability: $\pm 230$ ppm/ $^{\circ}\text{C}$ $\pm 50$ ppm/year Load regulation: <0.01% for Load change 0V to 5V Crosstalk: <0.01% effect on other channels from voltage changes Compliance Voltage: >4.8V; Output Impedance: >10M $\Omega$ , DC to 20kHz Noise: <3nA RMS 10Hz to 40kHz Measured within $\pm 0.05\%$ during Factory Calibration and stored in memory for use to calculate Ohms
Current Excitation Load Regulation	150nA worst case; Vout: 0V to 5V Current Exc. in one channel does not affect other channels if Input is OPEN
Ohms & Strain Measurement Accuracy	DC Coupling: $\pm 0.10\% \pm 60$ ppm/ $^{\circ}\text{C}$ $\pm 50$ ppm/year AC Coupling: $\pm 0.15\% \pm 70$ ppm/ $^{\circ}\text{C}$ $\pm 50$ ppm/year
Analog Bandwidth (Anti-Alias Filter)	<-60dB: 5MHz; -3dB: 0.5Hz - 64kHz Typical
Crosstalk	< -80dB; DC to 1kHz, sine with amplitude < FS Input Range
Slew Rate: 10% to 90% of FS Range	> 10 V/ $\mu\text{s}$
Phase Accuracy vs. Trigger	< 0.5 $\mu\text{s}$ ; DC Coupling
Latency	<50mS

# RX0124

## ENVIRONMENTAL SPECIFICATIONS

Parameter	Specification
Environmental Sealing	IP66 Rating (Dust & water jet tight)
Temperature	Operating Temperature: -20°C to +60°C Storage Temperature: -55°C to +80°C Cold Start: -34°C
Humidity	95% non-condensing
Internal Pressure	< 4 PSIA
Vibration & Shock	MIL-PRF-28800F
Resistance to Corrosive Fluids	Per RR EIR2553 Fuel, Engine Oil, Hydraulic Fluid
CE Compliance	YES
EMC Directive	EMC EN 61326 Class A, Criteria A, Annex A
Service Life	> 10 Years
Recommended Calibration Cycle	1 Year
Dimensions	15.91" by 12.32" x 4.33"
Weight	20 lbs (9.1 kg)

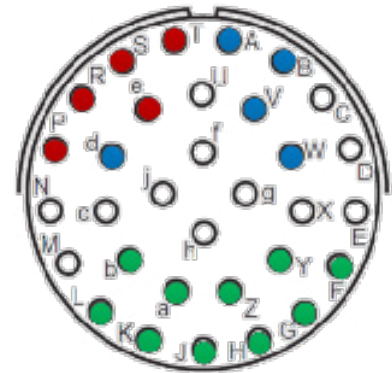
# RX0124

## CONNECTORS

Parameter	QTY	Description	Part No.
Power Connector	1	MIL-C-26482 32-Pin Receptacle, Shell Size 18	62GB-12E-18-32P Or LMH 02A 18 32 PN
Ethernet Connector	1	Rugged Sealed RJ-45	RJF 22B series (Amphenol)
EXR0124 Resistive Bridge Sensor Input Connector	16	MIL-C-26482 19-Pin Receptacle, Shell Size 14	62GB-12E-14-19S Or LMH 02A 14 19 SN

## POWER CONNECTOR

Parameter	Pin
Positive supply	A, V, B, W, d
Negative supply	P, R, S, e, T
Ground	Y, F, G, Z, H, J, a, b, K, L



Mating Plug Face View

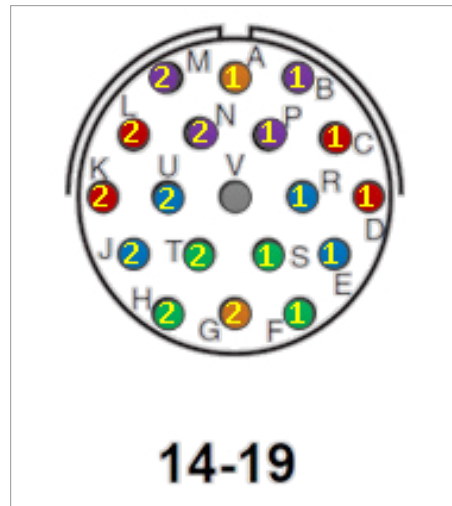
# RX0124

## INPUT CONNECTORS

RX0124 Resistive Bridge Sensor Input Connector

There are 12 19-PIN circular connectors. Each connector can accept 2 input channels. Connector pin outs shown below.

	Signal	Pin #
1	1P+	R
2	1P-	E
3	1PS+	P
4	1PS-	B
5	1S+	C
6	1S-	D
7	1D	A
8	1RSH+/TEDS+	S
9	1RSH-/TEDS-	F
10	2P+	U
11	2P-	J
12	2PS+	N
13	2PS-	M
14	2S+	L
15	2S-	K
16	2D	G
17	2RSH+/TEDS+	T
18	2RSH-/TEDS-	H
19	Shield	V





D A T A   S H E E T



# RX0224

24 CHANNEL HIGH PERFORMANCE CHARGE  
VIBRATION MEASUREMENTS

## APPLICATIONS

- Gas Turbine measurements
- Vibration Health Monitoring in Harsh Environments

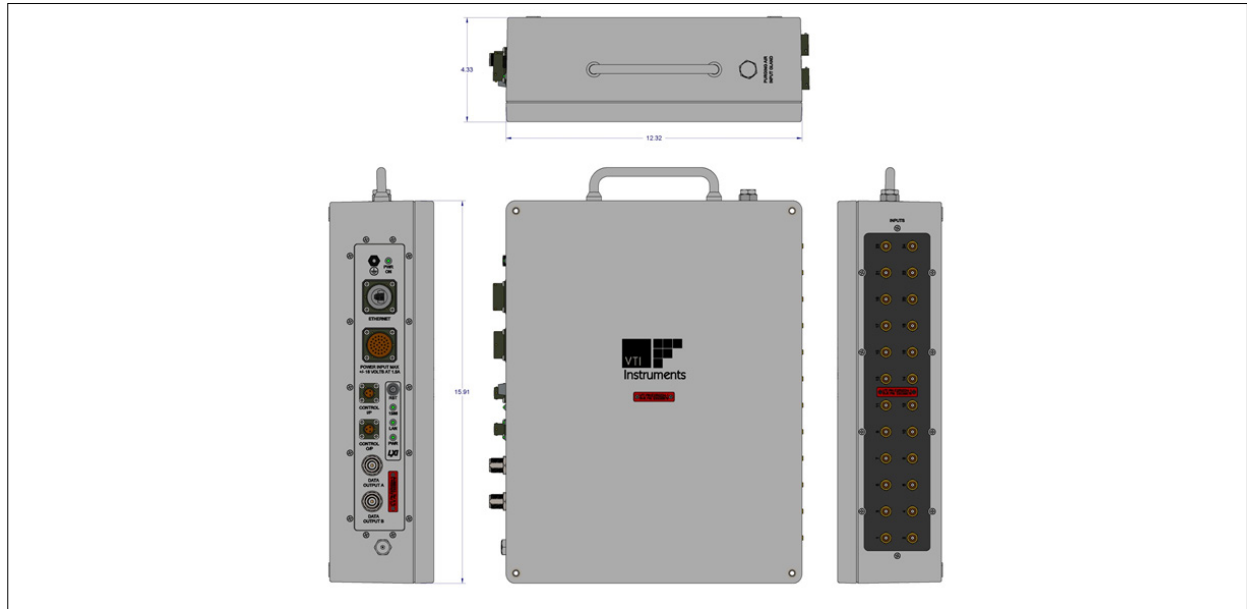
## OVERVIEW

- 24 Channel Charge vibration measurements
- Provides full charge signal conditioning with built in integrator for velocity output. Single ended or differential (isolated) operation
- 128 Ksa/Sec with 24 bit ADC per channel for high resolution data and wide dynamic range
- Precise synchronization of measurements in a distributed environment through IEEE-1588
- Rugged design; 20°C to +60°C operating range
- IP66 rated
- GigE Ethernet connectivity via LXI industry standard

## SOFTWARE DRIVERS

- IVI-COM, IVI-C, LabVIEW™

Specifications contained within this document are subject to change without notice



RX0224 - EXTERNAL DIMENSIONS

## OVERVIEW

The RX0224 is part of VTI's RX0XXX family of rugged instrument with built in sensor signal conditioning. All connections and operations are designed for rugged operation by using Mil-Grade connections for all inputs. The RX0224 is capable of:

- 24 channels of charge signal conditioning and simultaneous sampling ADC
- Ethernet interface for simplified scalability and distributability of measurements
- 24-bit A/D converters per channel with selectable sample rate of up to 128Ksa/s

Although the RX0224 has a single-ended charge converter, it behaves as a differential charge input that provides common mode rejection. This is because it operates from an isolated power supply.

### PRECISION ACCURACY FOR HARSH ENVIRONMENTS

The RX0224 is designed to allow users the ability to record charge type transducers in harsh environments. Multiple input ranges and 24 bit ADC per channel allow for very high resolution measurements so that large or small vibration events can be accurately captured.

Micro-dot connections provide direct connection for each input channel and the ability to select either single ended or differential inputs gives users more flexibility with a wider range of charge input devices. Power and communications are done using Mil-Standard type connectors for maximum reliability.

The unit has an IP66 rating, protecting against dust, spills, humidity, and water jets from every direction. All connections are designed for rugged operation through the incorporation of Mil-Grade connections for all inputs. The unit also has an extended operating temperature range of -20°C to +60°C and a compact, light-weight design. Using thermal conduction cooling techniques, the RX0224 is able to dissipate heat without the use of a fan.

## SELF-TEST DIAGNOSTICS

The RX0224 has a built in health monitoring capability. This allows for close monitoring of functions, including:

- Input Charge Ranges
- Volatile and Non-Volatile Memory of the System
- Closed loop end-to-end self-calibration to help ensure maximum accuracy over time and temperature

## BUILT-IN SIGNAL PROCESSING

The RX0224 leverages its internal FPGA for all necessary signal processing and provides the ability to output alias free data for maximum data reliability. Its advanced trigger model and high speed data streaming capability will allow users to capture all critical data.

ADC data can be corrected in real time and scaled to Engineering Units. Digital Filtering and Averaging are examples of digital signal processing that can be applied real time to the ADC data. DSP (Digital Signal Processing) allows for the user to change filter characteristics without changing hardware.

## TEMPERATURE MONITORING

The RX0224 can monitor its own internal temperature and airflow and provide over-temperature warning and temperature readings over Ethernet interfaces.

## SCALABLE FOR HIGH-SPEED SYNCHRONIZED DATA ACQUISITION

The VTI RX0224 supports easy integration and synchronization of multiple devices through the IEEE-1588 synchronization standard. Multiple instruments can be easily distributed extremely close to the measurement points of interest reducing the run length of analog cable, minimizing errors induced by noisy environments. All measurement data is returned with IEEE-1588 timestamp values with typical accuracies of <100 ns ensuring that acquired data is tightly correlated across the test article.

The precision timing sources can not only be used to synchronize modules within a single instrument, but can also be used to synchronize data across multiple instruments in a distributed data acquisition system. When multiple instruments are connected on a local network, the instrument with the most accurate clock source will automatically become the master, and other instruments will derive the clock from the master - simplifying data synchronization across multiple units.

# RX0224

## SPECIFICATIONS

Parameter	Specification
Sensor Type	Charge, Piezo-Electric
No. of Channels	24
Input Type (Diff or Single-Ended)	Both Diff. (Isolated) & Single-Ended
Input Ground Isolation	LO side Isolated when Input set to Differential LO side grounded when Input set to Single-Ended
Input Range	$\pm 12.5\text{kpC-pk}$ , $\pm 100\text{kpC-pk}$ $\pm 512$ inch/sec (ips) peak when Integrator enabled when Range set to 100kpC and using 10pC/G accelerometer
Input High-Pass Filter	-3dB: 0.5Hz High-Pass Filter $\pm 10\%$
Charge Measurement Accuracy	Signal $>0.8\%$ FS 1 to 10 Hz: 2% of reading 10 to 10k Hz: 1% of reading Signal $<0.8\%$ FS 1 to 10 Hz: 2% of 0.8% FS 10 to 10k Hz: 1% 0.8% FS
Velocity Measurement Accuracy	Signal $>0.8\%$ FS 1 to 10 Hz: 2% of reading 10 to 5k Hz: 1% of reading Signal $<0.8\%$ FS 1 to 10 Hz: 2% of 0.8% FS 10 to 5k Hz: 1% 0.8% FS
SNR	$>100\text{dB}$
Analog Bandwidth (Anti-Alias Filter)	$<-60\text{dB}$ : 5MHz; $-3\text{dB}$ : 0.5Hz - 64kHz Typical for 10nF Source Capacitance (Sensor + Cable)
Input Ground Isolation	LO side Isolated when Input set to Differential LO side grounded when Input set to Single-Ended
Crosstalk	$< -80\text{dB}$ ; DC to 1kHz, sine with amplitude $< \text{FS}$ Input Range
Slew Rate: 10% to 90% of FS Range	$> 2\text{kpC}/\mu\text{s}$
Phase Accuracy vs. Trigger	$< 0.5 \mu\text{s}$ ; DC Coupling
Latency	$<50\text{mS}$

# RX0224

## ENVIRONMENTAL SPECIFICATION

Parameter	Specification
Environmental Sealing	IP66 Rating (Dust & water jet tight)
Temperature	Operating Temperature: -20°C to +60°C Storage Temperature: -55°C to +80°C Cold Start: -54°C
Humidity	95% non-condensing
Internal Pressure	< 4 PSIA
Vibration & Shock	MIL-PRF-28800F Class 1
Acoustic Noise	Endurance: 160 dB for 30 minutes Continuous: 150 dB 50Hz - 10,000 Hz
Resistance to Corrosive Fluids	Per RR EIR2553 Fuel, Engine Oil, Hydraulic Fluid
X-Rays	Total Exposure: 195 rads 0.65 rads/min
CE Compliance	YES
EMC Directive	EMC EN 61326 Class A, Criteria A. Annex A
Service Life	> 10 Years
Dimensions	15.91" x 12.32" x 4.33"

## CONNECTORS

Parameter	QTY	Description	Part No.
Power Connector	1	MIL-C-26482 32-Pin Receptacle, Shell Size 18	62GB-12E-18-32P or LMH-02A-18-32P
Ethernet Connector	1	Rugged Sealed RJ-45	RJF 22B Series (Amphenol)
RX0224 Charge Sensor Input Connector	24	Isolated Microdofit (10-32 thread)	